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Community Events Proceedings

Editors Angelique Dimitracopoulou, Claire O'Malley, Daniel Suthers, Peter Reimann

COMPUTER SUPPORTED COLLABORATIVE LEARNING PRACTICES

CSCL2009 COMMUNITY EVENTS PROCEEDINGS

9th INTERNATIONAL CONFERENCE CSCL

JUNE 8-13, 2009, RHODES

UNIVERSITY OF THE AEGEAN, GREECE

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Table of Contents

INTRODUCTORY PART

Introduction *XI*
Angelique Dimitracopoulou, Claire O'Malley, Daniel Suthers, Peter Reimann
Conference Organization *XVI*

PART I: MAIN CONFERENCE EVENTS

I.1 Keynotes
I.1.1 Calibrating bodies and cognition through interactive practice in a meaningful environment *5*
Charles Goodwin
I.1.2 Exploring neglected planes: social signals and class orchestration *6*
Pierre Dillenbourg
I.1.3 Participatory learning in context *8*
Rosemary Luckin

I.2 Panels
I.2.1 From Maratea to Rhodes: Twenty years of CSCL *11*
Claire O'Malley
I.2.2 Toward a technology community in the learning sciences *12*
James Slotta & Touradg Aleahmad
I.2.3 Manifesting embodiment: Designers' variations on a theme *15*
Alissa Antle, Chronis Kynigos, Leilah Lyons, Paul Marshall, Tom Moher, Maria Roussou

I.3 Symposia
I.3.1 Symposium of ijCSCL Journal: Productive tensions in CSCL: Should design be driven by theory, research or practice? *21*
Friedrich W.Hesse & Gerry Stahl
I.3.2 Long-Tail Learning: A unique opportunity for CSCL? *22*
Allan Collins, Gerhard Fischer, Brigid Barron, Chen-Chung Liu, Hans Spada
I.3.3 Repertoires of collaborative practice *25*
Brigid Barron, Caitlin Kennedy Martin, Emma Mercier, Roy Pea, Daniel Steinbock, Sarah Walter, Leslie Herrenkohl, Véronique Mertl, Kersti Tyson
I.3.4 A Comparative analysis of understanding practices in the VMT environment *28*
Timothy Koschmann & Gerry Stahl
I.3.5 Socio-relational, affective and cognitive dimensions of CSCL interactions: Integrating theoretical-methodological perspectives *31*
Michael Baker & Jerry Andriessen
I.3.6 Issues in scaffolding collaborative inquiry science learning *34*
Stamatina Anastopoulou & Claire O'Malley
I.3.7 The Assistance dilemma in CSCL *37*
Manu Kapur & Nikol Rummel

I.4 Interactive Events
I.4.1 Methods for Triangulation and Revealing Interaction *43*
Vanessa Svihla
I.4.2 A tool for 21st Century Learning and Assessment *46*
Vanessa Svihla, Rachel Philips, Drue Gawel, Nancy Vye, Megan Brown, John Bransford

I.5 Posters
I.5.1 Understanding and studying collaborative processes
I.5.1.1 Positioning theory as analytic tool for understanding intersubjective meaning-making *51*
Trena Paulus, Heather Stewart, Anton Reece, Patti Long
I.5.1.2 From outcast to expert: Identities as a conceptual lens for studying learning through design across spaces *54*

Deborah Fields & Yasmin B. Kafai
I.5.1.3 When to Collaborate: Individual and group exploration of a hypertext environment within an inquiry science classroom *56*
Garrett W. Smith, Sarah A. Sullivan, Sadhana Puntambekar
I.5.1.4 Motivation and collaborative behavior: An exploratory analysis *59*
Iris Howley, Sourish Chaudhuri, Rohit Kumar, Carolyn Penstein Rosé
I.5.1.5 Impact of learning presence on learner interaction and outcome in web-based project learning *62*
Myung hee Kang, Ji yoon Jung, Mi soon Park, Hyo jin Park
I.5.1.6 Organized Mischief: Comparing shared and private displays on a collaborative learning task *65*
Neema Moraveji, Robb Lindgren, Roy Pea
I.5.1.7 Interplay of group dynamics and science talk in a designed based classroom *68*
Anushree Bopardikar, Dana Gnesdilow, Sadhana Puntambekar
I.5.1.8 What is seen on the screen? Exploring collaborative interpretation, representational tools and disciplined perception in medicine *71*
Andreas Gegenfurtner
I.5.1.9 Learning support through scaffolding collaborative project work *73*
Matthias Korn & Michael Veith

I.5.2 Online Communities (studying practices, studying design issues)
I.5.2.1 Scratch-Ed: An online community for Scratch educators *76*
Karen Brennan
I.5.2.2 Designing on-line communities to enhance teacher professional development *79*
Cheryl Ann Madeira & James D. Slotta
I.5.2.3 Can teachers' discussion lists be a tool for in-service collaborative learning? What reveals a three years analysis? *82*
Olivier Caviale & Éric Bruillard
I.5.2.4 Advancing collaborative creativity in the context of Greek teachers' In-service training in environmental education *85*
Maria Daskolia, Niki Lambropoulos, Panagiotis Kampylis
I.5.2.5 WISETales: Sharing personal stories as informal learning experience for women in science and engineering *88*
Zina Sahib & Julita Vassileva

I.5.3 Design of collaborative environments
I.5.3.1 Complete environments design
I.5.3.1.1 A new framework for smart classroom research: Co-designing curriculum, research and technology *91*
Mike Tissenbaum & James D. Slotta
I.5.3.1.2 Design of an online global learning community: International collaboration of grades 7-9 science students *94*
Steven Kertin, Elizabeth Goehring, William Carlsen, James Larsen, Charles Fisher
I.5.3.1.3 Designing environments for collaborative learning: Facilitating the adoption of ICT in small and medium sized enterprises in Costa Rica *97*
Heilyn Camacho & Lone Dirckinck-Holmfeld
I.5.3.1.4 eJournalPlus: development of a collaborative learning system for constructive and critical reading skills *100*
Toshio Mochizuki, Hiroki Oura, Tomomi Sato, Toshihisa Nishimori, Mio Tsubakimoto, Jun Nakahara, Yuhei Yamauchi, Johansson Kjell Henrik, Kenichiro Matsumoto, Shinichi Watanabe, Takashi Miyatani
I.5.3.1.5 Using speech recognition technology in the classroom: An experiment in computer-supported collaborative learning *103*
Anthony Cocciolo
I.5.3.1.6 Mobltz: A mobile multimedia tool for informal learning *106*
Sarah Lewis, Roy Pea, Joe Rosen
I.5.3.1.7 Collaborative augmented reality in schools *109*
Lyn Pemberton & Marcus Winter
I.5.3.1.8 iSocial: A 3D VLE for youth with autism *112*

James Laffey, Matthew Schmidt, Janine Stichter, Carla Schmidt, Sean Goggins

I.5.3.1.9 Fostering online collaborative learning using wikis: A pilot study *115*
Andri Ioannou & Agni Stylianou-Georgiou

I.5.3.1.10 Designing wikis for collaborative learning and knowledge-building in higher education *118*
Swapna Kumar

I.5.3.1.11 Designing with learners for game-based collaborative learning: An account of T-Rex group *120*
Beaumie Kim, Alexis Pang, Misong Kim, Jason Lee

I.5.3.1.12 Bridging school and home: Students' engagement with technology-rich activities *123*
Britte Haugan Cheng, Serena Villalba, Daniel Schwartz, Doris Chin, Patrik Lundh, Aasha Joshi

I.5.3.1.13 CoPe_it!: Argumentative collaboration towards learning *126*
Manolis Tzagarakis, George Gkotsis, Markos Hatzitaskos, Nikos Karousos, Nikos Karacapilidis

I.5.3.1.14 The 'Talk Factory' software: scaffolding students' argumentation around an Interactive Whiteboard in primary school science *129*
Marilena Petrou, Lucinda Kerawalla, Eileen Scanlon

I.5.3.1.15 Software design principles for video research in the learning sciences and CSCL: Two studies use the perspectivity framework & Orion™ *132*
Ricki Goldman, Chaoyan Dong, Reneta Lansiquot

I.5.3.2 Specific features Design

I.5.3.2.1 Connecting online learners at a distance: The promise and challenge of using metaphors as reference points *135*
Alyssa Friend Wise, Poornima Padmanabhan, Thomas Duffy

I.5.3.2.2 Explicit references in chat-based CSCL: Do they facilitate global text processing? Evidence from eye movement analyses *138*
Michael Oehl & Hans-Rüdiger Pfister

I.5.3.2.3 Analyzing technology-enhanced knowledge practices in an engineering course *141*
Satu Jalonen, Kari Kosonen, Minna Lakkala

I.5.3.2.4 Context and scripts: Supporting interactive work-integrated learning *144*
Mario Aehnelt, Sybille Hambach, Petra Müsebeck, Marleen Musielak, Robert de Hoog, Jose Kooken, Stefanie Lindstaedt

I.5.3.2.5 Supporting collaborative learning across social media applications *147*
Vlad Posea, Stefan Trăusan-Matu, Eelco Mossel, Paola Monachesi

I.5.3.2.6 Design distributed scaffolding for modeling a complex system *150*
Ying-Shao Hsu, Hsin-Kai Wu, Fu-Kwun Hwang, Li-Fen Lin

I.5.3.2.7 Scaffolding for computer supported writing to learn activities in vocational training *153*
Monica Gavota, Mireille Bétrancourt, Daniel Schneider, Urs Richle

I.5.3.2.8 Fostering collaborators' ability to draw inferences from distributed information: a training experiment *156*
Anne Meier & Hans Spada

I.5.3.2.9 Scaffolding teacher adaptation by making design intent explicit *159*
Hsien-Ta Lin & Barry Fishman

I.5.3.3 Specific features Design-Computer-based Interaction Analysis (analysis indicators and tools)

I.5.3.3.1 Automating the analysis of collaborative discourse: Identifying idea clusters *162*
Nobuko Fujita & Christopher Teplovs

I.5.3.3.2 Determining curricular coverage of student contributions to an online discourse environment through the use of Latent Semantic analysis and term clouds *165*
Christopher Teplovs & Nobuko Fujita

I.5.3.3.3 Proposing "collaborative filtering" to foster collaboration in ScratchR community *168*

Georgios Fessakis & Angelique Dimitracopoulou
I.5.3.3.4 Context-aware activity notification system: supporting CSCL *171*
James Laffey, Ran-Young Hong, Krista Galyen, Sean Goggins, Chris Amelung
I.5.3.3.5 Share and explore discussion forum objects on the Calico website *174*
Emmanuel Giguet, Nadine Lucas, Francois-Marie Blondel, Eric Bruillard
I.5.3.3.6 Improving CSCL indicators by sharing multimodal teaching and learning Corpora *177*
Christophe Reffay & Marie-Laure Betbeder
I.5.3.3.7 Alternative ways of monitoring collaboration *180*
Eleni Voyiatzaki & Nikolaos Avouris
I.5.3.3.8 Computer-assisted evaluation of CSCL chat conversations *183*
Traian Rebedea & Stefan Trausan-Matu
I.5.3.3.9 GRASP: The group learning assessment platform *186*
Gahgene Gweon, Rohit Kumar, Carolyn Penstein Rosé

I.5.4 Development aspects (architectures, scripting)
I.5.4.1 An architecture for intelligent CSCL argumentation systems *189*
Frank Loll, Niels Pinkwart, Oliver Scheuer, Bruce M. McLaren
I.5.4.2 VMT-Basilika: An environment for rapid prototyping of collaborative learning environments with dynamic support *192*
Rohit Kumar, Sourish Chaudhuri, Iris Howley & Carolyn Penstein Rosé
I.5.4.3 eXtremely Simple Scripting (XSS): A Framework to speed up the development of computer-supported collaboration scripts *195*
Karsten Stegmann, Sara Streng, Max Halbinger, Jonas Koch, Frank Fischer, Heinrich Hußmann
I.5.4.4 Design and enactment of Collaboration Scripts – an integrative approach with graphical notations and learning platforms *198*
Andreas Harrer, Dan Kohen-Vacs, Benedikt Roth, Nils Malzahn, Ulrich Hoppe, Miky Ronen
I.5.4.5 A design rational of an editor for pedagogical procedures *201*
Christian Martel, Laurence Vignollet, Christine Ferraris, Emmanuelle Villiot-Leclercq

PART II: PRE-CONFERENCE EVENTS

Introduction to Pre-conference Events: Tutorials, Seminars, Workshops *207*
Gerry Stahl & Paul Kirschner

II.1 Tutorials
II.1.1 Introduction to CSCL *211*
Gerry Stahl
II.1.2 Collecting and analyzing gaze data from collaborative interaction *212*
Patrick Jermann & Marc-Antoine Nüssli
II.1.3 Multi-level analysis *213*
Ulrike Cress

II.2 Seminars
II.2.1 Scratch: Creating and sharing interactive media *217*
Karen Brennan, Andrés Monroy Hernández, Mitchel Resnick
II.2.2 Modelling, creating and enacting online collaborative scripts *218*
Miky Ronen, Dan Kohen-Vacs, Andreas Harrer, Yael Kali
II.2.3 Constructing graphical and hypertextual knowledge representations for learning *219*
Jane Alexen Shuyska
II.2.4 E-discussions moderation made easier with the Argunaut tool *220*
Reuma De-Groot

II.3 Workshops
II.3.1 Common objects for productive multivocality in analysis *225*
Dan Suthers, Nancy Law, Kristine Lund, Carolyn Rose, Chris Teplovs

II.3.2 Interaction analysis and visualization for asynchronous communication: Analysis methods, tools and research questions *227*
Eric Bruillard, Angelique Dimitracopoulou, Peter Reimann
II.3.3 Intelligent and innovative support of collaborative learning activities (WIISCOLA) *228*
Jacqueline Bourdeau, Riichiro Mizoguchi, Seiji Isotani, Barbara Wasson, Weiqin Chen, Jelena Jovanovic
II.3.4 Competitive challenge on adapting activities modeled by CSCL scripts *229*
Christine Ferraris, Laurence Vignollet, Christian Martel, Andreas Harrer, Yannis Dimitriadis
II.3.5 Scripted vs. Free CS collaboration: Alternatives and paths for adaptable and flexible CS scripted collaboration *231*
Stavros Demetriadis, Yannis Dimitriadis, Frank Fischer
II.3.6 CSCL Argumentation systems: How do empirical results and emerging technologies inform system development? *232*
Niels Pinkwart, Frank Loll, Oliver Scheuer, Bruce M. McLaren
II.3.7 Agile learning and collaboration – Improvisational uses of group scribbles and other CSCL tools *233*
John Brecht, Patricia Schank, Yannis Dimitriadis

II.4 Post-Doc & Early Career Workshop
Post-Doc & Early Career Workshop: Summary *237*
Frank Fischer, Jody Underwood, Baruch Schwarz

II.5 Doctoral Consortium Workshop
Doctoral Consortium Workshop: Introduction *245*
Chris Quintana & Pierre Tchounikine
II.5.1 Supporting and fostering online communities with wikis *247*
Holger Dick
II.5.2 Understanding identities across social spaces *249*
Deborah A. Fields
II.5.3 Ontogenenetic and sociogenetic perspectives on learning, technology, and medical image diagnosis *252*
Andreas Gegenfurtner
II.5.4 Methods for analyzing teacher facilitation of collaborative learning in the science classroom *255*
Katherine D. Knight & Sadhana Puntambekar
II.5.5 Intersubjective meaning making as representational practice in multimodal collaborative environments *258*
Richard Medina
II.5.6 Transforming learning in science classrooms: A hybrid knowledge community approach *261*
Hedieh Najafi
II.5.7 The impact of computer supported written communication in a collaborative project based learning scenario *264*
Michele P. Notari
II.5.8 Impact of technological affordances on cognitive engagement in computer supported collaborative learning environments *267*
Suparna Sinha
II.5.9 Designing technology enhanced learning contexts *270*
Joshua Underwood
II.5.10 Fostering collaborative knowledge building through advancing students' personal epistemology *273*
Johnny Yuen

II.6 Educational Policy Symposium
CSCL and the transformation of education *279*
Stella Vosniadou & Lone Dirckinck-Holmfeld

Index of authors *281*

Introduction

The CSCL conference and the International Society of the Learning Sciences (ISLS)

The international conference on Computer-Supported Collaborative Learning 2009 (CSCL2009) is the 9_{th} in a series of international CSCL conferences, representing the growing interest of researchers and educators in social environments based on information and communication technologies and in the formal or informal learning that takes place during interactions around or through such technologies. In fact it represents an established multidisciplinary field of technology based collaborative learning, which emerged about 20 years ago[1] and has developed along with the explosive growth of communication technologies.

The first CSCL conference began at Indiana University, Bloomington, USA (1995) and continued biannually with conferences associated with the University of Toronto, Canada (1997); Stanford University, USA (1999); the University of Colorado at Boulder, USA (2001); the University of Bergen, Norway (2003); the National Central University, Taipei, Taiwan (2005) and the Rutgers University, New Jersey, USA (2007). In between, a European conference on CSCL (EuroCSCL) was organized at 2001, in Maastricht, Netherlands. This was the first to be held outside North America since 1995, and which heralded subsequent conferences being held not only in the USA and Europe, but also across the world.

CSCL has grown over the years and become one of the two established conferences organized by the International Society of the Learning Science (ISLS). The society incorporated as a non-profit professional society in 2002, uniting the traditions started by the Journal of the Learning Sciences, the International Conferences of the Learning Sciences (ICLS), and the Computer-Supported Collaborative Learning Conferences (CSCL). It has also recently embraced the International Journal of Computer Supported Collaborative Learning (ijCSCL). It offers publications, conferences and educational programs to the community of researchers and practitioners who use cognitive, socio-cognitive and socio-cultural approaches to studying learning in real-world situations and designing environments, software, materials and other innovations that promote deep and lasting learning (www.isls.org).

CSCL 2009 is being held in the south-east part of Europe, in Greece, at Rhodes, in the University of the Aegean, a new and dynamic University (established in 1989) whose Faculties are distributed across five different islands of the Aegean archipelagos.

The present volume of CSCL2009 Community Events

By tradition, CSCL conferences include a lively mix of invited keynotes, submitted paper sessions, submitted symposia, workshops, panels, posters, demonstrations etc, covering timely and important issues of interest to the community and reporting recent research findings. This tradition is constantly improving and being enriched.

Typically, the heart of every scientific conference consists of the papers (full and short papers) that are selected after a rigorous review process and presented during the conference. The corresponding papers for CSCL2009 are found in the CSCL2009 Conference Proceedings (distributed by LuLu & Amazon).

The present volume of the CSCL2009 Community Events proceedings, crystallizes and provides community memory of the rich variety of events that take place beyond the papers. These community events reflect an important aspect of the character of CSCL conferences. This is due to four main reasons: (a) these events are much more interactive; (b) they address fresh subject matter; (c) they may open new methods and directions for research, design and development; and (d) they embrace and support junior researchers.

What are these events? They are community events that take place in the context of the main conference and include: Symposia, Panels, 'Interactive Events' as well as all the accepted posters, presented usually in an interactive mode during conference plenary sessions. Also, community events that take place during preconference days include Tutorials, Seminars, Workshops, as well as two special workshops, typical of the tradition of ISLS conferences, namely the Doctoral Consortium Workshop and the Post Doc & Early Career Workshop. In addition, in the CSCL2009 preconference days, the 'Educational Policy Symposium' is organized so as to explore potential plans, strategies, actions, that could contribute in promoting CSCL activities in education, according to the characteristics of different nations, countries and continents.

Contributors to the present Volume

The CSCL conference is a major international event that gathers together people involved in all aspects of the field of technology-based collaborative learning including research, education, training, work and technology. CSCL2009 participants include experienced as well as early career researchers, designers, educators, industrial

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[1] The first international workshop on CSCL was held in Maratea, Italy, in September 1989, organized by Claire O'Malley. Another early workshop on CSCL was held in Carbondale, Illinois, USA.

trainers from various disciplines including education, cognitive, social and educational psychology, didactics, subject matter specialties, computer science, linguistics and semiotics, speech communication, anthropology, sociology, design, etc.

The contributors to the CSCL2009 conference hail from all around the world, but mainly from Europe, North and South America, Middle East, Asia, and Australia.

CSCL2009 Conference Theme (CSCL Practices) and Conference Thematics

The CSCL conference, in general, focuses on issues related to formal and informal learning through collaboration, promoting productive collaborative interactions with the help of all kinds of information and communications technologies. The CSCL community studies and designs effective technological CSCL tools, as well as related educational interventions.

The themes of the work represented in the present volume are similar to the central thematic dimensions of the CSCL field itself. If we were to sketch out an overview of them we would distinguish five main dimensions:

- Understand collaborative and learning processes by observing them or studying them via investigations (controlled or not).
- Design and develop technology based collaborative learning environments, focusing also on activities or activities scripts' design, accompanying teachers/moderators strategies etc.
- Design and implement interventions (in educational systems, school units, worldwide communities, professional communities etc).
- Theories and analytical approaches (taking into account that it is a recent and multidisciplinary field)
- Methodologies for analysis, research design, design processes etc.

Internally to each dimension, there is a number of significant research sub-dimensions. For instance, internal to the design of technology based learning environments, the core aim is to examine how to support learning along different critical aspects with subtle combinations of human and technological scaffolding, how to support individual cognition, group cognition, and social cognition; and moreover how to support regulation and management of those processes (e.g. even in a wider context: how can school units be supported during the process of adopting innovative practices?), while in some cases epistemological and disciplinary aspects are salient (science, maths, literacy, language, environmental education, medicine etc).

The CSCL2009 conference theme '*CSCL Practices'* emphasises practices relating to technology based collaborative learning in three major areas:

- Learning in typical educational institutional structures: preschool and primary education, secondary education, higher and adults' education, as well as special education.
- Learning in workplaces, such as professional training in companies, but also informal learning during working processes.
- Learning in every day life: informal learning in everyday practice, involving the use of networked wired and wireless technological devices and especially the Internet, in the every day life of students or adults.

All three areas above are represented in the present volume, while in addition, some work refers to the practices of the CSCL research community itself, analyzing in a direct or indirect way its social nature, influences, dominances etc.

Most research papers represented in this Volume address formal Education (primary, secondary, higher education, special needs education), teachers' education as well as vocational training. However, some papers also address informal learning in everyday life, as well as the field of workplaces such as medicine, sciences, small or medium size enterprises etc.

One of the purposes of the title of this theme was to identify the current educational, professional or everyday practices that evolve within close or wider collaboration among small or larger groups or communities. The aim was also to identify 'naturally' emerging practices (in the sense that they were not designed, suggested or implemented by researchers). This purpose is consistent with the identification of how specific tools or platforms are appropriated, as well as of motivation, de-motivation, usability or effectiveness issues. Also, in some cases, the aim is not only to understand the origins of highly motivated current activities and practices, but also to examine whether and how these motivated aspects could be incorporated in designed environments (technological and/or humans).

More specifically, in the following paragraphs, we present briefly the specific topics of the present volume as they are reflected in each event category.

Main Conference Events' Topics

CSCL2009 was honored by three *Keynote Speakers,* by Professors Charles Goodwin, Pierre Dillenbourg and Rose Luckin. They invite us to reflect and take into account neglected aspects in the understanding of social and collaborative practices or in designing collaborative environments and related interventions, such as the fact that both cognition and action emerge through systematic transformation of environments, the critical role of class orchestration and teachers / moderators, or the nature and the role of participatory learning and context.

The three *Panels* of CSCL2009 discuss and exchange ideas, in a vivid way, in three different areas. The first panel, an invited one, incites the community to reflect on the twenty years of the field of CSCL, considering as the inaugural event the first workshop organized in 1989 in Aquafredda di Maratea, Italy; to reflect on research dimensions, theoretical grounds, methodologies, new emerging questions etc. The second panel intends to attract community members' attention to design and development central issues, by the announcement of the need to create a technology committee for the development of technological environments for learning sciences. It invites us to focus on the problems raised by the needs of scalable, usable and reusable, adaptable, interoperable software; aspects known but often neglected in researchers work. The third panel regards the design of the basic features of the interface of learning environments and discusses the various interpretations of the concept of embodiment as well as the related benefits in terms of learning support.

The seven different *Symposia* offer the opportunity to discuss in depth different thematic areas, while a number of them examine a range of practice related issues fitting with the CSCL2009 conference theme. The invited symposium organized by the ijCSCL editors reflect on practices of the CSCL community itself, and especially on the nature of productive roles for theory, research and practice regarding the design of CSCL environments. The second symposium refers to the naturally emerging practices of children, adolescent and adults around the usage of Web 2.0, introduces the concept of the 'long tail' for learning and discovery, and explores questions around the inherent passion of these practices and the possibility for exploiting it for formal learning purposes. The third symposium examines the repertoire of collaborative practices, in a variety of settings and contexts (via on-line gamers, musicians, product designers etc), introducing a corresponding analytic framework. The fourth symposium reflects on various practices by which researchers understand social activities and collaborative processes in a specific shared dataset. The three other symposia focus either on aspects that the community have progressed over the last few years such as scaffolding in inquiry science learning or the issue of providing assistance in CSCL and its associated problems, or on aspects that the community needs to focus on over the next few years such as the affective dimension that occurs alongside social and cognitive dimensions in CSCL.

This year the conference incorporates two *Interactive Events* – events that usually enable participants to experience new technologies or novel uses of current technologies to support teaching, learning or research. The selected specific events concern methods of interaction analysis: one examines closely Social Network Analysis methods and supplementary approaches, while the other proposes a specific learning assessment method.

Finally, the majority of the *Posters* represent work in progress, while they reflect new trends of the research. We were able to have about fifty accepted papers in the posters category.

A number of the posters concern work related to the understanding of collaborative processes (applying specific analytic views such as: 'positioning theory', or 'identities' in a community), or to the study of collaborative processes under controlled conditions, so as to identify the interplay between intervening factors (such as motivation, scaffolds, group dynamics and collaborative behaviour, learning etc). A few others have direct implications for the design of technological environments, studying individual vs social, private vs shared spaces, or exploring students' interpretations of visual representations that relate epistemological aspects of the underlying subject matter (e.g. medicine). Work on understanding and studying online communities is pervasive and ongoing in the CSCL field; at this point the effort concerns either naturally arising communities and the way they function (e.g. around discussion lists) or designed interventions in communities of educators or professionals (e.g. women in science and engineering).

The most important aspect of the posters concerns the design of social or more specifically collaborative environments. They can be distinguished roughly in terms of overall environment design and more specific aspects of learning environment design. In the first case, the reader of the present proceedings will find papers on virtual reality environments aimed at students in general as well as at children with special needs, some work on games design, studies of wikis, as well as mobile learning technologies and tools that support reading skills or argumentation. The three first posters of the category concern global views on design, taking into account either the micro-level of the context and conditions of classes, or the macro-level of global learning community features, either in formal educational systems or in professional worlds (enterprises).

The posters that concern mostly specific features on design propose solutions such as “the use of metaphors” as reference points, explicit references in chat tools etc. In order to support learning, they propose appropriate scripts, but also specific scaffolds for modelling, for writing, or even specific supports (e.g. ‘time availability awareness’). Other posters refer to functionalities or activities that help during the management of “knowledge objects” in communities.

A specific sub-category of design makes up the work that directly or indirectly proposes to incorporate into design automated interaction analysis components so as to produce analysis indicators or even complete interaction analysis tools that visualize the analysis results to the users (e.g. awareness tools). The underlying aim is to support awareness or even better metacognition and self-regulation of participants, as well as monitoring when these tools are addressed to teachers or moderators of collaborative activities. This tendency emerged and grew during the last CSCL conferences starting from CSCL2005. The corresponding posters propose automated interaction analysis of content and discourse, interaction analysis tools for teachers, platforms of interaction analysis indicators and corpora of forums addressed to researchers or highly experienced moderators, or even specific indicators usage that could foster collaboration in communities. Two papers apply interaction analysis so as to support the more typical form of assessment.

Finally, a number of posters concern development aspects, focusing on scripting, architectures, intelligent support environments including rapid prototyping.

Pre-conference events topics

Tutorials, seminars and workshops are at the heart of CSCL pre-conference events. Stahl & Kirschner’s introductory text, found in the corresponding part of these proceedings, presents briefly the role, the purpose and the nature of these events within the frame of CSCL conference.

This year, two of the *Tutorials* focus on analysis methods (quantitative data analysis). In addition, the first tutorial organized by ijCSCL is an introduction to the field of CSCL, and presents a unique opportunity to capture the views of various key scientists in the CSCL community.

The four *Seminars* offer the possibility of familiarizing and exploring specific environments or tools in different categories: programming environments, representation expression tools, or even tools for e-moderation aimed at teachers as well as environments for collaborative scripts aimed at researchers.

Seven different W*orkshops* address a variety of issues that have either already being dealt with by the community or have emerged recently: intelligent support and adaptation, analysis methods, as well as automated interaction analysis and scripting. In parallel, two workshops that concern examples of collaborative environments (e.g. argumentation environments, Group Scribbles) offer the opportunity to explore further specific environments.

The *Post Doc & Early Career Workshop* involves twenty six post-doc researchers, discussing together typical issues that concern all junior researchers: the constitution of a research agenda, career paths, publishing, international research networks, international mobility etc. Their actual research subjects reflect a great part of the current spectrum of CSCL 'hot' themes (emotion, context, personal identities vs social relations in communities, collaborative scripts, mobile technology, interaction analysis etc).

The *Doctoral Consortium Workshop,* involving ten PhD students aim to contribute to the creation of a supporting human network around junior researchers.

Finally, the *Educational Policy Symposium* which is organized for the first time in the CSCL conference, explores the appropriate actions, strategies and approaches to promote a more constructive exchange between the world of education and the world of CSCL research (e.g. disseminating in appropriate modes the results of CSCL research and conferences to the educators, exploring how existing interesting CSCL practices of educators could be pushed forward, applying related national plans). Given that different approaches might not be equally appropriate for different nations, countries of even continents, high level Educators and consultants of Ministries of Education, as well as key researchers from all around the world were invited.

Acknowledgements

We would like to thank the different committees and groups of people that have made key contributions to the organization of the events reflected in the CSCL2009 Community Events Proceedings.

First of all, the organization of most of the events was carried out by the corresponding Chairs of the CSCL2009 Steering Committee: Workshop/Tutorial/Seminar Chairs, Post Doc & Early Career Workshop Chairs, Doctoral Consortium Chairs of Pre-Conference events. They defined the corresponding calls for contributions, selected the submitted proposals, while they offered constructive guidelines to the corresponding

organizers or participants, or even they chaired the corresponding events during the conference. Educational Policy Symposium chairs organized the specific event and we thank them for that.

Similarly, for the main conference program, the Interactive Events Chairs have acted as previously mentioned, while the submitted Panels and Symposia were mainly evaluated by the CSCL2009 Program Chairs, a difficult task given the important number of received proposals (e.g. sixteen symposia were submitted while only six could be included into the conference program).

Regarding the selected and presented posters, we would like to thank the members of the Reviewers Committee, for the reviewing process. Three reviews per paper/poster were added to the work of the 177 members participating in this committee.

Concerning the organization of the whole CSCL2009 conference, we would like to thank all the members of the Hellenic organizing committee and especially thank all the members of the Learning Technology and Educational Engineering Laboratory (LTEE lab) of the Faculty of Humanities in Rhodes, that have devoted a great part of their time during the last year.

The CSCL2009 Steering Committee members have contributed in various aspects of the conference organization, while members of ISLS Board have enriched the whole process with their ideas and advice (special thanks to Chris Hoadley and Eric Rosé, as well as to the current ISLS President Marcia Linn).

Finally, we would like to thank all those who contributed by their research to this conference: not only the junior and senior scientists whose work is represented in this volume, but also all those who are interested in CSCL and have submitted special events proposals and papers.

Cordial and sincere thanks to all!

Angelique Dimitracopoulou, Claire O'Malley, Daniel Suthers, Peter Reimann

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PART I

MAIN CONFERENCE EVENTS

KEYNOTES

Calibrating Bodies and Cognition through Interactive Practice in a Meaningful Environment

Charles Goodwin
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Summary

Using as data videotapes of archaeologists working to see and map structure in the dirt they are excavating, meaning-making in the home of a man with severe aphasia, and sequences of actual talk-in-interaction, this talk will investigate action, cognition, language use and things as phenomena constituted through actual agent-object inter-action. Rather than viewing cognition as an abstract process lodged entirely within the mental life of sentient beings, language as a nonmaterial process situated within the psychological life of the individual, and things as mute, unmoving objects, this presentation will focus on the mutual constitution of actors, things, and communities within the ongoing organization of situated language use and dynamically unfolding activities. From such a perspective cognition emerges as a consequential and practical issue, for example as a part of the process through which both the world that is the focus a community's scrutiny, and other actors, are known in just the ways that allow the work of the community to be accomplished. It will be argued that both cognition and action emerge through the systematic transformation of environments that contain a range of structurally different kinds of resources that mutually interact with each other.

Exploring neglected planes: social signals and class orchestration

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Abstract. CSCL analyzed verbal interactions within small groups (plane 2) and cultural processes within larger communities (plane 4). We neglected the intermediate (3) level, the "class". If CSCL strives for impact on educational systems, it should become teacher-centric, i.e. it should empower teachers in the orchestration of integrated learning activities. I will present examples of "design for orchestration". I will also illustrate plane 1 which concerns the semanticless analyses of social signals such as voice and gaze records.

Summary

CSCL research has crystallized around the understanding that the effects of collaborative learning depend upon the emergence of productive interactions (explanation, conflict, …) in a group. Hence, empirical studies focused on interactions within small groups (2 to 8), both verbal interactions and task-level actions. During the same period, understanding that culture shapes individual cognition led to studies within larger communities. In summary, the two main planes of CSCL have been verbal interactions in groups and cultural tools in communities. I will respectively refer to them as planes 2 and 4 in order to make explicit that two other planes should now receive more attention

Plane 1 concerns the non-verbal signals between teams members. Studies on eye contact and studies on gestures treated these events almost semantically. Conversely, we now search for dialogue patterns at the signal level. For instance, we aim to detect conflicts with acoustic features, without semantics. Using two eye trackers, we found that misunderstandings and team performance can be predicted by a low level measures such as the distance between the gaze location of each learner. Applying powerful machine learning models to social signals paves the road for new CSCL functionalities.

Plane 3 is the school class. It is located between the group level and the community level. A class is not simply a group larger than the groups we usually study. It is a complex ecosystem comprising several “species”: students, teachers, parents,.. This ecosystem also includes a physical environment, a content structure (the curriculum) and a rigid time structure. CSCL has neglected the existence of classes and their teachers. We focused on informal learning and on distance education. After two decades of great work on "designing for conversations"(understanding how design choices may trigger productive interactions), it's time to devote more energy to "design for orchestration," (understanding how design choices may facilitate productive teamwork in a class ecosystem).

I will analyse seven constraints that shape orchestration, i.e. that help to understand why "things work in my class". This understanding is a condition for generalizing results in design-based research.

1. *Teacher-centrism.* CSCL literature often refers to the teachers' role with a politically correct slogan: "from a sage on the stage to a guide on the side." How can CSCL have any major impact on schools by putting teachers "on the side?" The impact of CSCL will be higher if we develop in environments that empower teachers of primary, secondary and higher education. Of course, what matters is what students learn and not what teachers do or say. Acknowledging that the teacher is the most salient person in a class does not mean increasing lecturing. Constructivist approaches to learning benefit from the subtle leadership of smart teachers, from their contradictions, their enthusiasm for their subject and their expectations of students.
2. *Curricular relevance*. The CSCL community developed tools for acquiring interesting skills that were not part of the actual curricula of schools or universities, while teachers struggle to get the time necessary to reach their educational objectives. If curricular relevance is not integrated in our models (e.g. explicitly linking activities to objectives), CSCL will not impact schools. Satisfying curriculum constraints is also the best way to tackle the assessment of collaborative learning, an issue to which CSCL did not bring clear answers but which remains a main concern for all education actors.
3. *Multiplanism.* CSCL obviously focused on collaborative learning, which is legitimate as long as we don't forget it is only one among the many ways to foster learning. Collaborative learning is our personal agenda as researchers, but it is not the only pedagogical method. Students have more to gain from the complementarity of individual, collaborative and collective (class-wide) activities. These activities should not simply be juxtaposed but integrated into a workflow-based scenario (a macro-scripts).

4. *Legacy*. We don't introduce a new CSCL environment in an empty world. All classes have a legacy: the set of tools, books and resources that have been used over time. We should not put teachers is a situation where they have to explain that a particular book will not be used because it is not compatible with the CSCL environment. This is a pledge for *design minimalism*. A "minimal" environment focuses on a few features with an added value and lets a teacher continue to use the books, tools and methods she has been using so far. The integration of digital worlds with paper documents and physical objects augment the possibilities of integrating digital tools within an existing ecosystem.
5. *Time.* Time management is a primary concern for all teachers. First, there is a global lack of time to reach all learning objectives. Being reasonable with respect to time necessary to reach objectives is a condition for the acceptability of our methods and for their generalisation beyond pilot studies. Second, as school time is sliced into periods, teachers have to anticipate duration in order to decide, for instance, if it is worth starting an activity for a few minutes and if they will be able to split it over several periods. Designing for orchestration means enabling teachers to shorten, to interrupt, to resume and to reschedule computer-based activities with the same ease as non-computerized activities.
6. *Flexibility*. Flexibility does not only concern time management, but also the ability to respond to the unpredictable events that may arise in a classroom. What happens if one student drops out the activity and leaves his two teammates with a higher workload? In a controlled study we can discard the team, but not in an actual class. Do we design CSCL environments that enable teachers to cope with these kinds of occurrences?
7. *Sustainability.* We design tools for teachers with high motivation and for use over a short period of time. An average teacher should be able to use a new method for at least five years. Teaching energy is not infinite; it must be rationed. The level of pedagogical skills expected from teachers using a CSCL tool should be sustainable. I made the mistake of designing scripts that required a high level of improvisational skills from teachers; they will never scale up.

I will illustrate these constraints with examples taken from various CSCL experiences. One of them is "der Erfahrraum," an orchestration method that exploits apprentices' workplace experiences to elaborate school activities.

Participatory Learning in Context

Rosemary Luckin
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Summary

In this talk I will consider the concepts of participation and context as two key learning essentials that we need to understand in order to develop rich learning experiences that can be supported by technology. I will present a model of context that is grounded in the participatory sociocultural principle that an individual's development is a collaborative interaction between that individual and her social and cultural environment. This model is called the Ecology of Resources and it operationalises a definition of context as the combination of interactions a learner experiences with multiple disciplines, people, artefacts and environments, across multiple physical spaces and times. There is much existing relevant research from a wealth of different disciplines including computer science, psychology, sociology and education that I will draw upon in my talk. I will however focus upon empirical evidence from two participatory design projects with learners aged 11 – 16 years, their teachers and mentors. The first project involves learners in a self-managed learning situation working with researchers to develop tools to increase their understanding of how they can use technology to best meet their learning needs. The second is a participatory science project that involves teachers and learners working with researchers to develop the concept and practical application of participatory science in the classroom so that learners can use technology to effectively access remote resources, collaborate with science projects and co-construct scientific explanations.

Each of these projects will be discussed in terms of the Ecology of Resources model in order to highlight how this model offers a useful conceptualisation of participation and context. This discussion will also identify some of the requirements we need to encompass when developing technology in order to support participation and build upon a learner's context. These include the need to:

- Develop within learners the skills that enable them to build conceptual links between the networks of people, places and things that form their personal Ecology of Resources.
- Develop within teachers, tutors and peers a greater understanding of how the deep levels of learner engagement with technology can be translated into a higher level of critical engagement with the collaborative knowledge construction process.
- Embrace the idea that institutions, such as schools, have a key place within each learner's Ecology of learning Resources, but that their importance is as much about how they enable learners to build links between their experiences outside the institution as it is with how they support learning within the institution
- Offer learners greater agency in the creation of their learning contexts to fulfill the opportunity to move beyond the generation of content for learning by learners to the generation of contexts for learning by learners through which that content can be given meaning.

PANELS

Invited Panel

From Maratea to Rhodes: Twenty Years of CSCL

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Abstract: The first international workshop on CSCL was held in Maratea, Italy in 1989. This panel brings together some of the contributors to that event, who are now key figures in the field, to reflect upon what they were researching then, and the subsequent developments of that research and its impacts. They will also reflect upon what they see as the key research questions for CSCL over the next ten or twenty years.

Summary

The first international meeting with the title Computer Supported Collaborative Learning was held in Aquafredda di Maratea, Italy, in September 1989, organized by Claire O'Malley. A total of 20 researchers from Europe (Belgium, Denmark, France, Italy, UK), the USA and Canada were brought together, with backgrounds in education, cognitive psychology and artificial intelligence, to discuss what were then quite novel approaches to the design of computer-based learning systems. In the late eighties, although the use of computers in education had started to move out of the lab and into classrooms, it was still very much focused on individualized learning – with a few exceptions in terms of the use of networked systems for distance learning. The aim of the workshop was to incorporate work on individual learning with technology, theoretical and computational models of learning and tutoring, with the use of computers for group learning in different contexts (co-present as well as remote), and to discuss some of the issues raised by a growing concern for the social and organisational context of learning.

It is interesting to note, looking back at the proceedings, that one of the implications to emerge from the workshop, was that studies of collaborative learning should focus more on the processes involved in successful peer interaction, rather than just on learning outcomes – a concern shared by CSCL researchers today. Several studies reported in that workshop also used discourse analysis rather than traditional experimental methods to focus on the microstructure of the interaction as it changed over time. Another focus was on processes that take place between participants, through the mediation of shared language, situation and activity – presaging the ensuing interest in Activity Theory that would be so characteristic of much of CSCL research in subsequent years.

This panel draws together some of the contributors to that first workshop, who are now some of the key figures in the CSCL field, to reflect upon what were their research concerns then, and to comment upon how the field has developed since, and what they see as being the key questions for the next ten or twenty years of CSCL research.

Toward a Technology Community in the Learning Sciences

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Chris Hoadley, Associate Professor of Education, New York University
Eleni Kyza, Lecturer, Dept. of Communication and Internet Studies, Cyprus University of Technology

Abstract: CSCL depends critically on technology development, yet the process of development is not much discussed in a research context. This panel is aimed at helping the CSCL community think more critically about how it develops technology and uses it.

Introduction

CSCL research and implementation depend critically on technology development, yet the process of development is not much discussed in a research context. This panel is aimed at helping the CSCL community think more critically about how it develops technology and uses it. Researchers in the learning sciences must be able to use technology with agility in order to create materials, manage complex pedagogical structures, collect data, analyze complex patterns, and report their findings. They must be able to exchange these materials in order to promote replication and innovation in the field. Finally, they must connect their materials to the public discourse on standards, re-use, and open source licensing. It is to our advantage as a field if we move toward a more coherent set of practices and internal standards regarding our own uses of technology. Further, we must enable our young investigators to get involved in such research, reducing the absurd level of collaborative and development overhead that currently confronts them. The average level of human resources that are available to any investigator in the field are certainly less than one full-time programmer – most likely closer to a quarter-time programmer. How can we enable investigators to move forward confidently in their research with such limited staff for developing technology infrastructure for their research?

This panel is proposed to discuss various efforts that have been made and are currently underway to address this matter, and to engage the community in a discussion about the nature of the problem. We will look at this problem through the themes of re-use, adaptability, easy of use and interoperability. The panel and audience will debate the costs and benefits of designing towards these goals and specific potential remedies such creating and participating in an open-source community of education research technology development. Is it reasonable to aspire to the creation of a commons of education research software components that can be set up and configured by any technology specialist in a short amount of time? Can they be made simple enough to configure and to author new materials and activities that a graduate student with some technical orientation could learn to do so without distracting from their research questions?

As a field, we have several prominent examples of large-scale efforts to develop scalable, reusable, interoperable software, which have met with some limited success. There are many reasons why previous efforts haven't resulted in an easy-to-use framework for new investigators, and these will be discussed by the panel. Perhaps more interesting, there are new emerging technologies and philosophies that may help our efforts become more successful. The goal of this panel is to understand the problems confronting our community in relation to technology frameworks and to begin articulating some of the possible solutions or responses to those problems.

To that end, we also address the issue of technology developers as a valuable element of our intellectual community. As the world of technology evolves, it offers new insight into the powerful mechanisms of collaboration, aggregation of knowledge, community, social and semantic networking. Researchers are captivated by the new metaphors of Web 2.0, the promise of open source and open content, and new forms of human computer interaction made popular by the Wii, the iPhone and multi-touch surfaces. Yet it is our technology specialists who lead the way in developing such innovations. In the past ten years, our technology staff have shifted from being "programmers who implemented our designs" to being co-designers and even colleagues. This is an exciting development, pointing to new intellectual capacity in our field that must be supported. This panel will recognize the opportunities that could come from nurturing a community of technology developers, who might otherwise work in isolation – helping them connect with peers, exchange ideas, and co-develop common resources.

Structure of the Panel

The panel will include two main phases: First, we invite representatives from four prominent technology development projects from the learning sciences to offer insight and reflections about their own trajectory in developing tools and materials that are aimed at supporting re-use and interoperability. Each panelist will be asked to speak for 10 minutes regarding several formative questions: (1) Describe your interests and achievements in developing a framework for re-use and interoperability. (2) Describe your success in supporting other researchers in the learning sciences to adopt this framework. (3) Describe the key challenges faced by your technology framework. (4) Describe how your technology developers have been involved in any sort of intellectual community. Next, we invite 3 individual researchers whose research requires technology-enhanced materials to discuss with the panel their general interests and specific challenges they've experienced, including their frustrations in using existing software, failing to find appropriate software or having to develop new software with limited technology development resources. These discussants will join the panel in a discussion to scope the problem and evaluate possible remedies. The following sections describe the four projects included in the panel and their perspectives on the four guiding questions.

1. Symphony and HI-CE - Chris Quintana & Elliot Soloway

We have developed large, integrated constructivist software environments for middle school and high school learners (e.g., Symphony, the Digital IdeaKeeper). Each of these software environments involved integrating a set of smaller software components within innovative, scaffolded interfaces that aim to support learners with different inquiry practices. In order to support such development, we have explored new component frameworks, such as our Symphony2 framework. Other similar frameworks have also been developed with the promise of providing a single technology infrastructure that developers and researchers could use to easily create new learner-centered software. However, while such component frameworks have been well intentioned, there are still significant challenges involving the component size, customization, and usability of such frameworks. We have seen the difficulty of using software components and frameworks to assemble different individual software parts into a larger software whole. These issues leave us questioning whether these software frameworks have truly provided our community with the leverage and support needed for research and development of learning technologies.

One issue involves the grain size of the components that can be integrated within a given framework. In Symphony2, we attempted to integrate larger software components (e.g. more general purpose modeling applications, visualization applications, etc.) These larger components provided more flexibility, but developing and integrating such large components was difficult. Other frameworks have components at a smaller grain size (e.g., very specific modules that have a single functional purpose). These components may be easier to develop and integrate, but may be too limited or specific in scope to assemble into a richer software project.

A second issue involves the customization capabilities of a given framework. Developers may find a component that is "close, but not quite" in terms of their requirements, but then find it difficult to get "under the hood" and revise the component so it fits their project needs. Similarly, there are customization issues involved in developing supportive interfaces for learning technology projects. It is still difficult for developers to add and customize scaffolding features along with functional components in the larger software project.

Finally, a third issue involves the usability of these frameworks—how easy is it for developers to put pieces together and create a larger piece of software. Developers have found it difficult to use software frameworks because of the different integration approaches and vocabularies that each uses. Additionally, there is the difficulty in learning and using the languages that underlie these frameworks. For example, some frameworks were built on Java and its cross-platform promise, but now new languages and technologies have emerged (e.g., Rails, AJAX, etc.) that are proving to be popular (or at least, trendy), making Java-based frameworks less desirable by some.

These issues are not necessarily unique to our work—indeed, the software engineering community has faced (and probably continues to face) similar issues. On the one hand, perhaps we need to take stock of research on object-oriented languages, component libraries, and end-user programming tools for guidance. But on the other hand, perhaps we also need to consider broader, more holistic supports for interaction design rather than just software integration to address the problem of facilitating the development of innovative learning technologies.

2. ESCOT and WILDs - Jeremy Roschelle & Roy Pea

As part of our drive for the Learning Sciences to have a larger scale impact in the everyday practices of math and science teachers, we have worked on re-use and interoperability issues for over 10 years. The ESCOT project, which used Java to interlink three research based technologies (The Geometer's Sketchpad, SimCalc, and AgentSheets) with supporting widgets, was perhaps the first major proof of concept that reuse and interoperability could work in educational technologies. In the WILD and G1:1 projects, we sought to understand how a community could collaboratively produce content for emerging wireless handheld platforms. While ESCOT did succeed in producing a series of "problems of the week" using interoperable and reusable technology that are still used by teachers today, no one is building on our platform – perhaps due to the immaturity of Java at the time of the project. Our handheld technologies also encountered a major platform issue: that handhelds have even MORE divergent operating systems than do desktop computers and its hard to get the community to agree on which platform to focus on. We are currently in better shape today, as the web-top platform (Web 2.0, Flash, Java) is stabilizing.

At present, we are investigating the form for a digital mathematics textbook that could aggregate improvements from the community without violating necessary properties of coherence, focus, and closure. For a digital mathematics textbook, the major challenge is to maintain coherence, focus and closure. A rare level of research-based consensus in mathematics education agrees that focus, coherence, and closure are key properties for accelerating learning. Our framework must allow a distributed team of editors to organize a process of improving a digital text while maintaining these fundamental properties. What tools will allow them to do that? We are building community for this effort, reaching out to organizations and teams with similar interests.

3. WISE, TELS and SAIL - Turadg Aleahmad & Jim Slotta

Re-use and interoperability have been themes in our software development practice over an 12-year time span in the WISE and TELS projects. WISE provided one of the first of its kind: An authorware environment where researchers could create their own interactive learning materials, then implement them in classrooms with no other software installation but a Web browser on all computers. WISE offers more than a dozen learning tools (graphing and datasets, drawing, journals, etc) that authors can configure. All student data is collected automatically via the Internet and provided to researchers and teachers in a user friendly portal. WISE has supported more than a dozen researchers around the world and is translated into six different languages. While some researchers have built new features into WISE, others have found it too restrictive. Later, we adapted WISE to serve a semester-long university curricuum in introductory computer science. While it was expandable into this new context, it took more effort than we expected and we learned many lessons and use cases in developing re-usable software for learning activities.

Since 2003, researchers and technologists from the Technology Enhanced Learning in Science (TELS) center have collaborated with colleagues internationally to create the Scalable Architecture for Interactive Learning (SAIL) - an open source java-based platform that can allow researchers and their technology specialists to create scalable, interoperable materials. The goal of SAIL is to enable software that could be re-used within a wide spectrum of research in the learning sciences. In designing our own applications, we separated out the “plumbing” so that it could be used in other applications, and in a way that we hope will support many different applications. While there has been some adoption of various portions of our software by other research labs, we are still in the early stages of establishing an open source developer community. In the years that we have spent developing SAIL, the most valuable part of our collaboration has been the knowledge community of software developers whose purpose is to support research in the learning sciences. We are now turning our efforts to supporting and expanding this community of technologists, to interface with researchers and to help them share code and expertise with each other.

4. Science Created by You (SCY) - Wouter van Joolingen & Ulrich Hoppe

Science Created by You (SCY) is an EU-funded Integrated Project that will deliver a system for constructive and productive learning of science and technology. SCY uses a flexible and adaptive pedagogical approach to learning based on "emerging learning objects" (ELOs) that are created by learners. In SCY-Lab (the SCY learning system) students work individually and collaboratively on "missions" which are guided by a general socio-scientific question (for example "how can build a climate-friendly house?") and fulfilling the mission requires a combination of knowledge from different domains (e.g., physics and mathematics, or biology and engineering). Students encounter multiple resources, collaborate with varying coalitions of peers, and use changing constellations of tools and scaffolds (e.g., to design a plan, to state a hypothesis etc.). The configuration of SCY-Lab is adaptive to the actual learning situation, advising students on appropriate learning actions, resources, tools and scaffolds, or peer learners that can support the learning process. The SCY approach is enabled by the innovative architecture of SCY-Lab that supports the creation, manipulation, and sharing of ELOs (models, data sets, designs, plans, etc.). SCY uses a Service Oriented Architecture, offering services for storage and retrieval of ELOs, collaboration, and management of learner profiles. Pedagogical decisions are based on information generated by pedagogical agents that exploit techniques of educational data mining to monitor information in the SCY repository that stores the ELOs as well as domain information, the log-files of student behavior, and the recorded chats between students.

Manifesting Embodiment: Designers' Variations on a Theme

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Abstract: This paper presents an overview of a CSCL 2009 panel that brings together five researchers whose work attempts to leverage physical embodiment in the design of technologies to support learning. Through a critical examination of distinctive approaches - design rationales, design features, and learner outcomes - the panel seeks to spark discussion over the principles by which designs might be driven and the role of design instances in advancing our understanding of embodiment as a construct.

Introduction

The construct of "embodiment" continues to inspire rich discussion and debate within the learning sciences community. While some of that debate focuses around issues of efficacy, much of the discussion centers on the multiple interpretations and articulation of the embodiment construct itself. Currently, there is no unified view of embodiment; rather there is a cluster of perspectives exploring the implications of having a body, ranging from neuronal to cultural levels. And even as the discourse is useful in illuminating what embodiment is and how it works in everyday life at a conceptual level, putting these ideas and concepts to work in the design of interactive systems to support learning activities—and then to find out how they worked—has proven challenging to designers.

This CSCL panel features five designers who have attempted, through their designs, to leverage the presumed benefits of physical embodiment in support of learning. The approaches they present represent disparate "takes" on embodiment, realized across a range of learning goals, technologies, and settings. Each panelist brings a distinctive perspective on the relationship between the design features of their environments and the intended impact on learners, and while the diversity of viewpoints among the panel reflects only the "tip of the iceberg" among interpretations within the design community, butting these designs up against one another in the context of a critical discussion may serve to highlight the challenges and opportunities facing designers.

The panel will be organized as a series of brief presentations, with each designer describing their design rationale, presenting a brief overview of their technologies and contexts of usage, and discussing outcomes associated with the use of those technologies. *Paul Marshall* (The Computing Department, The Open University), a specialist in tangible computing and embodied interaction within learning environments, will serve as moderator and discussant for the panel. He will center his comments around the benefits that a focus on embodiment might bring in the creation of each of these learning technologies: does it simply provide a general design philosophy, does it help to frame analysis, or does it allow specific hypotheses to be made about learning benefits? He will go on to invite discussion between the panelists and audience on relationships and inconsistencies between these different perspectives on embodiment.

Panelists

Alissa Antle (Interactive Arts and Technology, Simon Fraser University Surrey) will speak about her current research investigating how embodied metaphors may support learning of abstract concepts in movement-based interactive environments. The foundation for this research relates to the role that embodied (image) schemata play in the development of children's conceptual thinking. Children come to understand more abstract ideas through implicit, metaphorical elaboration of their physical and spatial experiences. In doing so, they build up a system of understanding grounded in physical experiences and extended through metaphor to give meaning to abstract concepts. Understanding how abstract concepts are built on bodily schema through metaphor has implications for the design of the interaction model that maps input actions to output responses in interactive systems; we conjecture that it is possible to trace the meaning of abstract concepts back to physical and spatial schemata, and then incorporate schemata based physical actions and spatial patterns as input to an interactive system.

The Sound Maker is an interactive musical performance environment that was designed to leverage an embodied metaphor ("music is body movement") in the interactional layer that maps input actions to output responses. Children make sounds by controlling the sequencing of percussive sounds and the change of musical parameters of those sounds through their collaborative body movements in the space. A camera vision system tracks pairs of children's locations in a rectilinear space, and an interpretation system infers qualities and quantities of movement from the sensed location data. The display system relates these characteristics of movement to changes in percussive audio output based on the metaphor. In a study involving twenty pairs of children, aged 7-10, she found evidence that the strategy of tracing higher order cognition back to its bodily basis and including this relationship in the interaction model had both performance and experiential benefits for children learning about concepts related to acoustics (Antle et al., 2009). She will discuss the implications of these results and present her latest work exploring how the 'balance' embodied schema is guiding the design of an interactive installation that supports children to learn about concepts in social justice and mathematics.

Leilah Lyons (Computer Science and Learning Sciences, University of Illinois at Chicago) will speak about her experiences designing computer-based museum exhibits, where the interactive experience is distributed across multiple visitors and multiple devices. Nowhere is the dual physical and social nature of embodied learning more apparent than at hands-on science museums, where visitors are presented with an array of exhibits that encourage both physical interaction with a scientific phenomenon and social interactions between visitors. Exhibit designers are often challenged to scale exhibits up to support more than one simultaneous visitor, because the usual interface opportunities (e.g., manipulable objects, buttons, or trackballs) must be placed in fixed physical locations. Lyon's work has focused on exploring how the personal mobile devices most visitors carry with them can be commandeered into service as Opportunistic User Interfaces (O-UIs) to museum exhibits, thus allowing exhibits to scale up to serve arbitrarily large groups of visitors. Specifically, her work has been aimed at understanding how to take advantage of the affordances provided by mobile computational devices in order to support both (a) interactions with phenomena presented at exhibits while still (b) supporting social learning interactions.

Lyons created a computer-based exhibit centered on a complex system simulation of cancer growth in human tissue, Malignancy, to study this issue (Lyons, 2008). Visitors use mobile devices to interact with the simulation wirelessly. Their interaction with the phenomenon takes the form of professional role-playing; visitors assume roles associated with real-world cancer treatment (e.g., administering radiation, or performing surgery). The mobile devices provide visitors with a specialized, "private" view onto the simulation, which is displayed in its entirety on a large shared display. For example, the visitors performing surgery can see a "zoomed in" view of the patient's tissue, an analogue to modern microsurgery techniques where surgeons wear head-mounted microscopes. Similarly, visitors administering radiation are privy to a map of the cumulative radiation exposure that the simulated patient's tissues have received. Thus, even though the visitors are occupying the same physical space, and interacting with the same shared simulation housed in the exhibit, the O-UIs splinter that space into individual, and individualized, regions. One concern was that this splintered space would encourage more visitor-exhibit interactions at the expense of the social component of the experience: visitor-visitor interactions. A controlled study revealed that providing visitors with their own "private" views of a shared activity encouraged social interactions that, surprisingly, were more promotive of collaborative learning. Lyons will discuss these findings, as well as the larger implications for the effect of private "subspaces" on competition and cooperation in a shared activity.

Chronis Kynigos (Educational Technology and Mathematics Education, National Kapodistrian University of Athens) and *Maria Roussou* (Interaction and Virtual Reality Design, makebelieve) will discuss the design of gesture–driven digital learning games enacted by small groups of users within the context of a new science center with exhibits intended for children age 8-15. Their primary goal is to design exhibits where visitors can engage in social games that require the use of their bodies and of computational interfaces to control machines and software. As users interact with the systems, their emergent mastery of the games reflects the physical embodiment of their understanding of the underlying mathematics and science concepts that drive the simulations. Their work explores the fusion among action (body movement), representation, construction, experimentation and argumentation within the context of learning in mathematics, science (kinematics, mechanics, and forces), and spatial awareness and orientation, adopting a socio-constructivist perspective of embodied cognition by looking at the ways in which individuals make sense of the ways they use gestures and whole-body movement to control digital devices.

The *Polymechanon* center consists of a set of playful physical activities each tied to specific learning goals. The *Reactable*, designed in collaboration with the University of Pompeu Fabra in Barcelona, is a tabular device that allows users to generate musical sounds by sliding objects on its surface. Other activities feature full-body interaction in which users move their bodies in synchronization with moving objects on the screen. These include a 'shufflepuck' game where they 'push' or 'kick' a virtual puck on the floor with their feet, and floor balance task, where up to twelve users make decisions on how to place themselves on a wooden floor in order to balance a virtual floor that rests on a small sphere. Kynigos and Roussou will discuss their experience with the exhibits, with special attention to the group as the unit of play, and to the communication and negotiations taking place as individuals in the groups collaborate in order to control rocking floors, balls, and objects.

Tom Moher (Computer Science and Learning Sciences, University of Illinois at Chicago) is the designer of the Embedded Phenomena framework (Moher, 2006), in which whole primary and middle-school classes engage in extended collaborative investigations of dynamic, spatial phenomena that are imagined to be unfolding within the physical confines of the classroom. Phenomena are visually and aurally manifested via conventional computing devices arranged around the room, with each portal persistently representing the dynamic state of the phenomena at that spatial position. Learning activities are physically embodied through student locomotion (understanding the full state of the phenomena requires physical movement among portals), location-sensitive visual and aural perception, manual interaction with simulated scientific instruments, and physical situation within a social community of science practice. Because phenomena unfold "at their own pace," asynchronously with respect to instructional schedules, the sense of embodiment is also temporal; experience is embedded within the inexorable flow of (real) time.

With colleague Jennifer Wiley, Moher is currently conducting a two-year quasi-experimental classroom study of the impact of the spatial and temporal embedded elements of the Embedded Phenomena framework on multiple learner outcomes, including conceptual understandings of the science domain, skill in the acquisition of inquiry skills, self-efficacy and attitudes toward science, and longitudinal participatory rates and roles. By comparing "embedded" and "non-embedded" variants of two applications—RoomQuake (a simulation of seismic events as represented through multiple simulated seismographs) and WallCology (a simulation of population ecologies presumed to inhabit the space within classroom walls)—in matched classrooms, the project seeks to bring insight into how these design features impact student learning, attitudes, and behavior. At CSCL, he will discuss the design rationale behind the Embedded Phenomena framework and present the initial results of the research study.

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SYMPOSIA

Invited Symposium – ijCSCL Journal

Productive tensions in CSCL: Should design be driven by theory, research or practice?

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Participants
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Discussant
Roy Pea

Summary

The relationship among theory, research and practice in the design of instructional technology and educational interventions is complex and controversial. It differs by discipline—e.g., psychology, education, computer science, sociology.

In some cases theory is used to derive special expectations to be tested in order to confirm and refine a developed and differentiated theory which can be used to guide design and intervention. In other cases (such as grounded theory, action research or ethnography) theory and analytic categories emerge largely from the data or even as a reflection on practice and the needs of practitioners. For design-based research, theory, research and practice co-evolve together through iterative trials in naturalistic circumstances. In this symposium, the nature of theories, their relevance for research and practice and their benefits with respect to traditions of the disciplines contributing to CSCL will be discussed as major forces for productive tensions in our field.

Researchers from the CSCL-Community and Authors of ijCSCL papers representing different positions on this issue will briefly present their arguments. Discussants will respond to each of these presentations. The audience will be challenged to conclude on productive roles for theory, research and practice in CSCL. In this context we will have two short contributions from participants for the theory part, two for the practice part and one contribution from a discussant.

Long-Tail Learning: A unique opportunity for CSCL?

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Summary

The Long Tail. The phrase "*The Long Tail*" was first coined by Chris Anderson in an October 2004 *Wired magazine* article to describe how our culture and economy is increasingly shifting away from a focus on a relatively small number of "hits" (mainstream products and markets) at the head of the demand curve toward a huge number of niches in the tail (as exemplified by companies such as Amazon or Netflix, that sell a large number of unique items in relatively small quantities).

Goal of the Symposium. The goal of the symposium is to present initial components of an analytical framework and an analysis of success stories in order to launch a discussion of how the participatory Web 2.0 provides *unique possibilities for an educational interpretation of the "Long Tail"* thereby creating new feasibility spaces for collaborative learning.

A Long-Tail Interpretation for Collaborative Learning. Long-tail learning refers at least to two aspects: (1) learning about exotic topics outside the mainstream education curriculum, and (2) the opportunity to communicate with people who share similar interests somewhere in the world on a regular basis. Long-tail learning represents a *fundamentally different objective* to cultural literacy [Hirsch, 1996]. The web gives children and adults the ability to pursue topics they are particularly interested and feel passionate about including topics such as quasars, Chinese history, Japanese anime, cuneiform writing, Viking ships, and casino games to name just a few. These are topics learners never encounter in school unless they pursue them later in college. Nor are they likely to find people among their acquaintances who share their interests and would study the topics together with them. Such exotic topics remained as lone pursuits for most people until the web came along. The long-tail of learning opportunities is contributing to the emergence of expert teens referred to as "pro-ams", amateur experts or hobbyists [Leadbeater & Miller, 2008] who have developed specialized knowledge about topics of interest using digital media [Anderson, 2006].

Exploiting the Creativity Potential of Long Tail Learning and Education. The Long Tail framework was developed primarily in the context of web-based businesses. It has fundamental implications for the producers of content, especially those whose products could not find a place in the *industrialized information economy* [Benkler, 2006]. The symposium will explore, support, and assess a learning and discovery interpretation of the Long Tail [Brown & Adler, 2008]. Table 1 shows a reinterpretation and mapping between the two perspectives.

Table 1: A Reinterpretation and Mapping of the Long Tail for Learning and Discovery

Web Based Businesses	Learning and Discovery
unlimited shelf-space	unlimited knowledge
megahits	core curriculum
niche markets	passion for unique topics
hybrid model of distribution	hybrid model of learning and discovery
many interesting books, movies, songs will not enter the traditional marketplace	many interesting topics and ideas will not be taught in schools and universities

The web enables long-tail learning in a variety of ways by supporting participation cultures among the members of communities interested in exotic topics. Novices can lurk in these communities to pick up the issues, techniques, and jargon that sustain the communities. When learners develop expertise, they can display their work or their thoughts to the community and get feedback from the community to guide their further development. Finished products might later get posted on YouTube or Epinions, where the world might see their work.

Another way the web enables long-tail learning derives from the plethora of information available on the web. When learners go into most libraries, they are likely to find a very limited amount of information on any exotic topic, the information they may find is very likely out of date for most hot topics being investigated, and there is rarely documentation on the techniques the community of practice around the topic are using. Based on the fact that the web is both constantly evolving and actively filling up all the long tails of knowledge about every conceivable topic, it can support long tail learning in a way not even the largest library in the world can support. In addition, the web can provide expert audit trails, active simulations, and tutorials on topics that support learning well beyond what learners can glean from books.

The symposium will include a set of case studies that illustrate long-tail learning phenomena. Cases will include online communities serving niche interests as well as portraits of learners that show how online and co-located communities can offer synergistic learning opportunities. The symposium will explore and debate with a focus on audience participation important questions focused on long-tail learning including:

Questions to be explored and debated

- How can we envision a productive synergy between the head and the tail and create mechanisms to support and exploit this synergy?
- Do we want to keep requiring everyone to learn the same thing in school rather than pursuing their deep interests?
- Do we want to keep extending the years of schooling to encompass the expanding knowledge base?
- Do we want to support kids to pursue more deeply the topics of interest to them — and if so, how?
- How does access to tools and learning resources influence long tail learning?
- How can the passion associated with topics from the tail be integrated with important basic knowledge and skills from the head that they successfully complement each other?

Contributors and Presentations

Allan Collins (Northwestern University) will describe how new technologies create learning opportunities that challenge traditional schools and colleges [Collins & Halverson, 2008]. These new learning niches enable people of all ages to pursue learning on their own terms, pursuing their particular goals and interests, and taking responsibility for their own learning. Fostering this kind of long tail learning requires a rethinking of education. This rethinking of fundamental aspects of learning will take many years to fully penetrate our understanding of the world and the society around us.

Gerhard Fischer (University of Colorado, Boulder) will explore and critically assess long-tail learning by describing (1) *conceptual frameworks* (including: meta-design, social creativity, and courses-as-seeds [Fischer, 2007]), (2) *models* (including: seeding, evolutionary growth and reseeding (SER) and authoritative versus democratic models of knowledge accumulation, sharing, and dissemination), and (3) *social-technical environments* (including: the "SketchUp/3D Warehouse/Google Earth" domain, in which participants worldwide collaborate to create 3D models and support environments for distributed communities such as open source software, the SAP Developer Network community, and the research community in Creativity and IT). He will discuss the challenges associated with the fundamental transformation from a consumer culture to a *participation culture*.

Brigid Barron (Stanford University) will share examples of long tail learning phenomenon based on case study research with adolescents in the Silicon Valley region of California, the south side of Chicago, and the small island country of Bermuda. She will share a learning ecology framework [Barron, 2006] that highlights the importance of understanding how access to learning resources, sources of inspiration, and tools shapes participation in digital media activities.

Chen-Chung Liu (National Central University, Taiwan) will describe technology-enabled long-tail learning phenomena occurred in Taiwan. The school for all projects will be presented to reflect why and how 4095 volunteers, adults and children, acted as teachers in a virtual community and taught various topics of their personal interests . The dramatically increasing amount of non-mainstream knowledge, such as the courseware in the school for all, indicates a gap between the world we live in and the formal education, where the latter focuses mainly on limited amount of knowledge. He will discuss the adjustments he has made based on practices in higher education to address the long-tail phenomenon [Liu, 2008].

Hans Spada (University of Freiburg, Germany) will discuss the new relation of science and the general public and give an example of long-tail learning. In recent years a great variety of science related information has become available to anyone with access to the Internet. How does the general public cope with the experience that science and especially science content on the Internet often only offers fragile and conflicting evidence? Do new kinds of online resources, like virtual communities, improve the competence and willingness to accept multiple and diverse scientific perspectives? These questions are dealt with in a new Priority Program of the German Science Foundation. An interesting example of long-tail learning are virtual communities of doctoral students and their supervisors working on subjects for which there is no critical mass at any of the involved universities [Strube & Spada, 2003]. These doctoral students learn to be full participants in the field by effective collaboration on common themes of their theses and by repeated mutual constructive reviews of the work of their peers.

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Repertoires of Collaborative Practice

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Abstract. This symposium presents results from a coordinated suite of studies on collaborative practices, and the theoretical framework we have developed to account for what is learned from collaborative episodes. We use the phrase 'Repertoires of Collaborative Practice' to describe the individual, interpersonal, contextual and community practices that can influence collaboration. We hypothesize that repertoires of collaborative practice are developmental in nature, and that collaborators may become adept at selecting which elements from their repertoires should be implemented in specific situations. The theoretical description is accompanied by four papers applying this framework to examine the collaborative practices in different collaborative settings – online gamers, adolescent musicians, middleschool technology projects, and a comparative study of Quakers and product designers.

Introduction

Collaborative activities take many forms, and are an increasing reality in education and work in the 21st century. However, how people learn to collaborate, and what people transfer from one collaborative situation to another is still undefined. While researchers have been exploring for decades what makes a single collaborative learning instance successful—by examining the individual attributes of collaborators, the interactions that occur, the context of a collaborative episode and the institutional or community practices that surround the episode—we are yet to fully understand how expertise develops. Through studying how people collaborate and how people talk about their collaborations, we propose that people develop Repertoires of Collaborative Practice, which they draw upon when they encounter a new collaborative situation.

The term Repertoires of Collaborative Practice reflects the breadth of factors that come into play during a collaborative episode. These include intentions, interactions, contextual affordances and community practices. We theorize that repertoires of collaborative practice develop through experience with different forms of collaboration and are influenced by the collaborative context. They include metacollaborative knowledge for managing interactions, monitoring the development of shared problem space, appropriately leveraging contextual affordances, and inventing new ways of interacting when needed.

We have built on the work of Gutierrez & Rogoff (2003) in characterizing our topic as repertoires of collaborative practice. Gutierrez and Rogoff describe linguistic and culturalhistorical repertoires as ways of engaging in activities which are developed through prior experiences. They emphasize that these repertoires can be differentially accessed across contexts, and that people need to develop dexterity in drawing on the most appropriate behaviors for a given context. In the same way, we see repertoires of collaborative practice as ways of engaging in collaborative activities that collaborators can elect to use in particular contexts. These repertoires, and an understanding of the conditions in which they appropriately come into play, are developed through individuals' prior experiences collaborating and interacting with others and feedback in those situations about what is effective or problematic. The implementation of such repertoires of collaborative practice in action is strongly influenced by the context of the collaboration, the repertoires that collaborators bring, and the cultural affordances of the community in which the episode occurs.

Our motivation for proposing and investigating this framework is twofold. First, there is a need to develop more comprehensive and inclusive theories to understand variability in collaboration. Inevitably, studies of collaborative learning find significant variability in learning or performance outcomes. Effect sizes for collaborative conditions range from 0.21 (Slavin, 1990) to 0.88 (Johnson & Johnson, 1992). This variation has been explained in many ways, and by drawing on quite disparate theoretical constructs. The second motivating factor for this work is the increasing use of, and need for, collaboration across many situations and contexts in the 21st century world. There is increasing recognition that the solutions to the societal and intellectual challenges we face, currently and in the future, will be solved collaboratively. The learning sciences literature calls out for more robust, holistic learning theories that articulate the significance of social resources and historical and developmental processes in learning (e.g., Cole, 1996; Rogoff, 2003; Wertsch, 1991).

Understanding how people become flexible collaborators who can draw on prior experience to develop new practices that support joint work, is essential to improve environments that require people to learn collectively, share knowledge, network, and innovate (JohnSteiner, 2000).

The Repertoires of Collaborative Practice framework allows us to view the practices that people bring to a collaborative episode through four lenses: At the individual level, intentions and orientations are important; at the interpersonal level, ways of supporting and managing the joint problem space and the relational space are focal; the context level allows us to examine how the constraints of a particular task or episode influence the outcomes of a group; and at the community practice level, institutional norms and historical ways of interacting are attended to. Following Rogoff (2003), we see these as interrelated planes that systemically interact in any collaborative situation but that are usefully segmented for analytic purposes.

In our four symposium papers, a variety of collaborative situations are explored. We see how each particular context and its community norms affects collaboration. Each paper will explore the existence or development of collaborative practices. By using multiple types of collaborative activity to elaborate our framework, we have been able to identify the aspects of collaboration that are most important across different settings. We have also identified features of collaborative practice that are predominant within some collaborative situations, but virtually unnoticed in others. By comparing and contrasting types of collaboration, and how collaborators conceptualize their joint work, we consider how practices from one community can be adapted or abandoned within a different context, depending on constraints or affordances at the four levels.

Paper 1: Collaboration in Massively Multiplayer Online RolePlaying Games

Author: Sarah Walter

I have participated in an online gaming community for over a year, capturing video, audio and text chat of intense collaborative gameplay activities known as raids. Participants spent months figuring out effective strategies, returning weekly to execute the strategy, until they were finally successful in completing the raid. Combined with interview data, analyses of how participants learned to collaborate in these raids over several months are presented. I examine how joint attention is established and maintained in the virtual setting, the role of newcomers in the community, influences of the larger gaming community, and how participants solved problems concerning strategies for success. Quantitative data, such as number of teammate casualties and time to completion, help illustrate learning and successful innovation over time.

Paper 2: "Don't touch anything, it might break!": Adolescent musicians' accounts of collaboration and access to technologies seminal to their musical practice

Author: Véronique Mertl

In this ethnographic study, I investigate the accounts of adolescent musicians about collaborative practices in the context of their outofschool musical practice. I seek to understand the complexity of collaborative engagement by investigating how people in collaborative settings think about and design for collaboration and by exploring how interactions unfold within the ecology of the music context. The use of technologies was central to their creative process when they composed, performed, and recorded their own music. Additionally, the ability to access these tools and resources were vital to their collaborations since knowledge and the collaborative process is distributed between members and the resources and tools they use (Hutchins, 2002).

Through interviews and videorecordings of rehearsals and performances of ten adolescent hip hop, jazz and rock musicians, I report on their sophisticated collaborative practices when managing their music groups, strategizing to recruit new members, and composing and recording new songs. Interestingly, within outofschool music organizations, the adolescent musicians were often marginalized from the technologies seminal to their musical practice. The very institution created to support their practice seemed to erect barriers for the musicians. One hiphop artist was told by facilitators not to touch anything when recording. She saw the recording studio as inaccessible, even though she was actively trying to learn recording technology and was designing a recording studio in her own home. Technological tools and resources were not part of the collaborative practices for the adolescent youth in these venues and there was a divide between how youth gained technical expertise to sustain their musical practice and the barriers to technology.

Paper 3: Learning to collaborate through multimedia composing

Authors: Caitlin Martin & Brigid Barron

In this presentation we share middle school students' theories of collaboration as they develop in the context of projectbased work. Our research centers on the Digital Youth Network (DYN), a digital literacy program creating opportunities for youth to extend their consciousness around social change through the production and critique of media (Pinkard, et al., 2008). The DYN program is part of an innercity charter school located in the Midwest serving approximately 140 68 graders (ages 1113) from middle to lowincome households. DYN provides mandatory school day technology classes and voluntary afterschool technology clubs, both offering opportunities for students to work with peers on collaborative projects. As students move from sixth to eighth grade, we collect longitudinal learning data from interviews and observations. Interviews ask students to reflect on causes of more and less successful collaborations and to describe advice they would offer to peers starting a new collaborative project. Our analysis reveals that students' emergent theories attend to: (1) the necessity of aligning goals of team members around project quality and effort; (2) the risks and benefits associated with partnering with friends; and (3) the frequent difficulty and importance of having all ideas heard. Students were able to articulate strategies for creating conditions to support collaboration including: (1) designing roles allowing everyone to participate and contribute; (2) drawing on outside resources and talent; and (3) attending to time management. These themes will be discussed in relation to time and assessment constraints of schoolbased collaboration as compared to the symposium's other collaborative contexts. A case study will illustrate how these themes played out for one collaborator in the context of a multiweek classwide group project involving authoring and recording a song and producing a corresponding music video.

Paper 4: Prototyping practices in Quaker and product designer communities

Author: Daniel Steinbock

This paper presents a comparative qualitative inquiry of two different communities of practice: the Religious Society of Friends (Quakers) and humancentered product designers. The communities are compared in terms of practices they have developed to organize and regulate collaborative activity, with emphasis on assessing if and how participants change existing practices or innovate new ones. The primary purpose of this inquiry is to gain insight into how repertoires of collaborative practice develop and evolve over time.

Each of the two communities under study selfidentifies as a "culture of collaboration" and participants are peculiarly attentive to the socialrelational factors of their own collaborative practice. In addition, each community, in its own way, is engaged in ongoing innovation: for the Quakers, continuous revelation of new spiritual insights; for the designers, development of novel products and services. The communities were chosen for these qualities, as reflective practices around issues of collaboration and innovation are highly visible to ethnography in these settings. Drawing on this data, I use the designers' concept of a 'prototype' to explain how participants view the process by which practices evolve over time. The original communities of practice model (Lave & Wenger, 1991) conceptualizes participation as centripetal socialization into a fixed repertoire of practices which are reproduced unchangingly over time. This is insufficient to explain how innovation can lead to the emergence of new practices, or how existing repertoires of practice are dynamically modified and improved upon by participants. This paper reconceives participation in communities of practice as an ongoing, iterative design process, wherein practices are not finished products but prototypical worksinprogress.

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A Comparative Analysis of Understanding Practices in the VMT Environment

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Discussant
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Abstract: The oriented question of this symposium is, what are the appropriate methods and frameworks for studying practice in CSCL environments? To foster a useful dialogue on methodology, we apply a "comparative analysis" of computer-mediated interactions taken from a common data source of Virtual Math Teams (VMT) environment.

Introduction

A close attention to understanding and learning practices in technology-enhanced settings has been an earmark of CSCL research from its earliest days. Roschelle (1992), for example, documented in a detailed way the interaction between two students as they worked together at a computer. His analysis built upon an established and well-developed tradition of research on talk-in-interaction (Sacks, 1992; Jordan & Henderson, 1995). Programs of study focusing on interaction thin computer-mediated environments, however, are much less well-developed.

Grimshaw (Grimsaw, Burke & Cicourel, 1994) introduced the idea of a "comparative analysis" whereby a team of researchers, often with disparate backgrounds and interests, agrees to study a common set of materials. Exercises of this sort have been undertaken several times in education (e.g., Koschmann, 1999, in prep; Sfard & McClain, 2002). The participants in this symposium will present four different analyses of computer-mediated interaction taken from a common data source. In this way, we hope to challenge each other with regard to what can be found within these materials. Our goal is to engender discussion about methods and frameworks for studying the practices of producing understanding within online environments. A critical commentary will be delivered by the symposium discussant, Graham Button, following the four presentations.

The VMT Environment

The materials to be analyzed here represent the interactions of one particular team (Team B) who had participated in the 2006 Virtual Math Teams (VMT) Spring Fest. The three students worked and interacted within the VMT environment designed by the Math Forum at Drexel University (mathforum.org). The VMT environment supports collaboration at a distance using text-based, synchronous communication and includes a whiteboard with special functionality for referencing and a wiki for sharing findings with other teams. They worked together for four sessions, each of approximately one hour in length, and spaced out over a two-week period (see Medina, Suthers & Vatrapu [2009] for a description of Sessions I-III and Stahl [2009] for a description of Session IV). The problems with which they were engaged have to do with algebraic representations of graphical patterns.

The students' interaction was recorded and can be replayed using the VMT Replayer application. Their textually-mediated interaction—with closely coordinated inscriptions in the text chat, graphical whiteboard and shared wiki—provides a rich set of materials for examining understanding practice within computer-mediated interaction.

Presentation 1: How (not) to Build a Pyramid in the VMT Environment

Authors: Christian Greiffenhagen (University of Manchester) and Jacqueline Eke (Manchester Metropolitan University)

Abstract: In their second and third problem-solving sessions, the students in Team B decide to use blocks to construct a graphic pattern of a pyramid. This entails a discussion of what this 'pyramid' should look like. As becomes clear, different ideas of arranging the blocks into a pyramid format exist among participants (one of the participants writes: "You['re] thinking of the kind of pyramid that is flat on one whole edge. I mean like a real pyramid that each layer is completely centered"). In other words, participants have some difficulties in determining the exact shape of the pyramid that they want to work on.

The discussions surrounding the shape of the pyramid are rich and complex and therefore form an ideal environment in which to explore the following themes:

- *the unusual nature of the task*: rather than finding a solution to a teacher-given problem, students here are faced with the task of finding a problem to work on;
- *the affordances of the interface*: students must find ways of representing a three-dimensional shape (a pyramid) using a text-based chat room and a two-dimensional whiteboard;
- *issues of common understanding*: as a researcher, making sense of what is going on in these sessions is extremely difficult; however, in this case, this is an issue for participants themselves who have difficulties of establishing that they share a common understanding of the shape that they are working on; that is to say, the ambiguity over the shape of the pyramid is an issue for both participants and researchers.

Presentation 2: Understanding Work in the VMT Environment: Formulas, Variables and Explanations

Authors: Timothy Koschmann (Southern Illinois University), Gerry Stahl, and Alan Zemel (Drexel University)

Abstract: The initial task in the VMT Springfest 2006 was summarized in a table showing two geometric progressions. The first three elements in each were supplied and the participants were asked to compute the next three for both series and identify a "pattern of growth." One way of summarizing the "pattern of growth" would be to develop algebraic formulas expressed as a function of N, the level in the table. The participants of Team B—Aznx, Quicksilver and Bwang8—were able to fairly quickly produce such formulas for this and a related problem, but difficulties arose when they tried to explain the formulas for themselves and others. These difficulties persisted throughout the four sessions of the exercise. Our title, therefore, is a little play on words. It simultaneously specifies the analytic topic (participants' understanding work) and our analytic approach (analyzing *how* the participants produce their work as understandable).

We focus chiefly on some confusions that arose in Session IV. In this their final problem-solving session, Team B reflected on their previous work together and considered how to summarize it for others. Our interest is in the mundane practices whereby they make their actions understood to each other and to the wiki audience. We begin from the assigned task, then document just what the participants actually did and then, finally, advance to our chief analytic task, explicating just how they did what they did. Influenced by the Ethnomethodological tradition in sociology and borrowing methods and findings from Conversation Analysis (CA), we seek to document these understandings within the details of the participants' interaction. We examine in particular how some findings developed in CA might be applied to text-chat interaction.

Presentation 3: Using Commognitive Lens to Analyze the Development of Algebraic Discourse in the VMT Environment

Authors: Anna Sfard (Univ. of Haifa & Michigan State Univ.) and Shai Caspi (University of Haifa)

Abstract: According to the commognitive framework, thinking is an individualized form of interpersonal communication, whereas learning a particular subject, such as algebra, is the process of shaping discourse in a particular way. Four features of the discourse are likely to be modified in this latter process: the use of words and of visual mediators, endorsed narratives and discursive routines. In our analysis of the data, we will focus on how the participants construct their use of algebraic mediators (traditionally known as "representations"). While doing this, we will also speculate on the question of how the VMT environment might have affected the process (this will be done by comparing the present findings to what is known from the burgeoning research on learning algebra in more traditional classroom settings).

Presentation 4: Tracing the Development of Representational Practices

Authors: Dan Suthers, Richard Medina, & Ravikirian Vatrapu (Univ. of Hawaii)

Abstract: Our analysis of the VMT data focuses on the development of representational practices. Our method traces contingent relationships between events at two granularities. We begin with an event in which the group is applying shared practices for the class of mathematical problems under consideration. In this event, participants construed certain inscriptions as representational resources for resolving the question at hand. We then search backwards to find chronologically prior episodes in which these and related inscriptions are constructed, resulting in a sequence of episodes through which the representational practices were developed. We then work forwards within each episode to construct an account of how the inscriptions become representations through the negotiated practices of participants, using methods similar to conversation analysis but attending to inscriptional acts as well as conversations in the chat tool. The resulting account shows not only how practices are negotiated locally, but also how prior work is re-invoked with the aid of persistent inscriptions. Intersubjective meaning-making takes place in interaction, but not in a vacuum: it draws on the history and resources of the group.

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Socio-relational, affective and cognitive dimensions of CSCL interactions: integrating theoretical-methodological perspectives

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Abstract: Collaborative learning interactions involve a subtle interplay between social relations, the knowledge being co-elaborated, and empathetic circulation of emotions. CSCL situations involve specific transformations of the relations between these three dimensions, within an inherently open collective process of tool appropriation, the study and theorisation of which is the objective of this symposium.

Introduction and research background

Collaborative learning is not only an inter-cognitive process; it must also be seen as a specific personal, interpersonal and emotional experience (Crook, 1994). Learning from collaboration involves a subtle interplay between cognitive-epistemic processes (knowledge and reasoning, as elaborated, exchanged and negotiated in interaction) and socio-relational processes (aspects of cooperativity, friendship/animosity, politeness and emotion influencing the way students inter-(re)-act to each other as interlocutors and as persons). Emotions infuse both cognitive and interpersonal dimensions of joint activity, crosscutting the articulation of the intra-and inter-subjective. Students' own thoughts may arouse pleasure or uneasiness, cognitive dissonance or harmony, and the same applies to their interactive relations with the thoughts, communications and persons of others, within the empathic emergence of socio-cognition. An appropriate balance between the cognitive, the social and the emotional dimensions of interaction is required for effective collaborative learning, since the effort students expend on the interpersonal relation, whether conflictual or irenic, will inevitably interact with their work on the cognitive task.

Although it may be analytically convenient to isolate cognitive and social dimensions of human activity, they are two sides of the same coin: "… research paradigms built on supposedly clear distinctions between what is social and what is cognitive will have an inherent weakness, because the causality of social and cognitive processes is, at the very least, circular and is perhaps even more complex …" (Perret-Clermont, Perret & Bell, 1991, p. 50). Students' interpersonal relations depend in part on their joint understanding of each other's cognitive abilities (the social is influenced by the cognitive); and social interaction influences students' cognitive contributions and understanding (the cognitive is influenced by the social). However, research still lacks precise theories and models of the interrelations between the social and the cognitive (pace Vygotsky), in part because each dimension has been undergoing re-definition in cognitive science. Claims that cognition and consciousness are essentially orientations of social activity, operations with signs (sign-systems being inherently socially shared), situated in socio-cultural practices, distributed across artefacts and socially shared, all contribute to complex reconfigurations of the socio-cognitive.

Affects (experiences or displays of emotions, such as anger, fear, love, hate, jealousy, sympathy, (un)happiness) are integral to cognition and social interaction, since learners who are emotionally aroused may be more motivated and attentive (Kunda, 1990), and perception of others' emotions can involve an interactive process of empathetic mutual influence (Cosnier, 1994). The roles of emotions can be understood on different 'levels' of activity. Thus, expression of emotions can be seen as intrinsically social and cultural (Boehner et al., 2007). On the level of group dynamics, classical work in social psychology established clear relations between the manner of expression of emotions and leadership styles (Lewin, 1948); and Bales' (1950) early work on interaction process analysis included explicit categories for interventions that increase and release tension in groups. Finally, on the level of communicative acts themselves, the circulation of emotions in interactions relates to the interplay of face-threatening and preserving acts (Brown & Levinson, 1987). Argumentative interactions are of special importance in this context, given their potential for CSCL (Andriessen, Baker & Suthers, 2003) and the fact that modalities of critiques (irrelevancy, contradiction, counterclaim) crucially influence the course of the interaction (Muntig & Turnbull, 1998).

Computer-mediated interactions in CSCL environments represent particular educational situations for the enactment of emotionally-charged socio-cognition. Specific characteristics of these situations, such as physical distance between students, as well as physical and semiotic characteristics (Clark & Brennan, 1991) and affordances (Suthers, 2006) of technologies for collaboration, interaction and communication, create open spaces for the mutual re-configuration of the cognitive and the socio-relational in educational activities. CSCL situations comprise unique tools, such as interaction histories, structured communication interfaces and scripted collaboration (Fischer et al., 2007) that require students to transform the means by which they habitually jointly achieve epistemic activities. However, there is nevertheless a degree of flexibility, openness and unpredictability in the processes of appropriation of educational tools (Rabardel, 1995; Overdijk & van Diggelen, 2008) that make them appropriate objects for microanalysis since they are undergoing transformation.

The aim of this symposium is thus to explore theoretical and methodological foundations required for understanding the relations between socio-relational, emotional and cognitive dimensions of collective educational activities, in the context of the collective processes of appropriation of CSCL tools and situations.

Organisation and presentations

The symposium is organised around three main presentations, to be given by experienced researchers working collaborative learning with or without computers. Jay Lemke will be the discussant of this symposium.

Table 1: Organisation of the symposium

Duration (mn)	Title	Presenter(s)/coordinators
10	Introduction to the symposium	M. Baker (CNRS-Telecom ParisTech), J. Andriessen (Wise & Munro Learning Research)
15	1st presentation: “Socio-cognitive tension-relaxation in argumentative CSCL interactions”	J. Andriessen, M. Baker, K. Lund (CNRS-University of Lyon)
15	2nd presentation: “Identifying and overcoming tension in interdisciplinary teamwork in professional development: Two cases and a tool for support”	P. Sins (University of Utrecht), K. Karlgren (Karolinska Institutet, Stockholm)
15	3rd presentation: “Affect and its expression within computer ecologies for learning”	C. Crook (University of Nottingham)
10	Discussant intervention	J. Lemke (University of Michigan)
25	Questions and discussion with the audience	M. Baker, J. Andriessen

1st presentation: “Socio-cognitive tension-relaxation in argumentative CSCL interactions”

Authors: J. Andriessen, M. Baker, K. Lund

One pedagogical goal of collaborative argumentation-based learning is to encourage students to broaden and deepen their understanding of a space of debate (Baker et al. 2003). Since deepening cognitive conflicts can create tension within interpersonal relations, students need to manage its release whilst preserving an effective collaborative working relation (Andriessen, Baker & van der Puil, in press). We present and compare data from three different situations of argumentative interactions. The first involves argumentation in distant CSCL, by dyads of secondary school students. The second involves 13-14 year old students engaged in a design project taking 16 weeks of 2-hour meetings; interactions are oral, with coaching by several teachers. The third situation involves secondary students debating in small groups in the classroom, using face-to-face networked collaboration. We analyse argumentative interactions in each situation in terms of patterns of tension/relaxation, in relation to the breadth/depth of the argumentation. This allows us to relate developments in the socioemotional dimension of collaboration to the form and content of the argumentative interaction. We then present an analysis and comparison of (the absence of) the three argumentative practices in which the activities were embedded in order to propose a framework for understanding the relationship between argumentative practice and the management of social tension in collaborative learning tasks. Our analysis shows that interpersonal tensions resulting from one cognitive conflict can take time to subside, thus creating a higher threshold of tension for subsequent conflicts.

2nd presentation: “Identifying and overcoming tension in interdisciplinary teamwork in professional development: Two cases and a tool for support”

Authors: P. Sins & K. Karlgren

A central interest in developing professionalism resides in the potential for practitioners to learn from and with one another in ways that support transformations of their knowledge practices. However, negotiation between multiple perspectives, interests, practices and traditions intertwines cognitive-epistemic with socio-relational and affective aspects, which may lead to tension and conflict. While tension can disable learning, we argue that identifying these tensions should be viewed as a significant source for change and development. We will present two cases, which show similar patterns. Tension in medical teams is a threat to patient safety. However, an uncritical attitude does not foster learning, and instructors at simulation training courses may therefore put focus on tensions through questioning. Eventually learners may develop skills in analysis, which cover explanations and strategies and which provide a fruitful approach to the problems. The second case investigated teacher-researcher collaboration at a secondary school, and focuses on the design of a learning module. Identification of tensions during meetings helped participants to focus their efforts on the root causes of problems, which led to a reconceptualisation of the current work practices. This subsequently helped team members to deviate from established norms and improve their practices. We will present a video annotation tool with which learners can make annotations that serve the role of mirroring material: letting learners use the tool to annotate video recordings of their teamwork can highlight underlying tensions. An advantage is that problems do not risk being overlooked and instead become a starting point for change.

3rd presentation: "Affect and its expression within computer ecologies for learning"

Authors: C. Crook

Affect is widely accepted as a (somewhat neglected) force in the motivation of study – whether to animate it or obstruct it. Moreover, collaborative interactions have been identified as a significant study arena in which affect is generated. So, the synchronies of collaborating engagement may be a source of positive affect, while the tensions of coordinating an agreed trajectory of problem solving may be a source of negative affect. Consideration of such emotions in the CSCL community tends to dwell on the iconic CSCL case of synchronous conversation around a computer screen (either face to face or across networks). Yet this configuration may have become a fairly unusual context for joint study. Accordingly, any theorising of affect and CSCL may need to notice looser structures whereby technology coordinates students into collaborative arrangements. Findings will be presented from two projects in which individuals were invited to reflect on the personal experience of study. In the first, 20 undergraduates kept voice diaries over a two-week period. In the second, focus groups of secondary school pupils discussed their learning with special attention to social software. These reflections are analysed in relation to the expression of affect. Affect is frequently expressed, but rarely in relation to collaborations, an exception being negative affect arising from enforced group work. Yet the widespread positive affect associated with recreational use of social software suggests new structures of CSCL that might re-capture the positive affect of joint study.

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Issues in Scaffolding Collaborative Inquiry Science Learning

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Abstract: The aim of this symposium is to explore a number of different approaches to providing scaffolding of collaborative activities in inquiry learning in science that are adaptive to context, that support coordination of activities across contexts and that take account of individual variation in learners' and teachers' preferences and motivations.

Introduction

The aim of this symposium is to highlight issues in collaborative inquiry science learning that have challenged researchers when designing technologies for the support of learners and teachers, and to advance a discussion about how these issues can be addressed. We will explore a number of different approaches to providing scaffolding of collaborative activities in inquiry learning in science that are adaptive to context, that support coordination of activities across contexts and that take account of individual variation in learners' and teachers' preferences and motivations. The session involves four papers, each of which describes a project on inquiry learning in science that involves collaborative activities of varying types and in various settings. The first paper focuses on the characteristics of patterns of collaboration amongst learners that lead to more effective forms of inquiry and discusses the design of technology to enable teachers to monitor and reflect upon these patterns of their students' collaborative activities in order to provide timely and flexible guidance. The second contribution raises issues about reconciling the challenges of supporting collaborative activities, where individual learners' inquiry activities need to be shared, with the need to support personal inquiry, which at times learners may wish to keep private – i.e., sometimes personal inquiry learning in science can be too personal. These challenges are particularly acute in classroom contexts where it is difficult for learners to be anonymous. The third paper focuses on how to provide scaffolding of collaborative activities and workflows across different contexts and settings, via mobile devices and web 2.0 technologies. The final contribution takes a slightly different approach to the need for scaffolding to be adaptive to particular learning contexts based on emerging (rather than static) learning objects that are created and shared by students themselves and where adaptive support is provided via pedagogical agents. The common themes across the different projects described in these contributions include the challenge of providing scaffolding within and across co-present real time as well as online contexts, when there may sometimes be sensitivities around revealing individual learners' contributions, and that allow teachers as well as learners to be involved in the adaptation to contexts.

The session will begin with a brief introduction to the issues, followed by a 15 minute presentation of each paper. There will then be a short summary by the discussant to draw out some of the common themes, followed by a 15 minute discussion session that is open to the floor. The session will end with a very short summary of the key points emerging from the symposium.

Designing effective collaborative inquiry with new technology

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New technologies have both extended the opportunities for research on collaborative inquiry and produced new insights. Based on research on knowledge integration, we have reformulated WISE, the Web-based Inquiry Science Environment to support promising student activities around exploration of complex visualizations such as a NetLOGO model of global climate change, added teacher supports for progress monitoring and communication with students, and identified patterns of activities that lead to successful collaborative inquiry. Our prior research shows how to design effective inquiry projects that are conducted collaboratively by students working in pairs. Recently we have ported WISE to SAIL, the Scalable Architecture for Interactive Learning, which has extended our capabilities for collaborative inquiry. We have used these new technologies to study contemporary controversies asking students to discuss topics like climate change, controlling malaria, or reducing the risk of asthma. This presentation highlights results from several studies of the global warming controversy conducted by members of the Technology Enhanced Learning in Science (TELS), NSF funded center. We have investigated global climate change in both a week-long project and a 10-week curriculum that uses wiki technologies to scaffold whole-class collaborations to supplement the climate change model. Both projects use a NetLOGO model of climate change embedded in a technology-scaffolded project. From these studies we have identified collaboration patterns that enhance instruction. Consistent with many studies, we find that debates are more successful when students first generate all their ideas and then develop their argument. In addition, during debate preparation, it helps to explicitly develop criteria for distinguishing among ideas, a step that is sometimes skipped in collaborative inquiry. Finally, adding a summary report after a face-to-face debate strengthens student understanding. The summary encourages individuals to reflect on the ideas they learned from working with their peers. We have used SAIL-based technologies to open up new opportunities for teachers to gain valuable information about their students' ideas during collaborative inquiry. We have designed a new "teacher dashboard" that motivates teachers to reflect on student progress, provide real-time feedback, and plan agile changes to their curriculum that are based on evidence of student learning. This research illustrates how a rich technology framework can scaffold students as they conduct collaborative inquiry activities and enable teachers to provide timely guidance.

Personal Inquiry and Groupwork: Issues for computer-supported inquiry learning

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This paper will draw on research work, currently being undertaken as part of the Personal Inquiry (PI) project to explore how evidence-based inquiry learning can be supported and resourced. The PI project aims to understand how personal and mobile technologies can be designed and deployed to make the processes of evidence-based scientific inquiry personally relevant and readily accessible to young people (aged 11-15 years). It also aims to support the continuity of science learning between classrooms and non-formal settings. Informed by a series of inquiry projects with schools, we are developing a toolkit to support inquiry learning across a range of learning contexts. Based on four school-based interventions, our analysis of processes of learning-teaching (including the analysis of 'breakdowns' in support and pupils' understanding) explores the following questions:

- How can effective evidence based inquiry processes be characterised and supported?
- What dilemmas and tensions are encountered when supporting processes of 'personal' inquiry through structured activities that involve phases of collaborative group work?
- What resources enable and what constrains support collaborative inquiry processes?

The analyses draw on our experiences of using an inquiry activity guide for structuring and guiding activities, supporting class, group and individual working. They also highlight the challenges which confront educators when attempting to mobilise or build upon young people's interests for schooled purposes. Making an inquiry authentic and personally relevant is a challenge that has been widely discussed in inquiry-based learning research. We wish to understand whether there are any circumstances for students in which the exploration of personally relevant topics and questions, rather than being engaging, becomes aversive – there being a fine line between a topic being personally interesting and engaging and being 'too personal' and thus not readily amenable to group investigation or discussion. Conversely, being very personal might be fruitful– a range of personal viewpoints and differences might stimulate engaging group discussion. This points to the necessity and the difficulty of understanding the students' points of view regarding the educational tasks in hand. A way to address this challenge is through our ongoing commitment to participatory design processes involving young people instead of working with educators own assumptions regarding what these are or might be.

Mobile science collaboratories to support open inquiry

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Scientific practices increasingly incorporate sensors for data capture, information visualization for data analysis, and low-cost mobile computers/phones for field-based inquiries exploiting the open internet and web standards. Handheld probes augment learner investigations with real-time geo-positioned data and visualizations, which may increase students' engagement, enabling conduct of scientific inquiries and analyses in new ways. One innovative aspect of these new learning landscapes is combining educational activities across different settings such as school, nature and science centers/museums. The design opportunity is that for K-12 learners, each setting has its own strengths in supporting such inquiries, and with student participation in scientific inquiries supported by mobile science collaboratories, we can bring these sites into complementary functioning in reflective learning cycles which bring concepts into focus through their uses in field studies. Our work is developing the notion of "open inquiry" for catalyzing and sustaining global learning using mobile science collaboratories that provide open software tools and resources, and online participation frameworks for learner collaboration in projects involving mobile media and data capture, analysis, reflection and publishing. We are working to productively integrate geo-location sensing, rich mobile media and Web 2.0 mashup technologies, for creating mobile science learning collaboratories using interdisciplinary co-design methodologies with teachers, learners, technology developers, domain experts, and learning scientists. Our domain is field ecology; we work with biologists on curriculum activities in high school environmental science coupling classroom activities with field-based inquiries and data collection in each school's riparian ecosystem. Field ecology topics are well-suited for geo-gridded data and data visualization, data collection using educationally-robust sensors for water quality data (pH, temperature, oxygen content, conductivity), as well as geo-tagged rich media on plant and animal species. All these activities support learning to reason about ecosystem dynamics. We argue mobile science learning collaboratories can support data-centered conversations where learners experiment with and explore multiple representations of causal interactions and functional relationships that are typical in science learning, promoting a deeper domain understanding. We will discuss, based on learning scenario developments with teachers, what could be the most suitable scaffolding techniques for "collaboration workflows" across these contexts, and the roles that mobile and web 2.0 technologies should play in this process. The specific challenges we will focus on in our contribution are those involved in creating and sustaining (i.e., managing) persistent engagement in inquiry for every learner. How can we optimize engaged participation?

Learning by Design. An example from the SCY-project.

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Science Created by You (SCY) is a project for constructive and productive learning of science and technology. SCY-learners create and share so-called "emerging learning objects" (ELOs), e.g., models, data sets, designs, plans, etc. Learners will be scaffolded to interchange ELOs, review similar or dissimilar ELOs, and to operate on the reasoning represented in these ELOs. In SCY-Lab (the SCY learning environment) students work individually and collaboratively on "missions" which are guided by a general socio-scientific question (for example "how can we produce healthier milk?"). Fulfilling the mission requires a combination of knowledge from different domains (e.g., physics and mathematics, or biology and engineering). In these missions, students use changing constellations of tools and scaffolds (e.g., to design a plan, to state a hypothesis etc.). The configuration of SCY-Lab is adaptive to the actual learning situation, advising students on appropriate learning activities, resources including ELOs, tools, or peer learners that can support the learning process. The SCY project aims at students between 12-18 years. From a conceptual point of view we are tackling the followings issues:

- What pedagogical scenarios are applicable in the overall SCY learning philosophy? Currently a number of pedagogical scenarios have been defined, consisting of sets of learning activities and their associated products (emerging learning objects).
- What scaffolds and tools can be developed to support the type of learning that is foreseen in SCY. A number of these scaffolds and tools are specified and currently under development.
- What topics are suitable for SCY-Lab learning environments? The first mission, which is currently under development, concerns the design of a climate neutral house.
- How can students have easy access to their own products and those from others? An ELO repository and a user-friendly ELO browser are under development
- How can we provide adaptive support to learners? Currently we have explored ways to automatically analyze chats, ELOs, and log-files. These data are processed by so-called pedagogical agents that help to adapt SCY-Lab. Currently these pedagogical agents are under development. Their behavior will partly be based on data mining techniques.

The SCY approach is enabled by the innovative architecture of SCY-Lab that supports the creation, modification, and sharing of ELOs. The central unit in the SCY architecture is a broker that configures SCY-Lab to unfolding learning processes and activities. A first, limited, prototype of SCY-lab is foreseen for spring 2009.

The Assistance Dilemma in CSCL

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Abstract: How to design structure for supporting collaborative learning is a fundamental theoretical and design issue in CSCL research. At the center of this issue lies an assistance dilemma: when to provide support structures and when to withhold them (at least temporarily) to optimize student learning. On the one hand, providing support structures right from the start has the advantage of reducing cognitive load, avoiding floundering and potential frustration. It may well lead to productive success, but there is also the danger of unproductive success—an illusion of performance without learning. On the other hand, withholding support may well lead to productive failure as students persist in active sense-making and problem-solving activities, but there is the danger of unproductive failure in students being overwhelmed. This symposium aims to interrogate issues pertinent to the assistance dilemma continuum by bringing together an eclectic group of CSCL researchers with commitments on various points on the continuum.

Symposium Overview

Research on collaborative learning and problem solving suggests that productive collaboration does not automatically materialize when learners are left to their own devices (e.g., Salomon & Globerson, 1989). It is not surprising therefore that CSCL research focuses on structuring the process of collaboration so as to help learners achieve what they might not otherwise be able to in the absence of the structure. Structure, broadly conceived, has been operationalized in a variety of ways such as structuring the problem itself, process scaffolds and scripts, provision of tools, expert help, adaptive feedback, and so on (Puntambekar & Hübscher, 2005; Stahl, 2007). The question of what makes for optimal support for learning remains invariant across the diverse operationalizations of structure. In the context of individual learning, the problem of optimality is also known as the Assistance Dilemma (Koedinger & Aleven, 2007), that is, when and how to design structure for learning. In this symposium we attempt to broaden the discussion to the area of CSCL. On the one hand, there are CSCL researchers who propose structuring of collaborative processes, e.g., through interactional scripts (e.g., Fischer, Kollar, Haake, & Mandl, 2007). Research in this tradition generally supports the notion that structure should be provided right from the start, and potentially be reduced or faded later. A substantial amount of CSCL research speaks to this because understanding conditions under which structure can lead to productive success is an important line of research. On the other hand, there are CSCL researchers who examine conditions under which delaying structure may well be more beneficial than structuring from the outset especially in the longer term. For example, Kapur (2008) reported findings to suggest that there are conditions under which delaying structure in learning and problem solving activities can lead to productive failure. Along this continuum exist other positions that argue for adaptive ways of providing structure in CSCL (e.g., Rummel & Weinberger, 2008). The idea here is to scaffold collaboration in an adaptive fashion, based on the dynamically changing needs of the specific collaborators. The adaptive approach may serve as a bridge; adaptiveness would ideally take into account the benefit of providing or withholding support during collaboration. Implementing adaptiveness in such a manner seems particularly possible and potentially useful for CSCL settings.

The purpose of this symposium is to bring together an eclectic group of researchers with commitments to various points on the continuum in an effort to interrogate the assistance dilemma in CSCL. The symposium comprises three papers. Paper 1 presents findings from laboratory and field studies to suggest that providing collaboration scripts first and then fading them out engenders productive success, as evidenced by learning gains in domain-specific knowledge. In contrast to Paper 1 where structure was first provided and then faded, Paper 2 reports on a study where structure (in the form of problem-solving scaffolds) was first withheld and then provided, but only after students had persisted in agent-based modeling activities for learning concepts in Electricity. Compared with CSCL dyads whose problem-solving activities were heavily structured, dyads in the productive failure condition (who experienced a delay in structure) demonstrated significantly better learning gains. Paper 3 reports on a program of research that argues for adaptive structuring of CSCL groups.

Consolidating findings from a series of studies on computer-mediated individual and collaborative learning, the authors explore ways of designing for adaptive support in a computer-supported collaborative learning context.

Taken together, the three papers present different operationalization and designs for how and when one might structure CSCL groups. In so doing, these lines of inquiry speak to designing for productive success, productive failure, and adaptive support in important ways. More importantly, the symposium will provide an opportunity for these lines of inquiry to push back against and inform each other. Consequently, we might also achieve better understandings of conditions under which designs lead to unproductive success (an illusion of performance without learning) as well as unproductive failure (struggling without any learning).

Paper 1: Fostering domain-specific knowledge through the fading of scripts

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The instructional approach of collaboration scripts (see Kollar, Fischer, & Hesse, 2006) has been suggested in CSCL as a form of socio-cognitive scaffolding to overcome problems of coordination, argumentation, and individual knowledge acquisition. The findings are promising (e.g., Stegmann, Weinberger & Fischer, 2007), but so far mostly limited to studies of short duration where learners were not expected to gradually take over control of their processes of collaboration and learning, and positive effects on domain-specific knowledge (in contrast to domain-general knowledge, e.g., on argumentation) are rare. It has been hypothesized that the necessity to process the procedural prompts and hints of the script might prevent clear effects of collaboration scripts on domain-specific knowledge. Thus, an important question is how to fade out instructional hints and prompts of the script with increased self-direction skills of the learners. Fading is the increase or decrease of instruction according to changes in learning prerequisites. However, there are hardly any studies on fading in the context of collaborative learning. In a lab study (Wecker & Fischer, 2007) and a consequential field experiment (Kollar, Wecker & Fischer, submitted) we investigated the effects of fading on domain-specific knowledge. In the lab experiment ($N = 138$), we compared unfaded and faded collaboration scripts and found that fading had a positive effect on domain-specific knowledge. In a field study, we implemented collaboration scripts with and without fading (including distributed monitoring) in a school classroom where pairs ($N = 111$ students) worked on a web-based inquiry environment in biology (genetics). The positive effect of scripting plus fading on content knowledge was replicated. These findings are discussed and related to research on the assistance dilemma, adaptive scaffolding and scripting.

Paper 2: Delaying Structure: Productive Failure in Learning the Physics of Electricity using Agent-based models

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This research explored the efficacy of a productive failure design (Kapur, 2008) for learning the physics of electricity using NetLogo agent-based models (ABMs). The experimental condition involved Productive Failure (PF), where student dyads initially used a set of ABMs to solve problem-based tasks in a minimally-structured manner whereas the Non-Productive Failure (NPF) comparison condition was provided with a highly-scaffolded activity structure for the same. Dyads in both conditions groups then used ABMs for the same tasks that were structured, followed by minimally-structured problem-based tasks. This sequence was used for four different NetLogo models of electricity over four different days of the study. The participants were grade 10 male students in Singapore. Participants in the PF group performed significantly lower on the pretest than the NPF group. However, the PF group showed significant learning gains by the posttest that included open-ended and transfer items. The PF group also had a significantly higher score on the posttest than the NPF group. This paper will build upon the quantitative findings (see Jacobson, Pathak, Kim, & Zhang, 2009, for more details) with qualitative analyses of how two dyads used the ABMs—one from the PF and the other from the NPF groups—over the four sessions of the study and describe differences in their respective dyadic interactions related to their manipulations of the different NetLogo models of electricity. This analysis will potentially reveal the interactional dynamics and learning mechanisms underpinning the productive failure effect. Implications for theory and structuring CSCL dyads engaged in agent-based modeling activities will be discussed.

Paper 3: Adapting Assistance to the Student(s): Preliminary Ideas from Individual and Collaborative Computer-Supported Learning Contexts

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We are interested in the assistance dilemma in both an individual and collaborative computer-supported learning context. For instance, in an individual learning setting we have investigated, in three separate studies involving chemistry, whether worked examples, a high-assistance approach, studied in conjunction with computer-tutored problems to be solved, a mid-level assistance approach, can lead to better learning. We found that worked examples alternating with isomorphic tutored problems did not produce more learning gains than tutored problems alone, but the examples group learned more efficiently. In summary, our results, as well as indications from other studies with worked examples and tutored problems, hint toward the potential advantages of adapting assistance to improve learning, for instance by exposing the student to less examples over time (i.e., switching from high to low assistance). Our studies in a collaborative context, involving both chemistry and algebra also hint toward advantages of adaptive assistance, that is, providing a level of assistance commensurate with the learners' needs. In our chemistry studies, which were small-scale, we found that an approach balancing high-assistance (fixed collaboration script) and mid- to low-level assistance (tutoring by an "adaptive" human wizard) had a positive impact on student learning and collaboration. In our algebra studies, we also experimented with an adaptive assistance approach with indications that adaptive prompts yielded deeper learning processes following errors and hint requests. In general, our hypothesis is that an adaptive approach to assistance is likely to be the most successful, in both an individual and collaborative learning context, but this raises several key questions: How does one adapt a system to provide the right level of assistance per student or collaborating group of students? What should be adapted? When should the adaptation occur? In this talk, we explore some preliminary ideas about how one might adapt a computer system to support learning in a computer-based collaborative context, based on what we've observed from our individual and collaborative studies.

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INTERACTIVE EVENTS

Methods for Triangulation and Revealing Interaction

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Abstract: Quantitative methods in educational research tend to be heavily reductionist and to disregard interaction; most statistical models include an assumption of no interaction. Qualitative methods allow complexity and interaction, but tend not to include representations or otherwise allow the reader to "see" the interaction as the researcher can. By combining traditional qualitative methods with statistical modeling, we are afforded a better opportunity to see aspects of a phenomenon, but not always greater integration; interpretation does not easily emerge from potentially divergent data sets. By including social network analysis, which provides both summary statistics and graphical depiction of interaction we are afforded a better opportunity to examine collaborative work. Furthermore, technology facilitates collection and analysis of change over time in computer supported collaborative work. These methods enable a multifarious view of quantitative data, and allow for interpretation to more naturally emerge from multiple data sets.

Purpose

The purpose of this interactive event is to demonstrate innovative ways to analyze and represent collaborative learning processes and products. Static and "snap-shot" analyses predominate, resting on an implicit assumption that outcomes and products accurately reflect learning processes. Technology offers great potential for analysis of complex interactions and processes, though much of this potential is out of reach to many because of a lack of programming experience. By employing familiar programs (Excel and a graphics program such as Illustrator or a concept mapping program such as Inspiration or CMap) in creative ways, we can move beyond purely reductionist uses of numerical data, and evolve hybrid graphs in conversation with qualitative data, and as a tool for mixed methods integration. An illustrative example, derived from student design teams reporting on the productivity and utility of mentor interactions, is provided.

Objectives

Participants will learn basics about social network analysis (SNA) and about the limitations to current SNA software, such as UCINET (Borgatti, Everett, & Freeman, 2002) and Pajek (Batagelj & Mrvar, 1998), which tend to represent data according to projections which may or may not be appropriate and are rarely deliberately and meaningfully chosen by the researcher. Instead, participants will use either a graphical or concept map program to represent data (This may be data they already have, data collected about learning as a result of CSCL interactions during the conference, or data from the presenters on student design team interactions related to the illustrative example, described later).

SNA is an attempt to formalize and empirically explicate relationship ties and their patterns. Systemic relationship ties are considered as structures, and are measured by structural variables, whereas individuals are considered to be actors. Actors are viewed as interdependent and therefore are seen to influence each other. This view is critical for studying systems in which distributed cognition is ubiquitous. Relations between actors may be evaluative (like, respect, friendship, etc), may be based on movement (either physical, as in migration, or social, as in changes in employment), may represent types of relationships (kinship, other formal, societal roles, may represent transfer or flows (of material resources such as money, or non-material such as communication of knowledge), or may be based on types of interactions. Relations may be directional or non directional and dichotomous or valued (Wasserman & Faust, 1995).

SNA may provide descriptive context for relationships. Alternatively, hypotheses about relationship properties of the model may be tested via several methods (Wasserman & Faust, 1995). The unit of analysis is the whole group, not the individual actor, though differences of actors within groups may be contrasted. Outcomes from a model may be used as variables in other statistical modeling techniques (Wasserman & Faust, 1995). Additionally changes to structures or growth over time may be modeled (Wasserman & Faust, 1995). SNA produces several options for examining relationships and roles based on relationships. These include degree centrality, which reflects the number of direct connections to an actor; betweenness centrality, which reflects the degree to which an actor has influence over flow within a network; and closeness centrality, which reflects closeness between actors.

There is a very productive relationship between qualitative research and SNA, which may demonstrate whether interactions of subsets are different from a larger population, or be used to detect the extent of a network or to identify roles. The two have been effectively paired in diverse domains, from analysis of gang relationships (Fleisher, 2005), to studies of nomadic peoples (White & Johansen, 2006), to studies of computer supported collaborative learning (Martinez, Dimitriadis, Rubia, Gomez, & de la Fuente, 2003).

SNA is at once graph theory and matrix algebra. It affords representations that preserve the complexity of interaction, yet also provides variables summarizing characteristics of the group. For instance, group degree centralization (Cd) summarizes the variance in (strength of) ties each individual has to others. This may be used as a measure of cohesion, which can be included in statistical models involving collaborative learning.

When studying groups, it is critical to have group level measures, though these are challenging to procure, especially when it is the interactions between members, and not simply a group product that may be measured as one item. Interactions may not be considered to be unidimensional, adding to the difficulty. By having group members rate each other (bidirectional, valued data) and rate their other mentors (unidirectional, valued data) along multiple facets (likert scaled), we may produce group level summary statistics of these ratings. Such summary statistics may then be used in a statistical model (Figure 1).

Alternatively, SNA may be used to identify the boundaries of a group, and to locate cliques or subgroups and individuals who hold differing roles within a group. In this case, binary data may be most appropriate. In this interactive event, we will consider how participants' reported interactions during the conference may be represented, but will consider other uses of SNA for understanding collaborative learning.

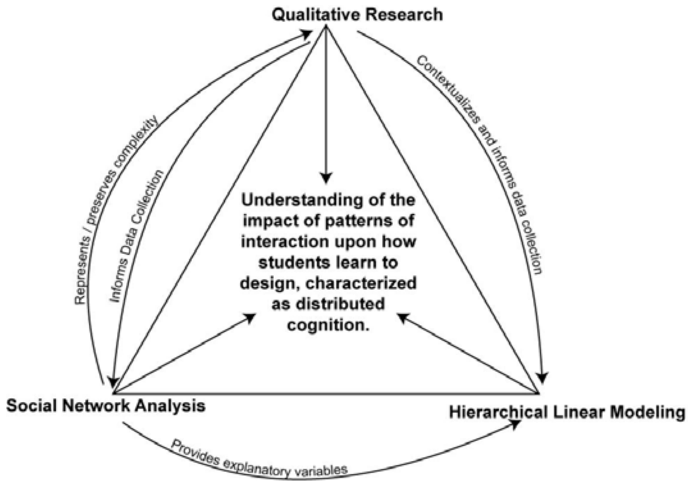

Figure 1. An example of how Social Network Analysis can act as a bridge between methods

Format

This event will begin with a brief discussion of the objectives, and participants will be asked to consider current issues they are having both in representing interaction and in interpretation and triangulation of mixed data. We will briefly discuss an example, then engage in our own analysis.

Participants may opt to complete a survey for each day of the conference (responding to "CSCL is an opportunity for learning. From whom have you learned something today?"), providing data for us to analyze at the interactive event. Alternatively, participants may bring their own data or use data related to the illustrative example. Participants will then contribute to a CMap (http://cmap.ihmc.us/conceptmap.html), a collaborative and free concept mapping program, which we will repurpose to consider both the quantitative analyses possible with these data, as well as the ways in which the graph may better reflect the interactions by also considering qualitative aspects of the interactions. We will also explore ways to produce summary statistics in a spreadsheet program (e.g., Excel) and consider how and when these might explain variance in statistical models of learning.

We will discuss ways to make different aspects of the graphs salient, and ways to use the various affordances of graphs. By deliberately choosing to define location, line thickness, color, and proximity, we may think about powerful ways to represent rather than uncritically allowing automatically-generated representations to coerce us into using ill-conceived models (for instance, using 3-D bar graphs when this may misconstrue the actual differences) (Tufte, 1983).

Illustrative Example

In this example, students within design teams were surveyed at three time points about the quality of their interactions with their mentors. Summary statistics of team cohesion were generated through social network analysis of these data and combined with other explanatory variables to explore whole class trends related to innovative design. Three case study teams were observed throughout their design processes, and these data were combined with the surveys from the case study teams to create graphs representing team interaction (Figure 2).

In this case, location of actors (the black rectangles) is an interpretation based on who reports interactions, who is observed interacting, how individuals interact, and who is referenced as helpful, both in surveys and in conversations.

In this example, we see the utility in representing groups over time. A singular graph would be messy and difficult to interpret. By including graphs from various time points, and by looking at several different groups, various features may become salient. Traditionally, only quantitative aspects are included, and the locations are determined by some sort of projection. Within the context of mixed methods research, we may capture the quantitative aspects by using the summary statistics of group interaction in a statistical model, and therefore use the graph as a base for creating hybrid interpretative graphs of the recorded and observed interaction. In this case, we notice greater change across teams rather than across time, but can still quickly pick out changes over time within teams. By letting these graphs evolve in conversation with qualitative analysis, location, rather than a projection based on an algorithm, becomes meaningful.

The process of generating such graphs allows the researcher to combine qualitative and quantitative data in a hybrid way, and to consider how these sometimes divergent data both reflect aspects of phenomena under study. This can be a powerful exercise towards triangulation of results, which can be an effortful and challenging task (Creswell & Clark, 2007).

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A Tool for 21st Century Learning and Assessment

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Abstract: Twenty-first century assessment must reveal and drive meaningful learning. Typical assessments focus on what students have learned but not necessarily how prepared they are to learn in the future. Through design experiments, we have created and researched Preparation for Future Learning assessments in which students use real-world resources to learn to solve problems. Our goal is to provide valid measures of students' existing strengths as well as skills and knowledge that they need to learn.

Purpose and Rationale

In this interactive event, participants will experience the affordances that a 21st century Preparation For Learning assessment (PFL) provides over a traditional sequestered assessment. We will demonstrate our current tool in which learners take on the role of a virtual genetic counselor as they solve a complex challenge, acting as members of a community of experts. Parts of the assessment involve individual, collaborative, and whole-class or cross-class activity.

This quest to design instructional assessments arose from a partnership with education and policy leaders in North Carolina and Washington State. We are striving to align our work with new sets of 21st Century Skills (Partnership for 21st Century Skills, 2003), in part because educational leaders in North Carolina worried that their current assessment systems are inadequate for the task of assessing 21st Century Skills. The problems facing North Carolina are shared by other countries as well (Partners In Learning, 2006). As emphasis has shifted to easily measurable learning, such as multiple choice assessments, teaching has aligned with this method of assessment.

In order to transform current accountability systems, we are designing a multimedia, PFL assessment that provides opportunities for students to learn while being assessed. In a PFL assessment, students demonstrate their capacity to solve problems by having the opportunity to learn while performing the task in knowledge rich environments (Bransford & Schwartz, 1999). We are designing an assessment that can be used in a formative (Black & Wiliam, 1998) and summative manner. Our goal is to assess skills in the context of challenging content (Figure 1).

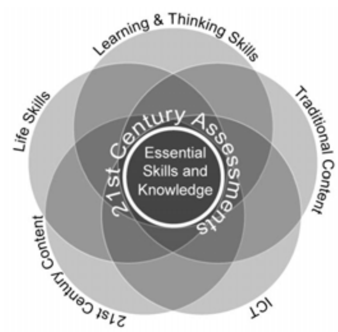

Figure 1. 21st Century assessment lies at the nexus of 21st Century Skills

The development of an assessment tool that is scalable and capable of making student thinking and learning more visible presents a possible solution to a critical global need. While there are examples of assessments making use of computers, and even use of latent semantic analysis for evaluating essays, neither leverages the potential presented by modern technology.

Partnering with content experts and teachers, we designed assessments in the context of genetics. Our PFL assessments are scenario-based and place the students in the role of genetic counselors who answer questions posed by virtual clients. We contrast these with traditional assessments that comprise multiple choice (MC) questions constructed by a test question analysis consultant to a large testing corporation and by a classroom teacher, then reviewed by a content expert.

Objectives

Our findings from two iterations of design experiments demonstrate some of the affordances presented by PFL assessment: students may make use of feedback and resources, learning and changing their minds during the assessment. This model of assessment not only provides deeper and more relevant information about students as well as for them, it also aligns better with real world demands. One of the objectives of our proposed interactive event is to contribute to the global conversation about assessment as a driver of instruction, and to consider how this model might help us to move beyond old inventory models (as when stores used to close to count their remaining stock; technology now allows this to occur dynamically This has yet to occur in schools: instead, we pause learning in order to measure student knowledge.). Another objective is to garner international perspectives on the current design and how we might improve. Our concerns include finding points of leverage for automating feedback, designing for collaboration, better reflecting 21st century skills, and considering ways to incorporate working smart tools.

Internet searching is included as a way to both foster student learning during the assessment, and to create an authentic 21st century task. An affordance of the searching is that students are given feedback by the search engine when they have poorly specified a search term. Students have demonstrated that they can make effective use of this type of feedback, but this is clearly not sufficient to our ultimate aims. Additionally, we need to consider ways to help students learn to be better critical readers with their searches, particularly in light of findings demonstrating that searchers are biased in their selection of an internet resources, based on their prior conceptions (Lau & Coiera, 2007). We recognize the shortcomings of a largely text-based assessment of scientific learning and intend for future renditions to foster model-based thinking (Schauble, 1996; Schauble, Glaser, Raghavan, & Reiner, 1991). We would like to explore how to powerfully incorporate simulations as part of the assessment.

As we continue to design to support collaboration, we consider how students may act as colleagues in a community of learners (Lave & Wenger, 1991). In addition to including questions that ask students to compare answers, to evaluate their answer in light of other (both student and expert) answers and to develop consensus about specific questions as a team or class, we have incorporated or repurposed freely available tools, such as social bookmarking and wikis. Social bookmarking tools allow students to "tag" resources they see as relevant to their research, building up class-wide (school-wide, or state-wide, etc.) resource lists that evolve as they continue to be used within that community. Additionally, in our current redesign, we are including ways for students to offer their expertise to others, as well as ways for students to request help from a colleague when needed.

The development of a PFL assessment that is both scalable and capable of making student thinking and learning more visible presents a possible solution to a critical global need. While there are examples of assessments making use of computers, and even use of latent semantic analysis for evaluating essays, neither leverages the potential presented by modern technology.

We are iterating towards a scalable "working smart" assessment system that will show how students, both individually and collaboratively, learn and improve. The PFL assessment employs scenarios in which students participate in cycles of 1) self-, peer-, technology- and teacher-directed learning, 2) formative assessment, 3) further learning and revision, and 4) benchmark assessment of knowledge and skills. We seek to continuously improve and to find partners who can contribute to this substantial undertaking.

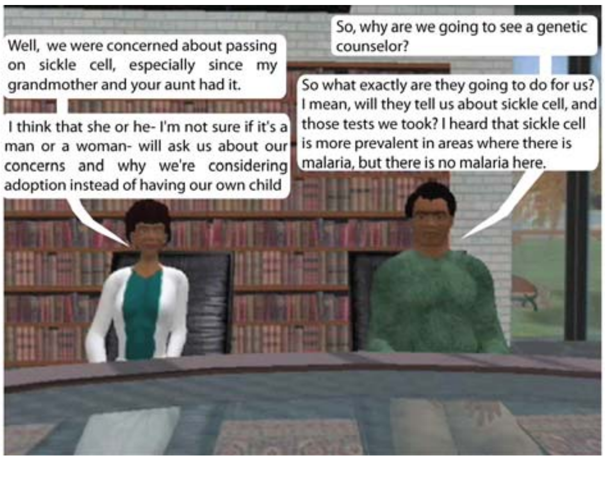

Figure 2. A screenshot of the clients in the 1st Genetic Counseling Scenario

Format

Participants will work in pairs, either sharing one computer or collaborating with two computers. Given sufficient time allocation, participants will first complete a brief traditional assessment in biological sciences as a point of contrast to our design. They will be asked to reflect on their experiences with this assessment, then begin the PFL assessment scenario. Two versions of the PFL assessment have been tested, one in North Carolina and one in Washington State (See http://staff.washington.edu/djgawel/ncavideo/ for links to the tool. Please contact us for a password). We are actively redesigning these as we prepare to go to scale next year; thus the version participants will interact with will be similar to this, but will include new features, such as more opportunities for feedback, better quality video and voice-over, and functional "teacher perspective" views, in which one can see what information about student work teachers will receive.

Participants will begin the PFL assessment by viewing a machinima of a virtual couple considering having a child, but concerned the child might inherit sickle cell disease (See Figure 2). Sickle cell disease was chosen because it is a widely used topic in high-school biology curricula and is sufficiently nuanced, providing many layers for exploration: inheritance, evolution, gene-environment interactions, protein structure-function, political policy and bioethics. Additionally this context has been studied elsewhere (Bell, et al., 1993). Participants are asked to take on the role of genetic counselor, which makes the problem more student-centered and eventually, student-driven. Learning theory posits that this is a way to keep students engaged with the learning experience, and will result in more successful learning (Bransford, Brown, & Cocking, 2000).

Participants will be directed to consider how this assessment currently measures 21st Century skills, as well as how it could better do this as they engage with it. Participants will be asked to comment upon the assessment, and if willing, be asked to help us critically evaluate how to improve learning and assessment of 21st Century Skills.

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POSTERS

Positioning theory as analytic tool for understanding intersubjective meaning-making

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Abstract: This paper explores how positioning theory can be used to understand intersubjective meaning-making in CSCL environments. We analyzed asynchronous conversations of three discussion groups in a learning environment designed to teach team process skills. Analysis of the storylines, speech acts and positions taken up by each group provided insights as to how students made meaning in this learning environment.

Positioning theory

Initially introduced to the social sciences by Hollway (1984), the notions of position and positioning are a dynamic alternative to the static concept of a role. That is, one position can only be understood in relation to another position. The position of husband only has meaning in relationship to the position of wife; the student position makes sense only in light of the teacher position. In turn, these positions can only be understood in the context of particular discourses, or storylines. Speech acts take on different meanings depending the position of those who utters them, and the utterances unfold according to the storyline. Analysis of "episodes of social interaction" (Harré & Moghaddam, 2003, p. 3) requires an understanding of "acts" and "actions". The intention of someone's action is important, but its significance depends on how it is understood as an act by the recipient. Positions limit the possible acts and actions in any social episode. That is, positions come with duties to act in a certain way given the storyline. Few studies have used positioning theory as a way to understand educational settings, and none have applied it in a CSCL environment. Further, positioning theory may provide an approach to assessing team process and perhaps even group learning in CSCL environments, something which continues to be a challenge for researchers. Our research questions is: How can positioning theory be used to understand meaning-making in a CSCL environment?

Method

Working in Teams traces the experiences of two fictitious teams, Team Green and Team Blue, as they work on design projects. After reading the scenes and reviewing resources, students participated in asynchronous discussions based on a given prompt. All 27 first-year graduate students participated in the *Scenario* as a required component of the course. Our data sources were the asynchronous discussion transcripts downloaded from the *Scenario* after the course was complete. Using a sequential strategy (Creswell, 2003; Suthers, 2006) we selected portions of the data to analyze in more detail. We narrowed our focus to the discussions which had the most variation in terms of *shared episodes* (a sequence of postings around a unifying concept in which participants respond to a previous idea). While Melissa's group made eight posts, the participants did not respond to each other, therefore there were no shared episodes. Rufus' group made eleven total posts, eight responses and had three shared episodes. Lilith's group made 21 posts, 16 responses and had more shared episodes than the other two groups (five). We next looked in depth at each of the three group discussions of this one scene. We followed Hatch's (2002) steps of interpretive analysis to identify tentative storylines, speech acts and positions being played out among the members of each discussion group.

Findings

We next describe the storylines, speech acts and positions taken up as students discussed the scene. Each group oriented to three perspectives and each perspective had several storylines. First, groups oriented to the perspective of the fictitious, virtual teams (Teams Green and Blue). Second, groups oriented to the perspective of their discussion group. Finally, groups oriented to the perspective of general claims about the nature of teamwork. These three perspectives indicated how the groups understood the task– as a chance to directly respond to the prompt that was given, a chance to engage in dialogue with other members of the discussion group, or a chance to draw broader conclusions about teamwork in general.

Each perspective had its own storylines. From the virtual team perspective, there were storylines of *blame* and *solution*. The blame storylines entailed and contrasted faulting one member of the team ("scapegoat") for the team's failure with acknowledging that when a team fails, it is everyone's fault ("shared team blame"). The solution storyline contrasted encouraging the team to come together ("rally the team") and solve the problem with appealing to the instructor ("appeal to authority") for a solution. When discussion groups oriented to the virtual team perspective and its storylines, it kept the meaning making at a concrete level – the level of the fictitious team activities.

From the discussion group perspective, storylines were responding to other group members as part of a learning community ("community"); and making connections between the scene and their own team experiences ("self-reflection"). Participants took up these storylines by addressing their responses, either by name or by reference to a previous post, to another group member. This positioning took place with speech actions of sharing personal experiences, practical job experience or referencing readings from the class. In these storylines participants showed their awareness not only of what was happening with the fictitious teams, but also their own reflections on their experiences as members of the current online discussion group team. Finally, the general team perspective storyline centered on what teams should do, will do, and can do, also taken up with speech actions of outside theoretical resources or personal experience.

Shared episodes consist of positions and speech acts through which participants take up a storyline. First, through a speech action of presenting a new idea, a participant positions herself as knower. Participants took up the action as an act in several ways: 1) with agreement, thereby accepting or supporting the initial speaker's positioning as knower; 2) with disagreement, thereby re-positioning his or herself as knower; or 3) by augmenting the claims of the first speaker, positioning both together as co-knowers.

We next contrast the three discussion groups positioning, speech acts and storylines, starting with this thread from Melissa's group.

> If I were a member of Team Green, I would definitely sense we were not on the right track. I would suggest going to the instructor to get an advice from him. Also I might think to myself, "Tim, it serves you right. You should have respected other team members' ideas. You should learn a lesson from this." Now team green needs a different approach to the project in which more open discussion is valued, beginning with the topic selection.

Moon, in making an initial post rather than responding to a previous post, positions herself as a knower ("I would", "team green needs"). She takes up the storyline of appealing to the instructor as an authority to solve the team problem. She also scapegoats Tim as the source of blame ("it serves you right"), yet does not suggest that the virtual team orient to that storyline. She speaks directly to the character ("you should have" and "you should learn") rather than to her group members.

In Derrick's response he orients to the virtual team storyline of shared team blame ("don't blame any single person") by providing a direct response to the prompt ("they should call a meeting"; "this is the time to put our personal difference aside"). He positions himself as a knower ("the thing to do is") and provides direct instruction to the team ("keep people on topic"). By choosing a new subject line and not responding to Moon's earlier post, he maintains a storyline of advising the virtual team rather than the storyline of engaging in discussion with the online discussion group. Fairuza posts a response and does not take up a storyline of a learning community, choosing instead to include a new subject line and respond to the prompt ("I would perhaps send an e-mail saying" and "I would act as a harmonizer") rather than to other members of her discussion group. She also adopts a knower position and takes up the storyline of rallying the team ("other members are equally charged with this bad result") rather than scapegoating one team member. Ralph's discussion group took up different storylines than Melissa's group, as illustrated below.

> This seems very obvious, but Tim would probably be the only person who would be in opposition. I believe we should have a meeting with Burt. All four members need to meet with Burt together to discuss some of the team dynamics of the group and the topic. That way no one can feel as though they are getting Burt on their side without other team members. Besides, it would be beneficial for Burt to actually see the group together. Then maybe Burt could constructively suggests ways in which they could better. In the resource about Constructive Criticism (the first article), I believe the most important of the 5 points was about criticizing in private and praising in public. Often times we are so quick to say just what is on our mind without thinking about how it may come across. . .

Ralph takes the position of knower and, like members of Melissa's group, takes up the storyline of scapegoating Tim and appealing to an authority for the solution ("we should have a meeting with Burt"). Unlike Melissa's group, Ralph takes up as well the storyline of self-reflection ("often times we are so quick to say just what is on our mind without thinking about how it may come across") and references course readings. In this way Ralph takes up the online discussion group storylines in addition to the virtual team storylines, something that did not occur in Melissa's group. In Wei Wei's reponse, she keeps he subject line the same. She positions herself as a knower, rather than a coknower by disagreeing with Ralph's suggestion for the team to meet with Burt. Instead, she takes up the storyline of the shared team fault ("our team should discuss.."), and reverts to the virtual team storyline.

Lilith's group takes up not only the virtual team and online discussion group storylines, but also the "all teams should" general storyline.

> I think team green got what they deserved. They let Tim take charge and proceed with a topic they knew didn't fit the requirements. The only member who should be the least bit surprised by this feedback is Tim. The rest of the members could have prevented this negative feedback by voicing their opinions. Ellen did voice her opinion, but Tim rolled right over her and she backed down. If the other two team members had backed her up, this whole mess could have been prevented. What I'm learning from teamwork is that it is no place for the timid!! You've got to step forward and make your opinions known, otherwise you take the grade your team gives you, not the grade you earn!

Karen positions herself as a knower and takes up the "shared team blame" ("they let Tim take charge"). She then moves into the self-reflection storyline ("what I'm learning from teamwork is") and the "teams should" ("you've got to" and "you have to allow"). She doesn't speak directly to the characters, but rather to her group members. Ron's subsequent post takes up the storyline of "shared team blame" and takes up the storyline of being part of a learning community by directly responding to Karen. He positions himself as a co-knower ("you say" and "I also think"). He takes up a storyline of self-reflection ("I know I am really bad with making decisions…") and of "teams should" ("recognize that some people need that time out"). Karen's post sustains the storyline by reflecting on her own team experiences ("looking back know, there are things I would have done differently"). She positions herself as a co-knower ("I agree, Ron") and moves completely away from the virtual team storyline, instead taking up the storyline of engaging in a learning community and the "teams should" storyline ("if you're reluctant to speak up..")

Discussion and Conclusion

Only Lilith's group took up all three storylines of virtual team, discussion group and teams in general. Melissa's group took up the storyline of the virtual team. Thus, only Lilith's team showed a deeper, richer movement into multiple storylines. Taken together, the self-reflection, "teams should" and learning community storylines may be more likely to lead to learning. The positioning of participants through speech acts as in agreement or as augmenting the ideas of others also reflects the group members' meaning-making processes. We can make connections between the three perspectives and their storylines with traditional aspects of learning. The virtual team storylines, in which students position themselves in relation to the virtual characters, are a way of engaging at a concrete level. As students take up storylines of the online discussion group they begin to negotiate with each other the meaning of the scene itself. Finally, as students take up the storyline of "teams in general", they begin to transfer some of what they are learning through this particular scene to their understanding of teams at a general level. Further work will explore which storylines, positions and acts are most likely to lead to the intended learning outcome as defined by the designers of this particular scene and whether we can identify the typical storylines taken up by students learning team process skills in order to use these storylines as a teaching tool for self-reflection.

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From Outcast to Expert: Identities as a Conceptual Lens for Studying Learning through Design Across Spaces

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Abstract: In this paper we introduce the analytical lens of identities-in-practice to understand how one youth's participation in a classroom design project changed as he drew on his identities with design projects developed in other spaces, particularly an after-school technology club.

Background

In recent years there has been a renewed recognition that youth bring resources for learning from different places in their lives (e.g., Holland, Lachiotte, Skinner, & Cain, 2001) and hence the practices and ways of talking that one already knows and that are tied to one's identity can be seen as resources to participate in different social contexts. Participation in learning through design projects has been studied in classrooms and after school spaces (e.g. Peppler & Kafai, 2007; Roth, 1998). Only few studies such as Roth's (1998) have investigated how students bring in tools from home into classroom activities while Ching and Kafai's (2007) investigated how students with prior experience in design projects could be valuable peer teachers for inexperienced students. Much of this research has focused on activities and tools as resources but paid less attention to how learners' identities from multiple areas of participation in design can impact learning in school classrooms.

In this poster we argue for the value of studying participation in design across multiple contexts of students' lives, describing how one youth's participation in a classroom design project changed as he drew on his identities with design projects developed in other spaces particularly in an afterschool technology club. We use the concept of identities-in-practice as a theoretical lens for our research – the idea that a person's different identities, formed by ways of acting, talking and valuing in different social worlds of one's life, are potential resources for changing who one is in relationship to a group of people. In order to study this, we examined how an individual created bridging identities that involves more than simply imitating the practices of a group of people, it entails integrating practices and narratives to create a new identity in relationship to others. Applying this specifically to contexts of learning by design, our primary research question is how did this one youth attempt to use identities (conceived of as practices and narratives) from different contexts of participation in design as resources to become a particular type of person in other contexts?

Study Design and Methods

This research is part of a larger study that took place between February and June 2008 that focused on two case study youth who we observed in different social spaces of their lives: an after school technology design club for 10-12 year olds and a design unit on geometric art in the sixth grade classes of the school. In all of these contexts we collected field notes, videos, interviews, and artifacts (including programming projects from the club and class). We focus on one case study participant, Matthew, a twelve-year-old African-American boy, who participated in both the club and class. The data gathered about Matthew include over 60 hours of observation from the club, school, home, and sports practices, six interviews, and artifacts he created (e.g., programming projects and school work). The main design tool that he used across different contexts was Scratch, a media-rich, visual programming environment (cf., Peppler & Kafai, 2007). Analysis was based on grounded theory (Glazer & Strauss, 1967) and began with identifying moments when identities from different spaces of participation in design intersected or overlapped. We especially looked for times of heightened emotions and actions that seemed out of place as signals that identities might be conflicting or changing. Then we worked backward from such moments to study how participation in different social spaces changed over time. We focused on changes in reifying statements made by or about the case study participant (e.g., "I am" or "you are" statements) that we took as indicators of identities in relation to practices and narratives.

Findings

Our analyses focused on changes in Matthew's recognition from outcast to expert in Scratch design projects that crystallized during a three-week geometric art project in class. Doing design work in multiple contexts built up Matthew's practices with Scratch in different ways and together contributed to his growing narratives as a computer programmer, an expert, and a leader. There were two main issues with Matthew's engagement with digital technology at the beginning of the study. First, his parents and teachers did not support his identification with it because he used it at times they saw as inappropriate (i.e., when he should have been doing homework). Second, he saw himself as a consumer rather than a designer of technology -he read anime rather than wrote it, he played games rather than designing them, he browsed programming projects (in Scratch) online rather than designing them. Further complicating his academic participation in school was his peers' ostracizing of him because they saw him as demeaning, probably because comments intended to be sarcastically humorous such as "You're stupid," were not interpreted that way by his classmates. One affect of this was that Matthew's peers ignored his ideas and efforts to contribute in group projects. Over the course of the study this changed as Matthew's identities with his parents, teachers, peers, and computers shifted in ways that cannot be understood apart from each other.

Two of the primary influences in Matthew's changing identities were his participation in an after school technology design club and a class project where the students developed geometric art projects in Scratch. In the after school club, members used Scratch with no expectations other than that the only use of the computers was related to Scratch. Matthew's primary participation included watching anime Scratch projects online through the social networking site scratch.mit.edu and browsing the Internet for good illustrations of anime characters for his own projects. Thus his social participation with Scratch and the related online site was as a consumer rather than a designer. After the club ended, his class used Scratch in a much more structured way during math to develop geometric art projects. At the beginning of the project, the two girls partnered with Matthew ignored his efforts to give advice on the project and physically excluded him from a close view of the computer. Matthew was frustrated at this, "Why are you looking at me like I'm an idiot?! I'm the expert!" Still, he went around the class helping other groups meet their design goals, demonstrating small techniques, identifying problems in their coding, and helping problem solve. By the end of the first day, one classmate said to Matthew's group, "Sorry, he should be in our group because he's helping us a lot and he's really good at Scratch," signaling the beginning of a change in Matthew's identity with collaborative computer design work.

Over the three weeks of the project Matthew was able to draw on practices developed in the after school club to make suggestions that helped his partners accomplish their goals for their project and resulted in a positive change in his classmates' actions toward him – they began talking about Matthew as a leader and expert. The group also uploaded their project, one of the highest acclaimed and most complex of the class, to the Scratch website, indicating a shift in Matthew's participation on the collaborative site. Here we see a direct interaction between Matthew's identity with Scratch and his identity with peers that led to new identities as a leader amongst his peers and as a programmer/designer. These new identities also impacted Matthew's relationship with his parents and teachers. During his final parent-teacher conference, he highlighted the geometric art project as his best achievement in math, aligning his participation with Scratch (and thus the computer and Internet at large) with his parents' and teachers' norms for positive academic behavior. In fact, he even cited becoming "the fifth best Scratch programmer in the school" as one of the academic highlights of his school year.

This is only one example of how engaging in design work across different contexts can facilitate changes in identity, yet it points to the potential both for studying the resources students bring to work in design and for creating complementary areas of engagement in design that might be mutually supporting,. The poster will provide details on Matthew's changing participation in the class, fuller description of the social worlds that he bridged through his participation in design, and implications for facilitating engagement in design in multiple contexts that might help youth positively connect different identities.

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When to Collaborate: Individual and Group Exploration of a Hypertext Environment within an Inquiry Science Classroom

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Abstract: The use of a hypertext environment within an inquiry science curriculum is explored, comparing two conditions of group collaboration: one in which students explore the environment individually prior to a group discussion, and one in which students use the hypertext as a group while discussing the content. Student discourse is analyzed to compare the efficacy of the two conditions and the influence of classroom context on these learning conditions is discussed.

Introduction

Collaborative learning is an important part of inquiry science classrooms. In an inquiry environment, learners can benefit from the ability to discuss ideas and negotiate deeper meaning with other learners (Olson and Loucks- Horsley 2000). Though small group collaboration may be beneficial for learners, it is not always successful (e.g., Barron 2003). There are many factors that influence collaborative learning, including group composition, the nature of the task, and the nature of the environment itself. Collaborative learning is also influenced by the affordances of the tools, the context in which they are used, the role of the teacher as a facilitator of class discussions (Puntambekar and Young 2003), as well as when the tools are used in the learning process (Koschmann 1996). The exploratory study described in this paper attempts to explore the issue: when should students collaborate? Should students use a tool individually first and then discuss ideas in groups, or discuss their ideas while mutually engaged with the tool? We explored this issue within the context of using a hypertext system, which students used as a resource during inquiry-based science learning. This issue is especially relevant because, on the one hand, the hypertext system could offer points of shared reference for collaboration, which in turn could support the co-construction of knowledge among learners (Lipponen 2002) and lead to richer discussions of the content. On the other hand, as a technology tool not specifically designed to foster collaboration, the affordances of the hypertext environment might not meet the pre-conditions for successful collaboration (Stahl 2007). Furthermore, reading text in general is largely an individual activity. For these reasons, we examined student learning with hypertext in both an individual and a group condition. We also explored how the classroom context, such as the nature of the task and the role of the teacher, influenced how students interacted with each other and the tool.

Methods

The study was conducted in a 6th grade science classroom (N=16), consisting of four small groups of four students each. Students used the CoMPASS hypertext system (Puntambekar 2006) on a notebook computer as part of a project-based inquiry science curriculum to learn about physics concepts related to simple machines. The CoMPASS hypertext system is designed to complement students' hands-on investigations by providing text that describes the concepts, as well as navigable concept maps, which mirror the conceptual structure in the domain of physics.

In this study, we describe student and teacher discourse while students used CoMPASS to help them complete four design challenges: the inclined plane, lever, wheel and axle, and pulley challenges. For each challenge, students were told to find the best way to use the simple machine to reduce the force needed to complete a given task. For this study, student groups completed two challenges in each of two conditions. In the individual condition, students explored CoMPASS individually for both the inclined plane and pulley challenges. During this time, students used the hypertext to research information for their challenge, and then met in their small groups of four students to discuss what they had learned. In the group condition, students explored CoMPASS with their small groups to research information for the lever and wheel and axle challenges. For all design challenges, students were given 15 to 20 minutes for exploration of CoMPASS, with an additional 10 minutes of group discussion for the individual exploration condition, resulting in approximately 160 minutes of audio and 150 pages of transcripts.

Transcripts of group discourse for the four student groups were used to investigate the kinds of talk that occurred during the two conditions. For the individual condition, the discourse during the group discussion after individual exploration was analyzed; for the group condition, we analyzed the discourse of the group discussion while groups explored the hypertext environment together. We coded the group discourse using a rubric, consisting of five categories: 1) *off-topic* conversation included discourse unrelated to the material; 2) *group* *dynamics* included socially-oriented discourse such as instances of group conflict; 3) *task-oriented* discourse included talk pertaining to task management and hypertext navigation; 4) *fact-oriented* discourse consisted of students sharing facts learned in CoMPASS, without elaborating on the information or its relation to their challenge; 5) *deeper understanding* discourse included scientific discussions of the relationships between concepts, connecting concepts to the challenge, providing examples of physics concepts, making predictions about potential challenge solutions, and deeper questions or explanations of the underlying physics concepts. Each utterance was coded using the rubric, with inter-rater reliability between the first two authors of 85%.

Results

To compare discourse in the two conditions, we calculated the percentage of utterances in each discourse category out of the total utterances for each group, and computed the means and standard deviations of each condition across the four student groups. There were several differences in the types of discourse between the group and individual exploration conditions (see Figure 1). For the individual exploration condition, group discourse after using the hypertext individually was far more fact-oriented (M=53.3%, SD=19.2) than in the group exploration condition (M=18.7%, SD=11.4). However, much of this talk consisted of students simply taking turns reporting basic information (i.e. definitions and formulas) they found during their individual exploration of CoMPASS, including incorrect or incomplete facts. There was also more deeper understanding talk for the individual exploration condition (M=6.6%, SD=0.09) than in the group condition (M=2.2%, SD=0.02), though much of this talk was connecting the concepts to the challenge, rather than demonstrating a truly deep understanding of the science. During the group exploration condition, student discourse was on average more off-topic (M=37.0%, SD=17.0) than when exploring CoMPASS individually first (M=16.4%, SD=13.9), and more time was spent on task- oriented discussions (M=27.7%, SD=14.4) than for the individual exploration condition (M=13.5%, SD=8.8), though much of this difference could be attributed to the presence of navigation talk in the group exploration condition. There was essentially no difference in the frequency of group dynamics-related discourse between the group exploration (M=14.4%, SD=6.8) and individual exploration (M=12.2%, SD=19.6) conditions.

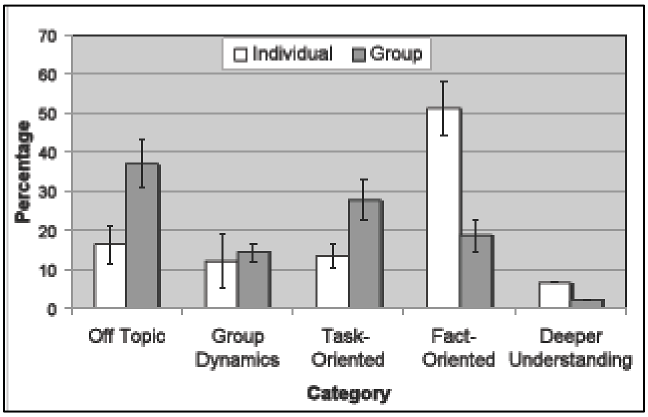

Figure 1. Percentage of group discourse category by exploration condition (with standard error bars).

Students' overarching goal for researching and discussing information from CoMPASS was to develop an understanding of the science concepts and relate them to their design challenge. However, the teacher did not always frame their research on CoMPASS and group discussions in a way that made this goal apparent. For example, after students used CoMPASS individually and were to have group discussions, the teacher directed that students' sentences should begin with "I learned that…" Students discourse therefore focused on simply reading from their notebooks everything they had written down; they were more focused on how much information they had recorded and could report to their group than on understanding the science, as illustrated in the following excerpt:

> [Student 4]: Um I learned that a stair is an inclined plane.
> [Student 3]: Me too. And I have the, the types of inclined planes. Er, eh, inclined planes...
> [Student 1]: Okay. I learned…
> [Student 3]: Wait, what did (Student 4) say?
> [Student 2]: Types of inclined planes, inclined planes…
> [Student 1]: I learned that work equals force times distance.
> [Student 3]: Okay what was yours (Student 4)? Sorry.

Further, direction and facilitation by the teacher was not much different when students navigated in the group condition. Students were still focused on simply writing down facts that they had found to answer specific questions. This kind of discourse was reinforced by the teacher as illustrated by the following excerpt:

[Teacher]: You're first finishing answering all of your questions.

[Student 2]: We did that.

[Teacher]: Then you're just continuing to research levers writing down important information on page twenty-four, write down that key information on page twenty-four.

Discussion

This exploratory study was conducted to compare group and individual exploration of a hypertext environment. Group discourse after individual exploration was largely focused on reporting basic facts found within the hypertext, with students often reporting incomplete or incorrect facts. Having students come together to share information that they learned individually did not lead to successful collaboration. For group exploration, there was more off-topic behavior, which may be attributable to the fact that only one group member was able to control the navigation. Simply having the hypertext available as a shared reference for collaboration did not in itself lead to richer discussions. Given the lack of talk focused on deep understanding of the science, neither condition seemed ideal.

This overall lack of depth in both conditions could perhaps be attributed to the nature of the task, as framed by the teacher. The students were mainly concerned with writing down and reporting basic facts, rather than developing a deeper understanding of the concepts and making connections to their design challenges. The way the teacher framed the task may have changed the task from an authentic, ill-defined, divergent task to a more constructed, well-defined, convergent task (Kirschner 2002). This suggests that the teacher should frame the task in a way to support collaborative inquiry, regardless of when the collaboration takes place. It also suggests that successful learning in an inquiry classroom may require a shift in how both the teacher and students think about scientific inquiry, especially those with no prior experience with collaborative learning in an inquiry environment.

Our original question of when to collaborate is not a simple one with a clear answer. Based on the results of this study, we suggest that future research is needed investigating the organization of collaborative activities in inquiry environments. Such research can include combining individual and group exploration, altering the group structure and the nature of the task, characterizing the teacher's role in collaborative inquiry, and exploring technologies designed specifically for collaboration.

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Motivation and Collaborative Behavior: An Exploratory Analysis

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Abstract: The motivating effects of collaborative learning have long been argued, however a careful analysis of the relationship between the motivation orientation of a student and perceptions of himself, his partners, his collaborative behaviors, and learning in a collaborative context have not been as thoroughly explored. In this paper we present an exploratory analysis of data from a collaborative learning study from the standpoint of motivation type of students and their partners. Overall, what we see is that a student's own motivation orientation may color their perception of the exchange of help in the collaboration, sometimes obscuring the reality of the help actually exchanged.

Introduction

A student's motivation is often the recipient of both the praise and blame behind his successes and failures. If he does his homework and asks questions without external rewards, then he is intrinsically motivated and is expected to succeed academically. Alternatively, disinterest and laziness are often reversed with threats of bad grades or even monetary rewards for achievement. And so, in this way, parents and educators have intuitively understood the importance of motivation orientations in a child's academic successes, but it is not obvious how the individual motivation orientations contribute to specific behaviors and learning outcomes in collaborative learning exercises.

Despite numerous acknowledgements of the motivational benefits of computer-supported collaborative learning (Järvelä et al, 1996; Lipponen et al, 1997), research exploring the specific effects of individual motivations on the quality of interactions in collaborative environments appears to be lacking. By determining what combination of motivational pairs yields the most positive results, we can contribute to both the CSCL and motivation communities, while improving the collaborative learning experience for students.

The concept of intrinsic motivation versus extrinsic motivation (i.e. performing an action for external rewards or to avoid negative outcomes) is explored further in the self-determination theory (SDT) literature (see Deci et al., 1991). According to SDT, students are intrinsically motivated only for activities that they find intrinsically interesting, but that an activity can evolve from being extrinsically motivated to intrinsically motivated by internalizing and integrating the value and regulation of the activity. Optimal situations where a student's psychological needs for competence, relatedness, and autonomy are maximized result in a more effective internalization process. That is, in a classroom environment that fosters a love of learning, rather than fear of control, the student will display more internally regulated motivations that rely less upon external rewards and punishments and more upon enjoyment.

Research based upon help seeking and achievement goal theory shows that an intrinsic goal-orientation reduced help seeking avoidance and increased the likelihood of more optimal help seeking strategies (Newman, 1990) providing further support for the benefits of intrinsic motivation. Help seeking as well as help receiving are experienced in collaborative learning contexts, a classroom activity whose positive effects on learning, self-esteem, and attitudes toward classmates and school have been documented for decades (Slavin, 1980). While other studies have previously examined how group composition based upon combinations of high and low ability students affects learning outcomes and helping behaviors (Webb et al, 2002), there does not yet appear to be any work to determine the effects of group composition based upon varying intrinsic and extrinsic motivational compositions on learning and helping behaviors.

This paper describes an exploratory study to determine the effect of motivation composition on group performance and behavior in a CSCL environment, with the aim of providing a foundation for future studies that elicit optimal collaboration between learning group members.

Method

We designed an exploratory experiment to determine the influence of sixth-grade students' motivation orientation on their interactions in a collaborative learning environment. As this is an exploratory study, there is not an experimental manipulation.

The collaborative environment used in our study was the Virtual Math Teams (VMT) environment (Stahl, 2006) which has a chat panel and an interactive whiteboard. Students worked in pairs on a series of tangram problems designed to teach them a basic conceptual understanding of fractions. As a graphical representation of fraction concepts, we used the same tangram representation throughout all of the problems, with movable pieces representing different fractions of the whole, which the students were able to manipulate the same way they would physical tangram pieces. Students worked in pairs on a series of 13 problems, spread over two lab days. The problems were adapted from similar materials developed by the Math Forum (http://mathforum.org/vmt) and pilot tested in an earlier exploratory study. Problems increased in difficulty over the two days, starting with the very basic due to the students' inexperience with fractions.

Thirty-two sixth-grade students were arbitrarily assigned to pairs by their teacher and were not told who their partner was. In order to enforce communication through typed chat, students were placed on opposite halves of the computer room. Of the 16 groups formed, four were homogenous gender pairings with three female-female groups and one male-male group. Students were primarily middle-class Caucasian children.

The materials for the experiment consisted of the following: collaborative software with an interactive whiteboard and text chat area, 13 conceptual fractions math problems, the Academic Motivation Scale (AMS)-elementary questionnaire to assess motivation orientation, a collaboration questionnaire used in earlier studies (Gweon et al., 2007), isomorphic pretests and posttests, and two quizzes with both near and far transfer problems. The students took the pretest and motivation questionnaire on Day 1, the first computer lab, quiz 1, and the collaboration questionnaire on Day 2, the second computer lab and second quiz on Day 3, and the posttest on Day 4. The fourth day was separated from the third day by a weekend.

Results

As our exploratory experiment does not have an experimental manipulation, our results will consist of comparisons between motivation orientations, rather than between conditions. Due to the small sample size, we adjusted our AMS motivation questionnaire results and distilled four different motivation types: Extrinsically motivated, Intrinsically motivated, Unknown (if their score for intrinsic motivation was identical to their score for extrinsic motivation), and No Data.

Student Learning and Behavior

There were no significant differences in learning between motivation groups, $F(3,13) = 1.02$, p = n.s. However, since the difference was not significant, we will not focus on learning per se for the remainder of the analysis. When we look at the sum of substantive chat contributions and object moves together as contributions to the collaborative problem solving, we see a marginal effect of motivation type, $F(3, 28) = 1.95$, $p=.1$, where the largest number of contributions come from students who are Intrinsically motivated (mean 171.6, s.d. 55.6), followed by students who are Extrinsically motivated (mean 150.6, s.d. 61.3), followed by students who were Unknown (mean 117.3, s.d. 70.5) or had No Data (mean 112.0, s.d. 36.0). Only the two endpoints were significantly different. Thus, we see little evidence that motivation orientation significantly affected behavior in this task, however below we see evidence that it did affect perception of behavior within the collaboration. This discrepancy between the reality of student behavior and the perception of behavior is the main finding of this study.

Student Perceptions of Themselves

Here we analyze questionnaire data to examine how students of different motivation orientations perceived themselves as well as how student perceptions of themselves were affected by the motivation type of their partner. Three indicators were computed, namely I-Know (the extent to which they perceived that they knew how to solve the problems), I-Interest (the extent to which they were interested in the material), and I-Help (the extent to which they offered help to their partner).

Student self perceptions were significantly affected by their own motivation type. For example, students who were Extrinsically motivated perceived themselves as knowing significantly less than students in the other three motivation groups, $F(3,27) = 3.4$, $p < .05$, effect sizes ranged from 1.1 to 1.5 standard deviations. Nevertheless, Extrinsically motivated students rated themselves highest out of the 4 groups on the extent to which they offered help to their partner $F(3,27) = 6.6$, $p < .005$. A posthoc analysis shows that the difference between Extrinsically motivated students and the No Data and Unknown groups was significant. The contrast between Intrinsically motivated students and the No Data group was also significant. Effect sizes of significant contrasts ranged between .88 and 1.2 standard deviations.

Student perceptions of their knowledge were largely consistent with their pretest scores, although the positive correlation between perceived self knowledge about the problems and their pretest score was only marginal, R-squared = .1, p = .1. The discrepancy may have been due to the effect of motivation type on perception of knowledge. There was no significant relationship between pretest score and motivation type.

Student Perceptions of Their Partner

Next we examined whether student perceptions of their partners in the collaboration was affected more by their own orientation or that of their partner and we only see evidence of a relationship between these indicators and the perceiver's own motivation orientation. We see a marginal effect of student Motivation type on perception of how much help the partner offered $F(3,27) = 2.1$, $p=.1$. A posthoc analysis shows a significant contrast between students with Extrinsic motivation orientation and those with no data. Students with Intrinsic motivation and Unknown orientation fall in the middle, not being significantly different from either end point. It is interesting to note that while it was the Intrinsically motivated students who contributed the most to the collaborations they participated in, it was the Extrinsically motivated students who perceived themselves as exchanging more help with their partners. The effect size of the difference between Intrinsically motivated and Extrinsically motivated students in their perception of how much help their partner offered was about .5 standard deviations, although it was not statistically significant.

Student Perceptions of the Collaboration

In looking at data related to student perceptions of the collaboration, we see a significant effect of partner Motivation type on Frustration with the collaboration, $F(3,27) = 3.5$, $p < .05$. A posthoc analysis shows that partners who are either Intrinsically or Extrinsically motivated are rated as the least frustrating to work with, while students who are Unknown are significantly more frustrating to work with. The effect size of that contrast was 1.4 standard deviations. However, one possible explanation is that students of Unknown orientation contributed less to the collaboration than students who are either Intrinsically or Extrinsically motivated.

Conclusions

Perceptions of the exchange of help in collaboration are important for fostering a sense of community membership and participation. Thus, the significant impact of motivation orientation on these perceptions that have been found in this study have important implications for future investigations of the role of motivation in collaborative learning. In particular, one surprising finding is that we see evidence that a student's own motivation orientation might affect their perceptions of their partner's performance in the collaboration, although their partner's motivational motivation may not affect their perception of their partner in the collaboration. To the extent that motivational orientation affects behavior, which we saw along some dimensions, this is a surprising finding. Another surprising finding is that student motivation orientation might lead them to perceive their behavior significantly differently even when it does not significantly affect their actual behavior. Overall, what we see is that a student's own motivation orientation may color their perception of the exchange of help in the collaboration, sometimes obscuring the reality of the help actually exchanged.

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Impact of Learning Presence on Learner Interaction and Outcome in Web-Based Project Learning

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Abstract: To identify the impact of presence on interaction and outcome in Web-based project learning, this study performs multiple regression analyses on learning presence, learner interaction, achievement, and satisfaction. Targeting sixty-three undergraduate students enrolled in a collaborative Web-based project task, the study measures presence and satisfaction through self-report questionnaires, learner interaction through the content analysis method, and achievement through an instructor-developed rubric. The results show that the major predictor of interaction and outcome is cognitive presence.

Background

Through cooperation, learners can improvise a new task, construct knowledge, and promote their learning experience (Gonella, 2001). Project learning is a cooperative teaching and learning method frequently used in Web-based environments. In a typical Web-based project learning scene, students design their own learning processes, search for resources necessary for problem solving, and are consistently involved in discussions with the members of the team (Barron, 1998). Following these procedures, the technology enlarges the locus of learner engagement and increases chances of cooperation (Jang, 2004).

Studies have suggested that interaction and learning presence could be key factors in cooperative Web-based project learning. For instance, a number of researchers identified interaction as an important predictor of success in Web-based learning (Bonk & Cunningham, 1998; Chung & Lim, 2000). Alongside interaction, learning presence is known to indicate students' level of perceiving the technology-enhanced world as authentic as the real world (Kang, 2005; Russo & Benson, 2005). Although empirical studies of learner interaction or learning presence have shown relations with learning outcomes (Stacey, 2002; Tu & McIsaac, 2002), not much effort has been devoted to identifying the intricate relationship among all three factors (interaction, learning presence, and outcomes) comprehensively.

Therefore, our primary goal of understanding the relationship between interaction, learning presence, and outcome is to investigate the impact of learning presence on learner interaction and learning outcome. More precisely, the impact of learning presence on learner interaction is investigated in terms of task-relatedness of the interaction messages, and the impact of learning presence on learning outcome in terms of achievement and satisfaction. In short, the research questions can be summarized as below:

1. Does learning presence predict learner interaction in Web-based project learning?
2. Does learning presence predict learning outcome (achievement, satiafaction) in Web-based project learning?

Method

This study sampled data from 63 students enrolled in a university-level introductory course. In approximately 15 weeks, the course was assigned with a project task. Students were constantly engaged in a Web-based environment to perform the project task, and they had the opportunity to have discussions in an offline setting at least twice a week during on-campus lectures. Students were grouped into project teams of 4-5 students each, and a total of 14 teams were created.

Factors were separately measured using different methods: learning presence and satisfaction through self-report questionnaires; learner interaction by counting frequencies; and achievement by an instructor-developed rubric. First, both *learning presence* and *satisfaction* was measured using the self-report method. As Wang and Kang (2006) defined learning presence as consisting of cognitive, social, and emotional components, 13, 11, 12 self-report questionnaires for each component were borrowed from Kang, Choi, & Park (2007), Kang, Kim, & Park (2007), Kang, Park, & Shin (2007) and were implemented in the present study. Along with learning presence questionnaires, satisfaction was also reported by students themselves using eight questionnaires from Chung and Lim (2000), a Korean-translated version of Stein's tool (1997). Items of satisfaction questionnaires, for example, included "I am satisfied with this class in general" and "I don't regret taking this class"

Second, *learner interaction* was measured in terms of frequency. Among the three types of interaction suggested by Moore (1993), this study mainly focuses on learner-to-learner interaction as learner interaction in Web-based project learning. Also, as stated in Veerman and Veldhuis-Diermanse (2001), this interaction is further divided into task-related and task-not-related interaction. Using these categories of learner interaction, three coders had cut the interaction messages, posted on the Web-based team project bulletin boards, at a sentence-level and coded its task-relatedness. The initial inconsistencies among the coders were adjusted after discussions to 90.53%. Third, *achievement* was measured by the instructor using a self-developed rubric. These scores included the final reports of the project task, presentation, workbook, and peer evaluation and were in total 100. Both interaction and achievement used raw scores in the statistical analyses.

Results

Correlation Analysis

A preliminary correlation analysis was conducted to examine the relationship among the factors and their components. It is recognizable from Table 1 that learning presence significantly correlates to learner interaction and both indicators of learning outcomes, achievement and satisfaction. However, it is noticeable that among the factors, learning presence most highly correlates to satisfaction and least to achievement. In addition, the correlation results of each component of learning presence differ slightly and are only partially significant.

Table 1: Correlations of the Factors and Their Components.

		1	2	3	4	5	6	7	8	9
1	*Learning Presence*	-								
2	Cognitive Presence	.79*	-							
3	Social Presence	.79*	.40*	-						
4	Emotional Presence	.82*	.54*	.46*	-					
5	*Learner Interaction*	.34*	.41*	.27*	.15*	-				
6	Task-Related Interaction	.39*	.46*	.28*	.20*	.93*	-			
7	Task-Not-Related Interaction	.21*	.25*	.20*	.06*	.87*	.63*	-		
8	*Achievement*	.26*	.32*	.18*	.12*	.76*	.68*	.70*	-	
9	*Satisfaction*	.63*	.70*	.38*	.45*	.37*	.36*	.31*	.32*	-

* $p < .05$

Regression Analysis

As partial insignificant correlations were found in the previous investigation of learning presence, a number of multiple regression analyses were conducted to examine the different effects each presence component has on learner interaction and outcome (achievement and satisfaction). First, the effect of cognitive, social, and emotional presence on total learner interaction was analyzed. Using the multiple regression method, Table 2 shows that the model significantly predicts learner interaction ($F_{3, 59} = 4.73$, $p = .01$), but among the components of learning presence, only cognitive presence significantly predicted learner interaction ($t = 2.97$, $p = .01$).

Table 2: Effect of Each Presence Component on Learner Interaction.

Predictor	*B*	*SE*	β	*t*	*F*	*p*	R^2
Cognitive Presence	100.61	33.94	.42	2.97*			
Social Presence	29.67	23.43	.17	1.27*	4.73*	.01	.19
Emotional Presence	-31.32	30.43	-.15	-1.03*			

* $p < .05$

Second, the effect of cognitive, social, and emotional presence on task-related interaction was analyzed. Using the multiple regression method, Table 3 shows that the model significantly predicts task-related interaction ($F_{3, 59} = 5.81$, $p = .01$), but similar to the previous analysis, only cognitive presence significantly predicts task-related interaction ($t = 3.31$, $p = .01$). The effect of the presence components on task-not-related interaction remains unexamined since the previous correlation result between learning presence and task-not-related interaction was insignificant.

Table 3: Effect of Each Presence Component on Task-Related Interaction.

Predictor	*B*	*SE*	β	*t*	*F*	*p*	R^2
Cognitive Presence	69.40	20.95	.46	3.31*			
Social Presence	16.25	14.46	.15	1.12*	5.81*	.01	.23
Emotional Presence	-14.94	18.79	-.11	-.80*			

* $p < .05$

Third, the effect of cognitive, social, and emotional presence on achievement was analyzed. However, this model fails to predict achievement significantly, though cognitive presence still significantly predicts achievement. Fourth, the effect of cognitive, social, and emotional presence on satisfaction was analyzed. Table 4 shows that the model significantly predicts learner interaction ($F_{3, 59}$ = 20.51, p = .01), yet again the only significant predictor among the components of learning presence is cognitive presence (t = 5.69, p = .01).

Table 4: Effect of Each Presence Component on Satisfaction.

Predictor	*B*	*SE*	β	*t*	*F*	*p*	R^2
Cognitive Presence	.84	.15	.63	5.69*			
Social Presence	.09	.10	.10	.91*	20.51*	.01	.51
Emotional Presence	.09	.13	.07	.65*			

* $p < .05$

Discussions

Several issues can be drawn from the current investigation on the impact of learning presence. As seen in the first correlation analysis, learning presence has significant relations toward learning outcome (achievement and satisfaction) as well as learner interaction. Yet, there seems to be some difference in the size of the correlation coefficients. This difference indicates that learning presence is inclined to have stronger influence on satisfaction than achievement. Moreover, deeper investigation on the task-relatedness of interaction messages reports that learning presence mainly affects task-related interaction. Also, as seen from Table 2 to Table 4, cognitive presence is the solely significant factor among the components of learning presence. This finding implies that while social and emotional aspects of learning is emphasized in collaborative project learning, cognitive component still stands as the most influential predictor of students' learning behaviors (interaction) and outcomes. Further studies can be designed to replicate the present findings in diverse educational settings.

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Organized Mischief: Comparing Shared and Private Displays on a Collaborative Learning Task

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Abstract: We describe a study in which students in two science classes worked on a collaborative learning task using either a shared display or individual displays. The purpose is to inform how display interactions support group collaboration and individual learning when using media technologies. We examined individual learning outcomes as well as behavioral differences between students using the two display types. Preliminary results indicate collaborating with a shared display may result in more effective task organization and subsequently higher conceptual understanding.

Introduction: Networked Individualism

Much of CSCL research is concerned with the use of networked individual devices (e.g., notebook computers, PDAs, graphing calculators, etc.). Although these devices are connected such that they can support synchronous collaborative activity, the displays for these devices are private. They make up a paradigm we refer to as *networked individualism,* where individual devices are adapted into collaborative activities. Networked individualism differs from traditional collaborative activity where students discuss and manipulate a shared artifact face-to-face, can see each other's actions and make attributions, and can make gestures to establish co-reference and work to evolve a shared interpretation.

The push to create networks of distributed learners that are empowered with their own devices has to some extent diminished the important role of shared physical space in the learning process. There are relatively few attempts to utilize shared display technologies such as tabletop displays in educational contexts (e.g., Scott, Grant, & Mandryk, 2003), whereas the movement to create "networked classrooms" is spreading rapidly. The purpose of this study is to examine the process of collaborative learning using shared versus individual displays in order to determine if there are differential effects on the ability of students to coordinate their actions and construct understanding. While there have been a number of studies in which students have collaborated around a shared technology (e.g., Moher *et al*, 2007; Stanton, Neale, & Bayon, 2002; Wilensky & Stroup, 2003) we are unaware of any study that has directly compared this practice to working through individual displays and controlled for the presented content.

The Mischief System

We were able to support a collaborative learning activity using both a shared display and an individual display by utilizing a platform called *Mischief*. A collection of mice (of the rodent variety) is called a "mischief." The Mischief software (Figure 1a) is a groupware application able to support a collection of students using wired or wireless mice. Each student has a unique cursor that can be moved around independently on a single display screen. Mischief has features that can mitigate the potential chaos of numerous cursors, and a teacher or activity leader is typically in place to guide and constrain the collaborative activities of the students. Mischief was designed to be used with a single shared display such as a classroom projection screen or SmartBoard, but for the purpose of this study we were able to use Mischief such that the collaborative (multi-mouse) activity could also be displayed on a set of distributed classroom laptops. In this case, the displays are synchronized, each individual monitor showing all student cursors and actions in real-time.

Shared Reference

The psycholinguist Herb Clark has argued for the importance of establishing referential identity in order for successful human discourse (and collaboration) to occur (Clark & Brennan, 1993). In a collaborative student learning task this means that the students must correctly identify the target of a referential act (e.g., a description, a gesture), and that the students have the *mutual belief* that the reference was understood. We hypothesized that a single shared display will be able to facilitate shared reference more effectively than the networked laptops, and that the ability to achieve shared reference will lead to greater success on the task, and possibly higher overall learning. Despite the fact that the visual presentation of the collaboration space is exactly the same for both classes, we suggest that it is easier to coordinate distributed actions and interpretations *around* a shared display rather than *through* multiple private displays.

Figure 1. (a) The Mischief system in use at a school in China. Each student has a mouse, using a single computer and display. (b) The simulation used for the task in the current study, a modified PhET simulation.

Study Design and Procedure

We designed a between-groups study to determine how a shared display versus individual display affects learning and coordinative behaviors in a classroom-size group of students on a collaborative discovery learning task. Two 9th grade science classrooms taught by the same instructor were asked to use an optics simulation distributed by the Physics Education Technology (PhET) group at the University of Colorado at Boulder. One class (13 students) worked with the simulation using a single shared display (i.e., students each had a mouse that was connected to one display projected on a screen at the front of the class). The other class (14 students) worked with the simulation using separate individual displays (i.e., students each had a laptop that displayed the same synchronous activity). In both cases the activity was collaborative and every student's cursor could be seen on screen; the only difference was whether this activity was viewed through separate displays or a single shared display. These classes were chosen because they had the same prior experience with physics and the same percentage of students who were taking an accelerated math course. Thus, there was no reason to believe that the students in these classes differed substantially in their abilities to solve optics problems prior to their participation in this study.

We modified the original Adobe Flash simulation created by the PhET group to remove several features outside the scope of our task and to integrate it into the Mischief platform, enabling multiple students to use the simulation simultaneously (Figure 1b). Each student's cursor was represented by a different animal. Most of the screen elements can be dragged and simulation parameters (e.g., index of refraction, display of primary rays) can be changed using the dials and checkboxes displayed at the top.

Each of the two classrooms received the same instructions and worked on the same tasks. The class instructor gave both classes an introductory lesson that lasted about 5 minutes in order to refresh their memory of optics concepts and terminology that would be used in the task. The experimenters then introduced the students to the simulation and familiarized them to the technology (mice or laptops) that they would be using in their condition. Students were then asked to work together to experiment with the simulation and to formulate statements or principles that characterize key relationships between elements in the simulation. For example, the first task given to students was to generate a set of rules that define where an image will appear based on the location of the object relative to the lens. Successfully completing these tasks necessitated that students develop a control-of-variables (COV) strategy: changing one variable and holding the rest constant. The class worked on each of the 3 tasks for 10 minutes, at which point they were expected to present the instructor with a consensus answer. There was relatively little teacher or experimenter intervention during the tasks except to remind students of time constraints. Screen capture and video of the students interactions were recorded for both classes.

A paper post-test was administered to each student after the 3 simulation tasks had been completed. The post-test was comprised of six questions and was completed individually. The post-test questions asked students to reason about ray diagrams, a convention for presenting optics problems that were structurally analogous to the PhET simulation. One question for example showed an object on an axis near to a lens and asked the students determine if the resulting image was real or virtual. The post-test also had problems where the students drew and reasoned about principle rays. These questions were chosen because they all required the application of knowledge that should have been generated during the 3 simulation tasks. In other words, if a class had formulated the correct principles for all 3 tasks and a student came away with a full understanding of these principles, we would expect that this student would be able to answer all the post-test questions correctly.

Results

We present preliminary results from two measures: individual post-test performance and qualitative descriptions of classroom activity extracted from experimenter field notes. On the post-test the maximum number of points is 17. Two raters, blind to condition, scored the post-tests using a common rubric. Inter-rater reliability was high as assessed by the intraclass correlation coefficient (ICC .86 - .96). Students who used the shared display to complete the collaborative tasks had a mean score of 8.30 (SD=3.20). Students who used individual displays had a mean score of 5.96 (SD=1.87). The non-independence of student scores in a class and the small sample size prevents us from using inferential statistics to generalize about display modality. Nonetheless, the difference in mean scores indicates that the class that used the shared display demonstrated higher learning outcomes than the class that used the individual display.

As expected, both groups experienced some frustration as they became accustomed to this novel software environment. For the first task especially, students would sometimes speak simultaneously and make unsuccessful attempts to establish order. There were also points were the "multi-user" feature of this task seemed to interfere with successful experimentation. For example, while one student tried to understand a particular parameter's effect, another student would change that parameter or a different one. Incidents like these occurred at the beginning of the session for both conditions.

While both groups struggled at first, the shared-display group was able to establish order fairly quickly. They seemed to realize that they needed to adopt a structured approach, and in fact one student stated near the end of the first task that they "need to change one [parameter] at a time" in order to understand its effect. The shared display group also determined early on that students should adopt different roles, such as "recorder", "organizer", and "leader." Students in these roles made verbal requests to "stop moving [objects] without saying what you're doing." Students even raised their hands at certain points to be called on by their chosen leader. Compared to the individual display class, there also seemed to be a greater degree of consensus and confidence in their task answers.

Students in the individual display condition also expressed the need to implement something akin to the COV strategy, but they did so later in the session than the shared display group and it appeared more difficult for this group to enforce. When two students in the individual display condition attempted to impose leadership on the activity, they were met with substantial resistance and non-collaborative behavior. These students exhibited a generally higher amount of off-task behavior and social loafing. Even as the final answers were being recorded, some students in the individual display condition were focused on playing with the user interface on their screen. Much of the discussion in this group was dedicated to questions like "who did that?" in response to some on-screen action. Less discussion in this class was dedicated to the focal task.

Discussion and Future Directions

The higher scores on the individual post assessments in the shared display group were consistent with observational accounts of the collaborative activity for the two conditions. The individual display group had a difficult time coordinating their activity through their private laptops, and this likely hindered the individuals in this group from constructing a full understanding of the simulation relationships. These results, while preliminary, suggests an interesting trend that warrants additional analysis and further study. We are interested in looking deeper into the video recordings of each condition to uncover reasons why group and individual behavior was so divergent. To this end, we are coding attempts to establish referential identity to determine how it is achieved (or not achieved) in each group. As it stands, this study provides a solid starting point for a greater understanding of socio-technical design factors that affect learning and collaboration in large group activities.

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Interplay of Group Dynamics and Science Talk in a Design Based Classroom

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Abstract: This exploratory study investigated the interplay between science discourse and group dynamics of two groups of 6th graders over time as they learned in a technology-rich, inquiry-based science environment. Analysis showed that the group with problematic dynamics engaged in less science talk and failed to improve over time. Despite dynamics and dialogue differences between groups, both groups primarily focused on procedural aspects instead of science. Future studies of group collaboration over time are discussed.

Introduction

Small group collaboration is now an integral part of inquiry-based science learning, with an emphasis on "learning to talk science" (Lemke, 1990, p.1). While peer interactions comprising explanations, arguments, and examples can enhance learning (O'Donnell, 1999), studies reveal that students often focus on task outcomes instead of the science (Coleman, 1998), and share factual information instead of deeper explanations (Arvaja, Häkkinen, Rasku-Puttonen, & Eteläpelto, 2002). Although researchers have attempted to support collaboration with scripts and prompts (Coleman, 1998; O'Donnell, 1999), these have mainly focused on the content of collaboration. Group processes such as dominance, competitive interactions, and lack of mutual engagement (Arvaja et al., 2002; Barron, 2003) also pose challenges to collaboration. Barron has emphasized attending to the dual nature of collaborative learning –the content related dimension and the social dimension to understand factors affecting collaborative learning.

In this paper, we report an exploratory study that investigated the interplay between the level of science discourse and group dynamics, as students learned in a technology-rich, inquiry-based science environment. We analyzed face-to-face (FTF) interactions as students collaborated in small groups around a single shared computer. Such FTF collaboration represents an emerging area of research in CSCL as students have to simultaneously manage their task and interactions (van Diggelen & Overdijk, 2007). In our study we examined the patterns of group dialogue and dynamics over time to understand the variability in group interactions. We investigated the following research question: How do group dynamics change with increasing familiarity with group members and task content, and affect the quality of science talk over time?

Method

This study was conducted in a sixth-grade science classroom in a Midwestern school. Students used CoMPASS (Puntambekar, Stylianou, & Goldstein, 2007), a design-based science curriculum with a hypertext system and design challenges, to learn about Simple Machines. While using the CoMPASS hypertext system, students collaborated in small groups in a face-to-face medium, and interacted around a single shared computer. To complete the design challenges, they brainstormed predictions and questions, used the CoMPASS hypertext system to conduct research for their designs, and completed their designs. Students worked on five mini design challenges, for each of the simple machines. Of the five, we used data from the Inclined Plane (IP) and Pulley units- the first and the final units- to study the two groups over time. The IP challenge involved designing the best ramp to lift a mini pool table, while the Pulley challenge, with more complex science, involved designing the best pulley set-up to lift a bottle of water.

Participants, Data sources, and Analysis

Based on the idea that contrasting cases can reveal differences in processes and outcomes between more and less effective groups (Rummel & Hmelo-Silver, 2008), we chose two groups, out of six, with contrasting learning gains on the post-test. Students took content-based pre-post tests of for IP and Pulley units. The IP test had nine multiple choice and one open-ended question(s). The Pulley test had 11 multiple choice and two open-ended questions. Students could score a maximum of 14 points on the IP test and 17 on the Pulley test.

We transcribed audiotapes of the two groups' collaborative interactions. The data consisted of 222 minutes of audio and 57 pages of transcripts. The rubric was generated inductively by two researchers, and consisted of seven broad themes denoting science talk and group dynamics. These were: (i) deep science talk (DT)- connections between science concepts and to concrete features, discussing formulae, misconceptions, science questions, explanations, and examples; (ii) connection to the goal (CG)- connections and predictions between text and the design challenge; (iii) distracting arguments (AG), (iv) missed opportunities (MO)- ignoring science question, explanation, or misconception that emerged, (v) off-task talk (OT) (vi) teacher facilitation of group discourse (TG)-teacher intervention during group discourse; and (vii) *procedural talk* (PT)-navigating, reading aloud, paraphrasing, taking notes, specific answers and definitions, exchanging factual questions and clarifications. All of the 57 pages were coded by the first author after two researchers independently coded a sub-set of 10% percent of the transcripts and achieved an inter-rater reliability of 86.11%. Each conversational turn was the unit of analysis.

Results

We selected two contrasting cases based on high and low post-test scores and percent learning gains, calculated as difference in scores between pre- and post-tests. Group A had the highest mean post-test scores with 11.3 for IP unit and 10.66 for Pulley unit, while Group B had the lowest with 8.25 for IP unit and 8.33 for Pulley unit. Group A had 100% learning gain in IP and 60% in Pulley, while Group B had 73.68% in IP unit and 25% in Pulley unit.

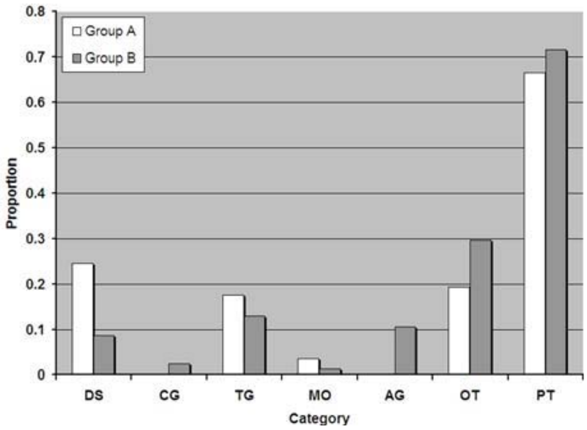

Figure 1. Inclined Plane

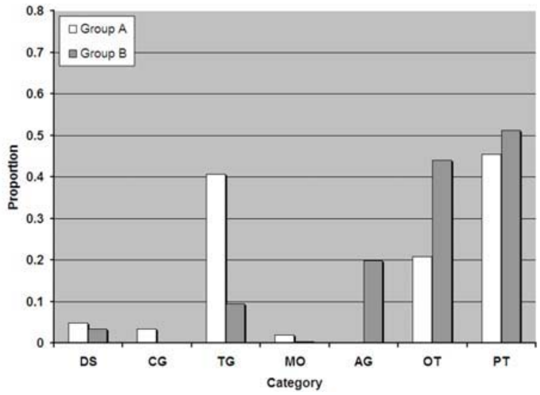

Figure 2. Pulley

We examined how group dialogue and dynamics changed when students used CoMPASS during the IP and Pulley units. This section reports the differences between and within the two groups in the IP and Pulley units based on the seven broad themes identified earlier. In general, comparison of the deep science talk of the two groups revealed a low proportion of science dialogue during both units (see Figures 1 and 2). Group A had 24.55% science talk in IP, with members exchanging science questions, connections between concepts and discussing formulae. Group B had a smaller proportion of science talk (8.6%) consisting of science questions, explanations, and discussion about formulae. Moreover, both groups had lesser science talk in the Pulley unit, with 4.82% for Group A and 3.42% in Group B. However, a closer examination revealed some changes in the nature of science talk in Group A in the Pulley unit. Their science talk was less, although more varied in the Pulley unit. There were singular instances of deep explanation and connection between abstract science concepts and concrete features, and some student misconceptions emerged as students attempted to make sense of the science. An important change was also seen with regards to connection to the goal, as members made predictions and connected the text to their challenge in the Pulley unit unlike the IP unit, where no connections were made. Group B, however, showed the opposite trend. Unlike the IP unit when members connected science concepts, offered some deep questions, explanations, and talked about formulae, their talk in the Pulley unit only involved some misconceptions and examples. Although they had made predictions and connected the text to their challenge in the IP unit, there were none in the Pulley unit.

Additionally, the two groups had substantially different interpersonal dynamics. In Group A, members were fairly on task and did not have any distracting arguments in the two units. However, they had 3.5% and 1.93% of missed opportunities for collaborative engagement in IP and Pulley respectively, indicating instances of ignoring opportunities for collaboratively extending science explanations, questions, and clarifying misconceptions. An important change in their dialogue occurred when teacher facilitation of group discourse came into play, shifting their dialogue towards science talk in the Pulley unit, as they grappled with science concepts. The group dynamics and discourse changed with the teacher's intervention as students confronted some of their science questions and misconceptions, showing a greater engagement with each other about science concepts. On the contrary, group dynamics in Group B failed to support deeper science talk over time. Group B had substantial arguments and an off- task orientation in both units. Despite teacher facilitation to maintain an on-task focus, their dynamics and discourse did not shift towards discussing science. Instead, conflicts increased from 10.49% from IP to 19.78% in the Pulley unit, and off-task talk increased from 29.62% in IP to 44.06% in Pulley. Further, a comparison of the two groups revealed a greater percentage of *procedural talk*, with a focus on reading aloud, navigating, looking for answers, and sharing factual questions and clarifications. In Group A, procedural talk accounted for 66.63% of the discourse in IP and 45.38% in Pulley. Similarly, Group B had 71.57% procedural talk in the IP unit and 51.15% in the Pulley unit.

Discussion and Conclusion

We examined the change in group dynamics and science talk in two groups in the first and final units in an inquiry based science classroom. In the higher performing Group A, the absence of arguments, less off-task talk, and shifts in discourse with teacher facilitation enabled some science talk in the Pulley unit, albeit a low proportion. However, in the lower performing Group B, members had dysfunctional dynamics. Interpersonal conflicts and off-task talk increased over time despite teacher intervention, along with a decline in the proportion and quality of their science talk. Overall, the interplay between group dynamics and science talk suggests that increasing familiarity with group members and content may not ensure more constructive interactions. Although members in Group B grew more familiar with each other and with the science in the final unit, their increased conflicts and off-task focus seemed to interfere with their engagement in a deeper science dialogue, especially in the Pulley unit. In Group A, members missed opportunities to engage in each other's ideas; instances of deep science question, explanation and misconceptions were not elaborated upon but followed by mainly procedural talk. These missed opportunities indicate inadequate co-ordination towards co-construction of knowledge (Baker & Bielaczyc, 1995). These findings confirm previous research showing uncritical dialogue (Arvaja, Häkkinen, Rasku-Puttonen, & Eteläpelto, 2002) and a task focus instead of the science (Coleman, 1998). Our findings lead us to question whether groups would improve their dynamics and have deeper science dialogue over time since challenges in co-ordination such as conflicts, missed opportunities, and off-task talk early on may distract the group's engagement in a science discourse. These results suggest that attending to the interplay between group dynamics and science discourse may facilitate a richer understanding of how group dialogue changes over time, instead of mainly focusing on examining their science talk.

Our findings indicate that groups may need support early on to promote effective collaboration pertaining to the task and social relational context (Barron, 2003). Along with teacher facilitation, groups may also need support for productive dynamics as well as generating questions, explanations, and examples, which can facilitate learning (O'Donnell, 1999). Future research will investigate support for each group specific to their needs during the early stages, and study its impact over time to understand the long-term effects of collaboration and learning.

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What is seen on the screen? Exploring collaborative interpretation, representational tools, and disciplined perception in medicine

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Abstract: Diagnostic decision-making in medicine involves meaning-making of what can be seen on medical images, such as positron emission tomography (PET) pictures. This meaning-making is seldom an individual activity; rather it involves interactional practices between clinical staff, and between the physician and the specific representational technology. This poster presentation contributes to earlier studies on professional vision and disciplined perception in that it emphasizes the role of feedback, power relations, and ontogeny that shape collaborative interpretation of what is seen on the screen. Taking an analytical perspective founded in ethnomethodology and conversation analysis, this study will closely examine participants of a medical training in PET reading to be held in a Finnish university hospital in spring 2009. Video-recorded data will be analyzed using discourse analytical methods with a focus in understanding the appropriation of professional concepts and analytical skills in relation to feedback, ontogeny, and power. Practical and theoretical implications are outlined.

Introduction

Diagnostic decision-making in medicine involves meaning-making of what can be seen on medical images, such as X-ray photographs or positron emission tomography (PET) pictures. In clinical practice, seeing and interpreting the features of medical images are not exclusively cognitive processes located within an individual. Rather seeing is "a socially situated activity accomplished through the deployment of a range of historically constituted discursive practices" (Goodwin, 1994, p. 606). These discursive practices form what Goodwin describes as professional vision (1994, 1997), and they are negotiated around a common object of disciplined perception (cf. Lindwall & Lymer, 2008), in this study: pictorial representations of the human body produced by a positron emission tomographer.

The increasing use of digital imaging technologies creates a number of challenges to professional and educational practice in medicine. First, it is evident that different representational tools have different affordances asking for different diagnostic skills. For example, while an X-ray photograph is an analogical, two-dimensional, and static image, a positron emission tomography (PET) picture is digital, three-dimensional, and dynamically changeable by the physician. Digital imaging techniques thus not only require seeing and interpreting what is seen but also modifying (zooming, rotating) the image to see each relevant aspect; they require a certain level of skillful human-computer interaction. Second, the increasing use of digital technology also transforms the clinical institutional context. It forms new discursive practices that are needed to diagnose digitally-processed images. It also creates new expert cultures within new communities of practice that develop around new medical computer tools. Third, the use of digital imaging techniques implies changes in how to address the development of visual diagnostic expertise (Crowley et al., 2003; Morita et al., 2008) in medical professional training. More specifically, it is still unclear how to promote the transfer of diagnostic skills from one technology to another and how to help reducing errors in the diagnostic process that result from personal histories. Also, there is still an interest to explore how computers are used in and for professional training, and how technology in medical education mediates human interactions and learning. To summarize, the use of technology challenges the development of professional vision and diagnostic expertise; it shapes the clinical institutional context; and it impacts medical education and training.

Following a dialogic approach (Arnseth & Ludvigsen, 2006), the purpose of this study is to explore how power and ontogeny shape the meaning-making process of what is seen on a PET screen. It is assumed that both personal learning histories and the power to perform operational actions related to the representational tool shape the practices of collaborative interpretation. The next section illustrates how this study aims to explore the interdependencies between, on one hand, the cognitive and perceptual processes of physicians associated with medical image diagnosis and, on the other, the institutional context, i.e. the representational tool and its mediation of interactional practices.

Method

The sample of the study will be participants of a medical training course on PET reading to be held in a Finnish university hospital in May 2009. The course is designed for physicians who are already experts in reading X-ray images and who are now also using PET in their everyday clinical work. Taking an analytical perspective founded in ethnomethodology and conversation analysis (Goodwin, 2000; Ivarsson, Linderoth, & Säljö, in press; Jordan & Henderson, 1995; Lindwall & Lymer, 2008), the study will examine episodes of how a training instructor and two training participants negotiate meaning of what they see in a PET image. We will collect a material of about 6 hours of these learning episodes. The video-recordings will be transcribed and analyzed using discourse analytical methods with a focus in understanding the appropriation of professional concepts and analytical skills related to feedback, ontogeny, and power. Additionally, we will employ an audit procedure to assure the quality of our qualitative observation study; this might help increase the visibility, comprehensibility, and acceptability of the research conducted (cf. Akkerman, Admiraal, Brekelmans, & Oost, 2008).

Discussion and Conclusion

This poster presentation outlines a study that aims to closely examine the discursive practices associated with diagnosing medical images. The analysis of a digital representation of the human body for diagnostic purposes involves meaning-making of what is seen. This process of meaning-making is a social process, since it involves interaction on two levels: interaction between the physicians and human-computer interaction. The process of meaning-making is proposed to be shaped by power relations ("Who has the power to manipulate the image? Who has the mouse to click on the screen?"). It also shaped by feedback given by the medical teacher (Ericsson, 2004), and by the personal history of the interpreters: Based upon their previous experience in reading X-rays, the training participants might experience conceptual conflicts in the course of collaboratively interpreting the PET image. The purpose of this study is to explore these interdependencies between feedback, power, ontogeny, technology, and seeing on the PET screen.

This research has several practical and theoretical implications. (1) Concerning its significance for theory development, the study contributes to previous attempts in understanding professional vision and disciplined perception (Goodwin, 1994, 1997; Lindwall & Lymer, 2008). It aims to unravel the influence of power relations and ontogeny on the collaborative interpretation of what is seen on the screen. These findings might be relevant for future conceptualizations of disciplined perception in the context of medical image diagnosis. (2) Concerning its significance for educational practice, this study will address the interdependencies between gaze, thinking, and technology to trace how training participants learn to interpret medical images, especially in relation to feedback. Moreover, it will highlight the need of equally distributing power between training participants to guarantee an optimal development of visual diagnostic expertise (cf. Crowley et al., 2003; Morita et al., 2008) for each trainee. Last, the in-depth analysis of interactional practices might inform future teaching practices of PET reading and the design of medical training programs.

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Learning Support through Scaffolding Collaborative Project Work

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Abstract: A Computer Club House (CCH) can be understood as a community of prosumers in which members are producing and consuming personally meaningful artifacts of each other. In a long term case study, we have analyzed learning practices in a German CCH setting. Observing children and their parents working with construction kits, we found that they had problems in maintaining the flow of their project work over time. Therefore, we develop concepts for a project management tool which support CCH settings to scaffold their growing information space in terms of artifact re-use and expertise development over time. Scaffolding in this regard is understood to support collaborative processes of learning communities.

Introduction

Today's children grow up in a highly computerized world already being exposed to various media technologies. We strive to support children in their cognitive and social development, i.e. to enable them to understand the world they live in and empower them to form it according to their own conviction. A social phenomenon described by futurologist Alvin Toffler (1980), which he coined 'prosumption', describes a development, where users produce and consume at once. Today, his observations are even more valid – especially with the notion of user created content that emerged recently within the Web 2.0 context (e.g. Wikipedia or Flickr). Similarly, von Hippel's (2005) concept of user innovation shows that innovations are often developed by end-users instead of the manufacturer triggered by their very own unsolved issues. Accordingly, we base our research on learning by the active production and consumption of collaboratively created, personally meaningful artifacts.

Not much research has been done on using the power of prosumption in collaborative project settings. In this paper, we therefore investigate how we can use Vygotsky's concept of scaffolding to support learning through prosumption during all phases of project work and in multiple projects over time. By conducting a qualitative field study we hope to shed some light on this area.

Theoretical Considerations and Motivation

Overcoming Papert's (1980) focus on subjective concepts in constructing artifacts, Bruner recognizes Vygotsky's social constructivist concept of scaffolding (Wood, Bruner, & Ross, 1976). With scaffolding, the tutor would offer assistance only with those skills that are beyond the learner's capability to help her master a task that she is initially unable to grasp independently. Quintana et al. (2004) lay out a scaffolding design framework and suggest twenty specific strategies for designing scaffolds in computer-based learning environments. Similarly, Puntambekar and Hübscher (2005) point out problems with the notion of scaffolding in the design of tools to support student learning in project-based classrooms. They argue that some of the critical elements, like ongoing diagnosis, calibrated support, and fading, are missing in many scaffolding tools.

By introducing the notion of prosumption, we are able to describe observed phenomena in communities from a new perspective (Toffler, 1980). Artifacts as collective goods are produced and consumed by 1) creator(s) of the artifact and 2) other community members (i.e. creators of other artifacts). Typically, these products are components, macros, snippets or other sub-parts of an underlying system. Consumption of products may include the orchestration of components or the inclusion into the underlying system. Sharing is a main force within the community. It needs description and meta-data of the products in order to guarantee a sufficient distribution to consumers (by retrieval strategies, etc.). Based on the concept of Communities of Practice (Lave & Wenger, 1991; Wenger, 1998), a *Community of Prosumption*, where members share a common practice, by producing and consuming personally meaningful artifacts of each other, is further characterized by an evolutionary growing repository of shared goods and information about expertise distribution. Learning within communities of prosumption is achieved through deep engagement with own artifacts and with those of others.

Too little attention has yet been drawn to the sustainable long-term support of learning processes by scaffolding collaboration and project work and the design of appropriate tools for community of prosumption use. We propose a transition from designing single artifact construction kits to whole frameworks, supporting project work and learning over time.

Setting and Methodological Approach

The computer club 'come_IN' provides opportunities for elementary school kids, their parents, and tutors to engage in group-oriented project work (Stevens, Veith, & Wulf, 2005; Veith, Schubert, von Rekowski, & Wulf, 2007). They meet two hours per week every Monday from 5pm to 7pm. There is some fluctuation in attendance, as some participants do not come to every session. As described in more detail in Stevens et al. (2005), come_IN is inspired by the Computer Clubhouse concept by Resnick & Rusk (1996), adapted specifically to the context in Germany. The project work within the club stems from the participants maps of experience and motivation. Projects normally last for several months and can encompass the creation of varied multi-media artifacts (e.g. texts, videos, animations and games). The computer club is regarded in this paper as a community of prosumption, implementing computer-supported collaborative project work.

Learning in this setting is seen as an unavoidable, subtle by-product, but indeed a very productive and important one. Children (and parents) in the club experience more intensive learning situations due to active participation by dealing with the chosen topics of their projects and by investigating how to solve the problems at hand. Children are further endorsed in their actions by people close to them, i.e. their parents, grand-parents or older siblings, who also pursue activities in the club. By scaffolding, the community can achieve much more than one individual participant could achieve: experts help novices by constructing and slowly reduce scaffolding as the novice becomes more acquainted with the task.

Our results stem from an evaluation study in the computer club house. Over the course of six months, we conducted participatory action research. One or more research assistants acted as tutors in the club collecting information through field notes, observations, interviews, and video and artifact analyses. Another researcher acted as an external observer not being directly involved in the club activities themselves. With the collected material, monthly reflection sessions were held between the both parties. Our goal is to identify practices in the club, how participants engage in project work and how this can be further supported for their learning progress.

Empirical Findings

Due to the project-based nature of the activities in the club, a vast amount of artifacts is created and used by the participants (e.g. photos, videos, reports and stories). They are gathered during field trips, investigations in the neighborhood or topic-related research on the internet among other. During the initial collective *brainstorming* phase re-use is rarely occurring. When beginning new projects, participants normally start from scratch building solely upon their prior experience but do not consider previously created artifacts or implemented ideas directly.

(a)  (b) 

Figure 1. (a) Tutors are planning alone while children go about their own business.
(b) Mother sitting next to her son, nearly uninvolved throughout the whole session.

Planning is only done by experts, i.e. tutors and some 'old-timer' parents. While children go about their own business, the experts are left alone discussing about the necessary tasks and task distribution at the big round table in the center of the club or sketching broader project layouts on the blackboard (see Figure 1a). Children do normally lack the patience for longer discussions, but more importantly, they, as well as many parents, do not always have the insights into the general workings of the club.

The *execution* work, then, is mainly done by children. They voluntarily commit themselves to realize their ideas within the project's scope as they have chosen the topics on their own or share a common experience. But they often have problems finding files on the network drive or other recently created artifacts to continue their work and stay focused. They lack an overview due to the unstructured storage of the many files. Parents are often much less involved in the actual project execution. Due to poor integration and personal disinterest, they only sit behind their own kids, from time to time giving hints or advice (see Figure 1b) – or: they are not present at all. Much less do they show initiative in using computers themselves in activities deeply connected with their child's activities. In general, parents barely take interest in other community members and their activities, only thinking about their own progress or that of their child.

Due to the lack of parents' involvement, tutors are also very much occupied during execution, helping all of the children (and also some parents) at the same time. The ICT expertise and club experience of the parents is too limited to help in some cases. In contrast, tutors have a relatively clear picture of the whole project structure, because they are heavily involved in all phases of the project workflow. Due to their high workload, *monitoring* of the overall project progress is hardly ever possible. Tutors do not have the time to coordinate the activities of everyone. The poor monitoring creates additional work in the following *wrapping-up* of artifacts. They collect the scattered sub-projects and fragmented material to combine it into the superordinate framework.

Collaboration is mainly initiated without ICT support by the tutors. It is mostly them, who point participants to other members to collaborate on similar issues or projects, or to exchange experience, ideas and help, which one party might have already acquired. Though participants collaboratively choose a common topic or share a common experience, they deal with it independently.

Projects often remaining incomplete and the need for intensive tutoring, as well as the participants' lack of direction in project work and collaboration motivate a need for scaffolding of collaborative learning and project work in the community, beyond the scaffolding of the individual mind. To support this scaffolding and enable the participants' involvement in all phases of the project workflow, we aim for a transparent visualization of the network of other participants' related previous work, of their expertise and generally supportive artifacts (e.g. tutorials, related tools). This may help to engage more community members in the planning process and the following phases of the workflow. These additional tools could be seen as a kind of project management software, used as the working environment by all participants. It acts as a scaffold for the members, giving them contextual help in those tasks that are initially beyond their individual capabilities or knowledge.

Conclusion and Outlook

Based on Vygotsky's concept of scaffolding, we investigated learning in *Communities of Prosumption* supported by scaffolding of collaborative project work. We propose that sustainability by providing learning support in collaborative project work over time is more important than the tools themselves (i.e. artifact construction kits). In our analysis we show how fostering collaboration by scaffolding orientation and cognitive mapping can be achieved through visualization of artifact and expertise distribution. Special attention needs to be drawn to *Communities of Prosumption*, giving them a stronger theoretical and empirical foundation. Based on the theory of *Communities of Practice*, they bring together production and consumption in a shared project environment.

Based on our experience, we show the Janus-faced nature of scaffolding. On the one side, scaffolding is seen to support the individual mind and thoughts, as constructionists use it in artifact construction kits. On the other side, similar to Kolodner et al. (2003), we propose a scaffolding technique to support collaborative learning processes of whole communities. Both sides of the Janus face need to be embraced, as they can lead to different design implications. Currently, architectural design decisions have been made and the system is being implemented and needs evaluation afterwards.

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Scratch-Ed: An Online Community for Scratch Educators

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Abstract: Scratch is a programming environment that enables users to easily construct a wide variety of interactive projects – and share these creations with an online community. A main goal of Scratch is to enable young people to engage in construction-oriented acts of personal expression. From community narratives to role-playing games to mathematical simulations to consciousness-raising presentations, the potential for creative production with Scratch is boundless. However, for those who are primarily concerned with assisting others' Scratch learning, there is a disconnect between what individuals want to do and the resources that are presently available. In response, we have developed Scratch-Ed, an online environment for educators. Using the lens of situated learning, Scratch-Ed has been designed to enable users to organize a community of practice for Scratch around the processes of mutual engagement, joint enterprise, and shared repertoire by sharing stories, exchanging resources, facilitating discussions, and establishing relationships.

A Challenge

Scratch (http://scratch.mit.edu) is a new programming environment that enables users to easily construct a wide variety of interactive projects – including stories, games, music, and art – and share these creations with an online community (Maloney et al., 2004; Maloney et al., 2008). A main goal of Scratch is to enable young people to engage in construction-oriented acts of personal expression (Peppler & Kafai, 2005; Resnick, 2007). From community narratives to role-playing games to mathematical simulations to consciousness-raising presentations, the potential for creative production with Scratch is boundless. However, for those who are primarily concerned with assisting others' Scratch learning, there is a disconnect between what individuals want to be able to do and the tools that are presently available to them.

Since joining the Lifelong Kindergarten group (which developed Scratch), I have had the opportunity to meet some of these people. They occupy a range of roles as teachers, researchers, parents, and hobbyists. Their interests in supporting Scratch learning are similarly diverse: a teacher who wants to share stories about Scratch and cross-curricular integration; a researcher who wants feedback on materials developed for exploring Scratch as participatory literacy; a parent who wants advice on how to introduce Scratch at a local all-girls high school; a hobbyist who wants to connect with others who have started Scratch groups for adults. These examples, which represent only a subset of individuals or groups who are interested in supporting Scratch learning, are shown along a two-dimensional spectrum of participation (see Figure 1). One dimension represents the context in which the individual situates the participation, from formal learning environments (e.g. a university) to informal learning environments (e.g. someone's home). The other dimension represents the individual's mode of participation, from organizer (e.g. curriculum designer) to participant (e.g. grassroots club member).

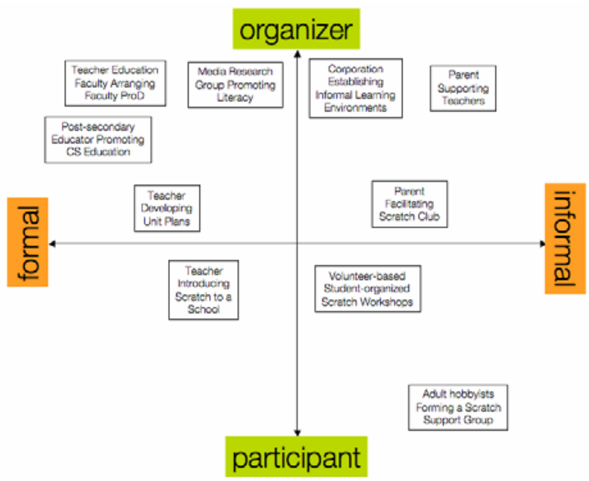

Figure 1. Spectrum of participation for individuals who want to support Scratch learning.

Currently, the Scratch website supports a subset of these interests and desires. The website offers: forums for questions, with a dedicated forum for educators; a page for educators, which has links to videos, reference materials, and writing; and links for email-based support. These resources have demonstrated value, as they have (to varying extents) supported a community of more than 175,000 registered members, but they are insufficient to fulfill the needs of all the individuals who are represented in Figure 1.

Theorizing a Response

Using the lens of situated learning, learning occurs through processes of participation that are inextricably connected to and located within a particular context (Brown, Collins, Duguid, 1996; Engeström, 1991). Theorizing learning as a situated practice (with notions of *communities of practice* and *legitimate peripheral participation*) suggests that it is not sufficient to simply add forums, materials, and pages to the Scratch website. Rather, an environment separate from the Scratch website is needed to support the range of activities involved in supporting Scratch learning.

Participation is not a uniform construct, and experiences of participation vary from person to person. This variability in participation is what Lave and Wenger (1991) described as *legitimate peripheral participation*, which is a way to think about how new participants to a practice cultivate capacities via their interactions with fuller participants. The contexts in which these interactions take place are described as *communities of practice*. Communities of practice are relations between people, actions, and tools characterized by three processes: *mutual engagement*, *joint enterprise*, and *shared repertoire* (Wenger, 1998). The processes of *mutual engagement* emphasize the community. Who are we as a group and how does that enable us to achieve our collective goals? The processes of *joint enterprise* emphasize the domain of the community. What practice are we interested in and what do we want to achieve? The processes of *shared repertoire* emphasize the resources of the community. What resources and repertoires do we cultivate to enable our practices? These community of practice processes are interconnected.

If we think about the Scratch group described above as a community of practice, we can see that it has a different domain or enterprise. The practice of the main Scratch site is producing Scratch projects. The practice of the group that supports Scratch learning is enabling the production of Scratch projects. While there is overlap between these two groups, they are not identical and members of each group may be deprived the opportunity to legitimately enter into fuller practice, as there is no obvious trajectory of participation between the groups. Barriers (either intentional or unintentional) to legitimate participation disrupt the processes of communities of practice, preventing the achievement of practice-related goals. A separate site would enable individuals who want to support Scratch learning to cultivate desired relationships, practices, and resources.

In pursuing the notion that a separate site is required, a question regarding implementation looms. Is ScratchR, the platform for sharing user-generated programmable media on which the Scratch website is built (Monroy-Hernandez, 2007), sufficient to accommodate the community of practice for enabling Scratch learning? From a community of practice perspective, I would argue that ScratchR is not sufficient for this task. For example, participants need to be able to talk and share stories about the practice, and while this is achieved somewhat through project notes and on the forums, it is clearly secondary to the central focus of project production. Although there exist numerous platforms for distributing content, there is a gap in available platforms (and design strategies for such platforms) that enable communities of practice to engage in explicit self-organization around learning (Barab, 2003; Schwen and Hara, 2003).

Designing Scratch-Ed

In response, we have designed Scratch-Ed. Scratch-Ed enables users to organize a community of practice for Scratch around the processes of mutual engagement (community), joint enterprise (domain), and shared repertoire (resources) by sharing stories, exchanging resources, facilitating discussions, and establishing connections with members.

Stories

Documenting the stories of a community serves multiple purposes. First, an individual that shares her/his stories makes it possible for other community members to know him/her, which strengthens the connections between individuals in the group. Second, a history of the practice is recorded. This history allows members to negotiate the trajectories of the practice, and respond accordingly by developing new resources and routines.

Materials

All communities of practice need tools and routines to achieve practice-related goals. By having access to infrastructure that catalogs these enabling materials, both new and fuller members can participate in the practice. Given the diversity of a community's repertoire and members' participation, this module accommodates multiple forms of materials, from text documents to multimedia productions.

Discussions

While all parts of the platform will be conducive to collaboration, the discussions module will be a place in which conversation can take place beyond what is incited by a particular story, material, or meeting. This is intended to be a space where new participants can seek guidance about the community and its practices from fuller participants, and fuller participants can articulate visions of the community's future trajectories.

Members

Part map and part profile, the members module provides a connection to the physical world. Communities of practice do not occur in isolation or, in the case of online communities, exclusively in virtual spaces. Members will be able to share and view practice-related events with other members of the community.

The implementation of Scratch-Ed is currently being internally tested by the development team and will be opened for broader testing by Spring 2009. Despite minimal promotion of the site, more than 200 educators – from both formal (K-12) and informal (museum, library, community center, homeschooling) learning environments – have already volunteered to be beta testers of the site. Through careful attention during the site's design process to community of practice theory, it is our hope that Scratch-Ed will meaningfully address the needs and desires of Scratch educators, building capacity within the educator community and enabling the effective support of Scratch learners.

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Designing On-line Communities to Enhance Teacher Professional Development

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Abstract: This poster presents research from a larger three-year study of teacher planning and enacting, where an on-line learning community was established for teacher professional development. This study employed a design research methodology to iteratively develop a computer-supported community. Nine secondary science teachers (N=9) designed, enacted and revised a project-based science lesson while participating in two interventions (reflection and peer exchange). Computer-supported collaborative tools such as wikis and a website were used to foster teacher knowledge, social exchange and collaboration of effective instructional strategies.

Introduction

Despite the interest in fostering new intentional online communities that support learning, online professional development is still a rarity and often not well understood (Barab, 2003). Many on-line communities are emerging in the wake of social networking tools, but how these environments benefit knowledge construction is unclear. In the Web 2.0 era, it seems only natural that the teaching profession, as a community, would identify the need for more technology-enhanced ways of sharing knowledge, social exchange and collaborating on effective strategies for student learning. This paper reports research on the use of the wiki tools and an accompanying Web site to create a teacher professional community focused on teacher learning. By engaging teachers in legitimate practices of planning, enactment and reflection within a community of peers, their study aims to establish a successful design for online communities of practice.

This design-based research study follows nine science teacher participants with different areas of domain specialties (such as biology, physics or chemistry) and different years of experience, as they co-design a technology-enriched project-based lesson for their courses. We explored the impact of scaffolded reflections and peer exchange in four phases: teacher background, lesson planning, enactment and revision. The teachers were prompted for reflection at regular intervals throughout the design process, and then participated in face-to-face and on-line collaborative activities that examined their lesson design, their enactment and their students' learning. These nine teachers established a community with both online and offline components and were committed to improving their practices, to developing their knowledge, to introducing innovative technologies to their science classrooms, and to improving their students' learning.

Theoretical Foundations

Research has shown that online communities offer peer-assisted learning, allowing members to help solve one another's problems and share ideas and experiences (Rourke & Anderson, 2002; Pallof & Pratt, 1999). In addition, learning within online environments can be influenced by reflections and interpretations of ideas, experiences and assumptions gained through prior learning and the haring of life experiences (Palloff & Pratt, 1999). On-line collaborative communication supports constructivist principles for teacher knowledge growth. Teacher knowledge growth can occur through professional development, which can facilitate teachers in their understanding of inquiry instruction by extending their ideas, student learning technology and their role as an instructor (Slotta, 2004). Research on professional development programs report that teachers are concerned about student success and justify their classroom and curriculum decisions (Borko et al., 1997). While, such findings are encouraging, professional development programs for teachers are limited in providing persistent and collaborative support. This study adopts Cultural Historical Activity Theory (CHAT-Leont'ev, 1978; Engeström, 1991) to capture the complex nature of teacher knowledge and the actions that teachers engage in and to develop a formalism of the interplay between various actors within a community, the rules that govern their actions and the activities in which they participate in relation to some objective. An activity system consists of a participant (e.g., the teacher(s)) who has intent to act (e.g., teach) on an object (e.g., teacher knowledge development), as well as the tools (e.g., wiki peer comments, lesson plans) that mediate between the participant and the object. Activity theory offers a model for representing and interpreting the teachers' conscious teaching activities and embraces the socio-cultural and historical perspectives of the teachers' day-to-day life.

Methodology

This is an iterative design-based study of teacher professional development as it occurs in the rich context of a curriculum-design community, where nine science teachers (N=9) each design, enact, and revise a technology-enhanced project-based lesson. The lessons were designed according to a generic set of characteristics for Project-Based Learning (see Laffey et al., 1998; Blumenfeld et al., 1991) and used various technologies including productivity software (e.g., Microsoft Office), visualization tools (e.g., Inspiration) social technologies (e.g., wikis or blogs) and interactive learning environments (e.g., WISE: The Web-based Inquiry Science Environment). This study focused on the role of two primary forms of intervention in a teacher professional development: reflections and peer-exchange within a community.

There were nine science teacher participants with a range of experience and disciplinary expertise (i.e., physics, biology, chemistry, or general science). The teachers were from 5 different schools located in a large urban city in North America and had a wide variety of technology supports provided by their school base. Figure 1 below illustrates the years of participants' teaching experiences and subject expertise. Selection was based on their interest and content knowledge but also their understanding of project-based instruction and technology. The student learning was followed through each teacher enactment of their lesson.

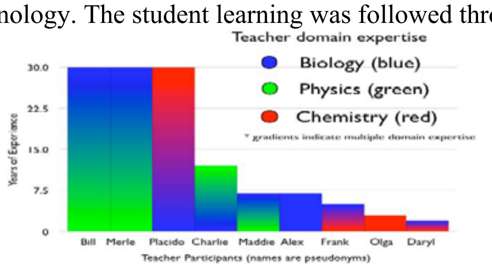

Figure 1. Teacher participants – Years of experience and subject expertise.

Materials

There are several materials that were used to examine the question of community development for fostering teacher knowledge. In order to establish a measure of teachers' background and pedagogical content knowledge, a pre-survey was administered to all teachers, followed by an interview that was administered for purposes of clarification and to orient the teacher with the mentor researcher. Reflection (both individual and community based) was one of the key interventions for this study. The reflection wiki site and interview questions were designed to promote reflections about pedagogical content. Examples of reflection questions asked during the study include: (1) What are your thoughts about the student ideas?; (2) What are some of the key elements in your project-based design?; (3) What is one change or addition you would like to put into place for next time? (4) What was one advantage in using the technology within the project-based activity?

The peer community within this project was manifested in both online and offline environments. The teachers had periodic community meetings where they exchanged ideas and shared their stories about the project-based enactment, which served to establish a personal relationship between community members. The online component of the community consisted of a website and a wiki site, developed to collect personal statements from teachers about their background and philosophy, as well as to collect details of lesson plans, and all reflections. The online community supported peer exchanges and reviews of lesson plans and discussions about enactments. Upon completing the lesson plan an update of the 'lessons learned' and the 'things I hope to add to the lesson next time' was added to the wiki lesson page. Teachers in a community were asked to connect to their peers by asking questions and commenting to this additional wiki page.

The on-line wiki site for lesson design and reflection played a significant role in supporting socially constructed knowledge. It enabled teachers and the mentor to make their knowledge visible for themselves and all members of the community. These on-line artefacts became assets for reference by all members of the community.

Design and Procedure

Four main phases of teacher activities occurred within each design iteration: (1) Teachers' background and experience; (2) Lesson design; (3) Classroom enactment; (4) Revision of lesson design. Data sources include teacher surveys, interview questions, lesson plans, reflections (captured in a wiki), videotaped classroom enactments, field notes, student artefacts and responses, peer exchanges (on a wiki and in group meetings).

The first iteration of the design study included four teachers who worked individually with the researcher-mentor to co-design a technology-enhanced project-based science lesson. The second iteration added five more science teachers, increasing the community to a total of nine teachers and one researcher.

Analysis and Findings

Evidence of Community Knowledge Sharing

The following is an example of how the peer-community and the mentor influenced participant's lesson design. (Charlie INT 29/10/08) "*I would not have been able to consider the changes to the lesson or even trying this video project-based lesson without the community*. Without you (researcher-mentor-peers), *so it has changed me and my perspectives -giving me things to think about*."

The layer of technology made many teacher ideas and actions more explicit, scaffolded discussions on revising lesson plans, and helped focus teachers' thinking on student learning. The following screen capture (Figure 2 below) of one sample of community comments, written by community members, about Charlie's wiki-lesson designs from the second iteration illustrates thoughtful reflection from his peers about his lesson and insightful suggestions about scripting and student focus.

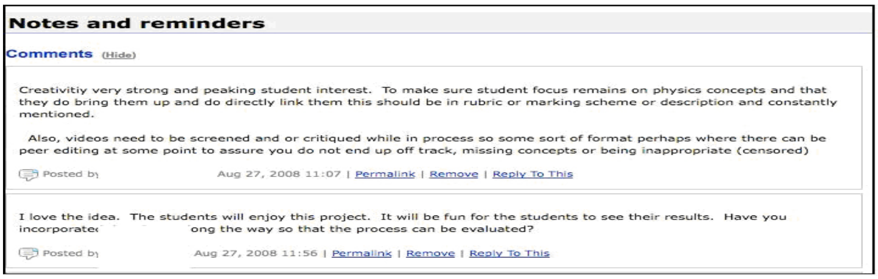

Figure 2. Wiki-Community Reflections on Peer's Lessons (27/07/08)

Use of wiki documentation enabled teachers from different schools not only to see lesson plans but also to see why changes in the lesson plans occurred and what components were critical to the design. The layer of technology made many teacher lesson ideas and actions more explicit and facilitated effective community discussions about lesson plans, and student learning.

Development of On-line Community Learning Environment

By coding teacher knowledge and actions, and then placing coded themes on the nodes of activity triangles, the use of CHAT enables viewing of changes and shifts in teacher enactments indicating teacher knowledge growth from one iteration to the next, and the sharing of revised lesson plans through the on-line community between participants activity systems. Figure 3, identifies one example of a pattern of actions as the teacher knowledge and wiki-documentation of teacher participants is shared through the on-line learning environment.

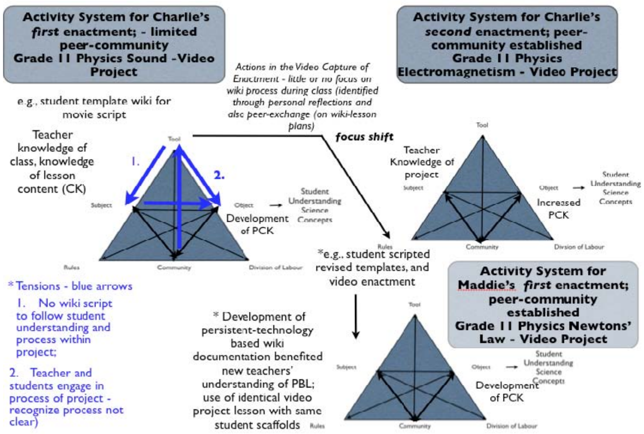

Figure 3. Activity Systems for different iterations and different participants. Indicates the use of computer-mediated supports for the teacher community offered a persistent record of the artifacts and demarked the tensions within teachers' lesson planning and revisions.

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Can teachers' discussion lists be a tool for in-service collaborative learning? What reveals a three years analysis?

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Abstract: Following Wenger (1998), discussion lists for inservice teachers are often considered as examples of communities of practice. Such lists have an important role in the professional communication of French teachers and exist for all secondary disciplinary fields. The increase of users for ten years indicates that this exchange medium can be an instrument for professional development. But, many discussion lists are managed by the ministry of education, and one can wonder if such lists are open spaces for all kinds of sharing or kinds of institutional disciplinary showcase. We studied all the messages, during three consecutive years, of a specific discussion list for management secondary teacher (named IGC – 2752 messages) and an extract of a private list for librarian teachers (named CDIDOC – 935 messages) and adopted an *ad hoc* coding process (with a triple dimension) to get an in-depth view of the nature of exchanges and an understanding of list regulation. The goal of the research is to get evidence of a list as a collaboration tool but results obtained give a contrasted picture of such teacher discussion list, more normative than democratic.

Results

The focus of this paper is to understand how works an institutional teachers' discussion lists, with a mission of accompaniment of curriculum innovation. Sociology of organizations (see Crozier & Friedberg, 1981; Amblard *et al*, 2005), help us as a guide to create a method of teachers' posts analysis including three dimensions: the regulation of the exchanges, the relations and the contents (see McGrath (1984) and circumplex and Nonaka & Takeuchi (1997) for knowledge management). Methodology and theoretical framework are detailed in Caviale's thesis (2008). See Dimitracopoulou (2005) and Bruillard (2007) about indicators for discussion list analysis.

The traces of personal experiences are weak

Globally, the communications about personal experiences (*internalization*) are the weakest on both lists (figure 1). In the year 2000, IGC list is new, not the CDIDOC list. The IGC teachers need to compare their contexts to better know each other: the *socialization* category is thus more important at IGC than CDIDOC. Librarian teachers are also accustomed to relaying information of knowledge (*combination*).

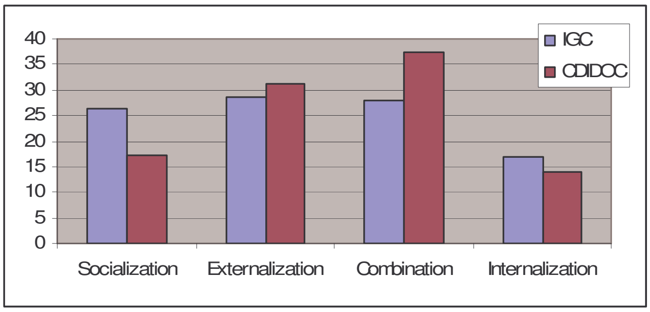
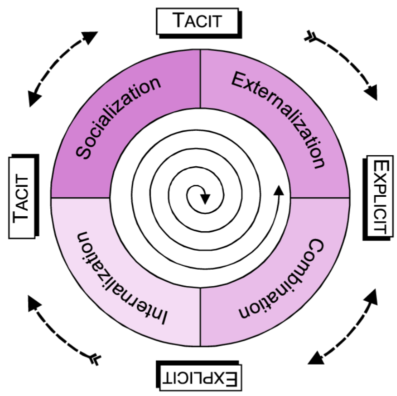


Figure 1. Comparison of knowledge exchanges in % for the two lists (IGC and CDIDOC) according to the process of knowledge creation by Nonaka & Takeuchi (1997)



The participation of an active minority is normalized

One of the most obvious results is a gap of participation between the actors: some of them are at the origin of a lot of threads and answer the others. We named "*activists*" these actors who represent 13 % of all the participants of the list IGC on three years and contribute to 38 % of messages. In figure 2, the height of the bubble means the number of created messages and the surface, activated thread. These regular actors do not know each other *a priori* but their behaviour collects similitude as presence on the list, regulation and exchanged knowledge.

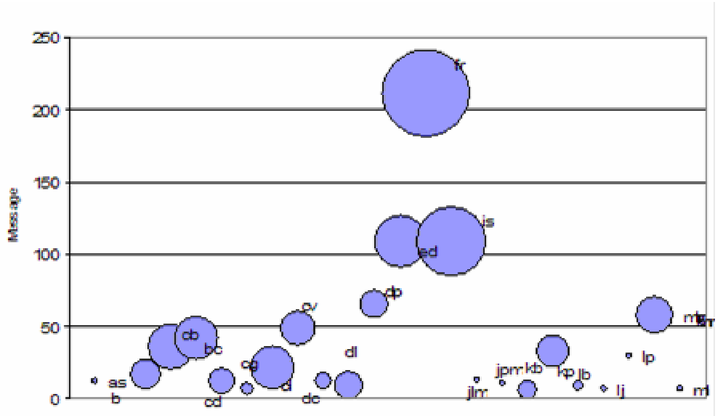


Figure 2. List IGC / *activists*

	Actors	Messages
Total	223	2778
Activists	28	1064

Distribution of the *activists'* roles

The actors composing the centre of lists have not same activity every quarters, nevertheless, even in weaker period of activity, their contribution remains constant. If the number of actors decreases, their activity remains the same. If a question occurs, only an *activist* answers, not the others. Each has an implicit activity domain. These leaders possess one register of wide intervention and hold the information without being involved in controversy. To solve a problem, if one *activist* answers, the others do not overbid; each one has a domain of speciality. If one of them decreases its participation, its place is occupied little by little, not by a newcomer on the list, but by another acting which has in fact more importance.

Contents of the *activists*' exchanges

Which types of messages dominate the *activists'* activity? This category of actor can produce without passing by a socialization step. The cognitive indicator "production" translates the production of resources (category *externalization*) or relay of necessary information (category *combination*) without passing by a phase of adjustment about the profession (category socialization). The occasional actors are obliged to know their context respective, before producing resources. The occasional actors are obliged to discover their respective contexts, before producing. The global analysis at the level of the answers means a relative balance of both groups.

The category "Generate" collects the productions of lessons or educational tracks. The *activists* are at work from the first quarter, for the first message of a thread. In the following messages, the tendency is inverted. This category of actor indicates clearly a tendency for the occasional actors. The category "Generate", important during the first message of a thread, has no more the same role. The production of resources does not seem to result from collaboration because teachers propose directly tracks, but messages relative to these propositions are weak.

Discussion

Our results make it possible to propose a different view about training using electronic exchanges (Figure 3). First, it is necessary to observe the volume of participation. Only 14% of subscribers participated once (stage 0). The teachers do not speak about their difficulties but they seek in the speeches similar traces of activity. This attitude is translated on the list by an absence of doubts or errors; otherwise the spectator can feel marginalized. Then, the first way of intervening is to call assistance but generally on a very precise point and often technique, never on pedagogy. A discussion list is most frequently used as a fast answer problem for 30 % of actors (stage 1). At this level, the answers are not useful for the whole list because of a too personal context. It is not very likely that these questions are useful for the audience. Like first conclusion, we can say that the potential of the lists corresponds to waiting of the teachers for the LLL, but quantity and type of expression are not easily transposable and yet, in the analyzed lists, the number of subscriptions increases in an important way. Why? Perhaps teachers seek other stages necessaries with their trade.

Stage 2 of participation is important: the discovery of contexts, named socialization. The model proposed by Daele (2006) also includes this stage, but it appears in its analysis like a precision of the question: "The exchange can be a question asking more information, a reformulation…" As far as we are concerned, separately the activists, we noted at the beginning of list, exchanges related to the trade, the curriculum… without particular questions. This stage of socialization seems necessary before any other form of production.

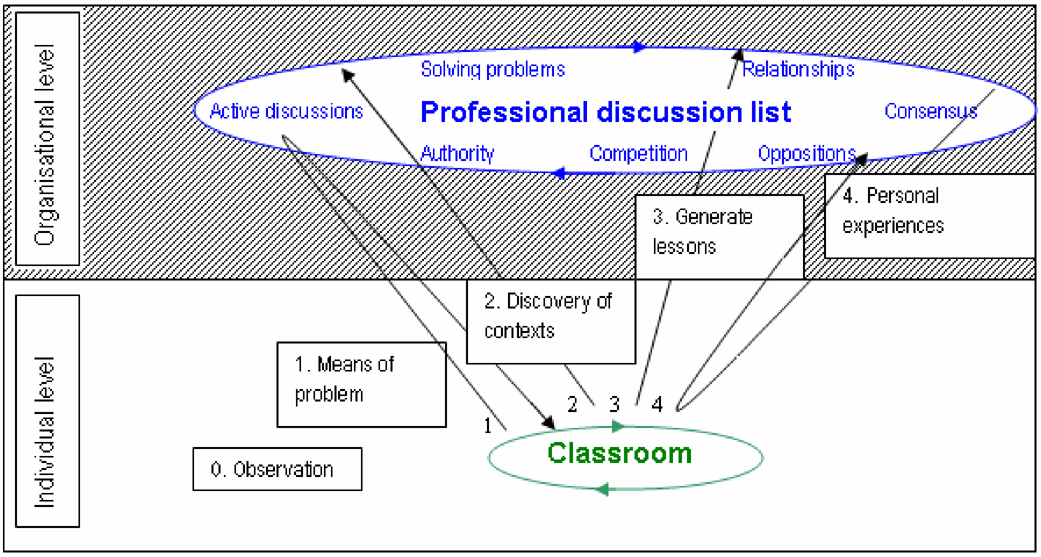


Figure 3. Stages of participation on a teachers' professional discussion list

Stage 3 of participation opens the door on another dimension: the actor does not write for himself, but for the organization. At this level, the activists are already there and produce. The spectators find the same contributions of knowledge and resources as during a "real" training session, but at home.

Stage 4 of participation, exchanges about experiences, corresponds to the weakest topic. Debates or analyzes starting from experiments were practically never met, contrary to the cycle of Daele, perhaps because of the type of list (size, culture…). Nevertheless, these asymmetries of participations bring a glance different on the place from the electronic exchanges in the *LLL*. The majority of the subscribers do not use these lists like place of exchanges and debates, but as an emission where experts bring a specific vision of trade. A discussion list cannot be easily regarded as reflection of practices, but rather as a media carrying resources.

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Advancing Collaborative Creativity in the context of Greek Teachers' In-Service Training in Environmental Education

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Abstract: This paper presents the research design of a case study aiming to enhance Greek environmental educators' competence in collaborative creativity through online training. The study, which is part of an on-going research project, entails the design of an e-learning course, the development and evaluation of a collaborative creativity framework called Hybrid Synergy and an associated tool to support it, and the identification of specific patterns related to the participants' engagement with the provided e-learning activities.

Introduction

The integration of Information and Communication Technologies (ICT) in education is now apparent in the collaborative social technologies that provide different media for communication, collaborative learning and training (Lambropoulos, Kampylis, Papadimitriou et al, 2008). According to UNESCO (2002), countries need to keep pace with technological development and the changing competencies reflected in the curriculum and teachers' training. In this context, e-learning platforms have now widely been used to support teachers' professional development on national and international levels.

In Environmental Education (EE), despite the fact that ICT are gradually recognised as important tools, and current trends indicate the need for more online EE learning environments (Liarakou & Gavrilakis, 2008; Daskolia, Kynigos & Gounari, 2008), opportunities for teachers' online training are virtually very scant, especially in Greece. However, the challenge is not just to provide some e-learning possibilities for in-service teachers in EE, but to organise content, activities and learning environments, through the use of appropriate technological and pedagogical frameworks, in order to promote teachers' thinking and practice required for educating students into an environmentally relevant and sustainable way of life.

Collaboration and *creativity* constitute, for example, integral processes of both individual and collective attempts to successfully address and resolve current environmental problems as well as to apply the aspired sustainability terms in everyday life. That is why they are regarded as core competencies to be developed in young people through EE (Flogaitis, 2006).

According to recent studies (Kampylis, Berki & Saariluoma, 2008; Dimos, 2006), Greek in-service and prospective teachers, consider EE among the school subjects that allow students to manifest their creative thinking, by acknowledging that it (i) promotes the students' active engagement in their personal learning, (ii) makes extensive use of explorative learning frameworks and procedures, (iii) provides students with opportunities to get involved in meaningful activities, (iv) establishes a playful and encouraging learning atmosphere, (v) improves collaboration, and (vi) adopts interdisciplinary and multidisciplinary approaches to the study of environmental issues (Dimos, 2006). However, teachers feel not well-trained enough and quite bewildered on how to "teach" such competencies (Kampylis et al, 2008).

An overview of the study

The rationale for this study was anchored in the previous remarks. The study is part of an on-going research project being designed and conducted by the Environmental Education Lab (Faculty of Philosophy, Pedagogy and Psychology, University of Athens) which aims: (a) to explore the appropriateness and effectiveness of an online training course for Greek teachers involved in EE; (b) to employ collaborative creativity techniques specifically developed for their teaching practice in EE, and (c) to observe and analyse patterns of their new knowledge co-construction anchored in collaborative creativity.

More specifically, the project is conceived to involve:

- The design of an online in-service training course for Greek teachers involved in EE.

- The development of a collaborative creativity framework to enhance the participants' new knowledge co-construction.
- The development of a new associated tool to support the suggested collaborative creativity framework.
- The evaluation of all the suggested frameworks and interventions.
- The identification of any principles derived from the implementation of the suggested frameworks and employed tools.

The e-learning environment was designed on Moodle, a widely used open source e-Learning Management System (eLMS), aiming to enhance the participating teachers' creative thinking and collaborative learning as much as to facilitate their communication and interaction within an e-learning community. Moreover, we combine collaborative creativity and collaborative e-learning in a coherent, easy-to-use and practical framework we call *Hybrid Synergy* (Lambropoulos et al, 2008), aided by an associated tool (HySynergyTag). This tool aims to support the teachers' argumentation and collaborative new knowledge construction by shedding light on its structure and at the same time allowing direct observation and analysis of the participants' interactions.

The online training is to last one week; this week is divided in three stages, a social, a didactic and a collaborative one, to facilitate participants' engagement with collaborative creativity in an e-learning context. This can be achieved by developing self-organized and vicarious learning skills, having proved to be of great importance in collaborative e-learning communities (Lambropoulos, 2008).

The research questions revolve around the effectiveness, added value and applicability of the suggested *Hybrid Synergy* framework and the *HySynergyTag* tool. More specifically, the study aims to explore in what ways and to what extent:

a) the suggested online course on collaborative creativity will contribute to the Greek teachers' professional development;
b) the participants in this online course will utilise the suggested *Hybrid Synergy* framework;
c) the suggested *HySynergyTag* tool will improve teachers' collaborative creativity;
d) the participating teachers will feel confident to apply the suggested frameworks to their everyday educational practice in EE;

Consequently, the present study involves the following frameworks (Figure 1):

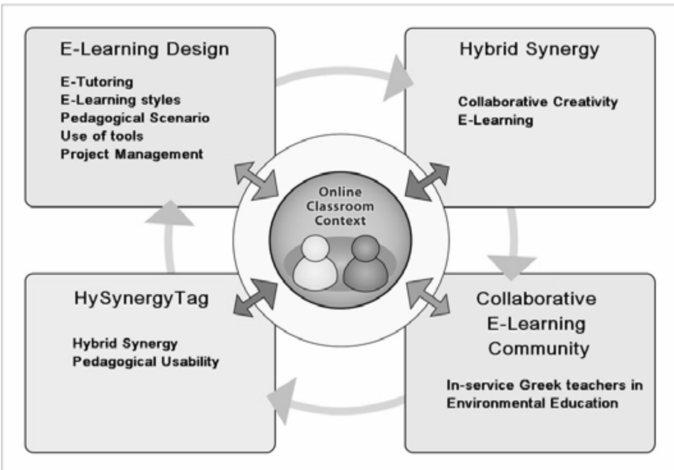

Figure 1. Overview of the project's frameworks

In this case study both quantitative and qualitative methodologies are to be used for data collection and analysis, such as the log files provided by the Moodle eLMS, pre-post questionnaires, online discourse analysis anchored in Hybrid Synergy, and data provided by the *HySynergyTag*. More particularly, the utilisation of the message-tagging *HySynergyTag* tool for observation and analysis of the underpinned *Hybrid Synergy* structures has the following methodological advantages, among others:

(a) it can support dialogue management to provide explicit control of the argumentation procedure, for both the e-tutors and e-learners, in order to support decision making when working collaboratively in EE projects;
(b) it can facilitate the type of interactions needed to promote collaborative work and co-build clear propositions;
(c) it can allow the e-learning participants to quantitatively evaluate their performance when working towards specific outcomes; and
(d) it can provide quantitative and structured qualitative data for further analysis.

Epilogue

This project is a pilot study within the authors' ongoing research on Greek teachers' professional development through online training on collaborative creativity in the context of EE. It is aligned with the current European initiatives for creativity and innovation (e.g. European Parliament, 2008), and its findings may have significant implications for educational policy-making, research and practice related to EE teachers' in-service training and professional growth.

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WISETales: Sharing Personal Stories as Informal Learning Experience for Women in Science and Engineering

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Abstract: Women are underrepresented in the areas of Science and Engineering, both in academia and industry. This leads to weaker support networks, lower self confidence and lesser access to mentors. We investigate whether a community built with a specific purpose to allow women in science and engineering to share personal stories can support women to reflect and learn from each other's experience. This paper presents the design of WISETales, a new online community for sharing personal stories. It discusses the design and the potential role of the community as an informal learning tool based on results of an exploratory user study.

Introduction

People are social by nature. They tend to connect easily with others who share their interests and opinions. These connections boost their self-esteem (Festinger, 1954), increase their sense of security (Reed, 1999) and allow them to establish status in their communities (Festinger, 1954). We investigate whether a new online community that allows and encourages women in science and engineering to share personal stories can support them to learn through their narratives and help in their personal, professional and career development. The community will also help to connect women who may be isolated in their workplace, provide a forum to ask questions, get help and informal mentoring, and ultimately, help them build up self-confidence and increase their motivation to achieve success. Other online communities exist for women in science and engineering, but there is no similar community focused on sharing personal stories.

We designed WISETales (Women in Science and Engineering Tales) – a new online community for sharing personal stories. The community is currently active and available on the web at http://www.ourwisetales.com and http://wisetales.usask.ca. It targets professional women from all over the world, of diverse backgrounds, cultures, ages and professional levels: undergraduates, graduate students, entry level professionals all through senior level professionals, in both academia and industry.

Related Work

Research suggests that there are two main factors behind women's underrepresentation in science and engineering: social gender stereotypes and (influenced by them) women's low self-efficacy and self-confidence in their abilities. According to (Cohoon, 2007) these social factors lower their expectations of performing well in these fields, thus diverging them away to other socially and gender-accepted fields.

By sharing stories about personal experience women can educate, support or warn other women going through similar situations. While positive stories encourage women in their professional journey by providing role model's original stories, negative stories project a realistic depth into the current obstacles they experience at various levels. The diversity and richness of the posted stories would serve many women in different stages in their lives and careers. Finally, as a result of story-sharing online, a repository of narratives evolves providing a deep and realistic perspective of the life and choices females in science and engineering face, which would be an important resource for researchers in gender studies, sociology, and human resources.

Some authors see the community design as the key to stating successfully a new community. Nine key design principles were identified (Kim, 2000). These principles evolve around identifying a goal for the community, having a flexible environment, allowing users to create profiles, assigning roles, encouraging social norms, promoting events, creating and celebrating special community occasions and finally assisting users in creating and managing their own subgroups.

Furthermore, the design should consider the possible motivations that users may have. One of the main theories in the area of motivation is Maslow's Hierarchy of Needs (Maslow, 1943). In the case of WISETales, there is a variety of needs that women may need to fulfill and that may affect their motivation for participation. First, the basic needs of providing access (easy to use interface, intuitive and understandable for users of different age and computer skills) need to be met by the community to allow users to participate. Ease of use is paramount to attract users of different backgrounds and computer skills to participate and contribute content (Fogg et al., 2003). Immediate feedback to users' contributions makes the interface easier to comprehend, is rewarding and motivating (Norman, 1988), (Webster & Vassileva, 2006).

There are two other theories that can be used as a theoretical framework. The Common Identity Theory focuses on the individual's relationship with a group as a whole, and the Common Bond Theory investigates personal relationships among individuals in a group. In online communities, users are motivated to contribute because they either associate strongly with the community as a whole, and they work hard together to succeed in achieving the community's purpose, or they are motivated to establish strong relationships with certain users in the community. The motivation to contribute to the community may be a combination common identity and common bond (Ren, et al., 2007). So a community design should emphasize both the overall goal and provide means for the users to see how their activities contribute to it, and also it should support users in building relationships with each other, e.g. by avoiding complete anonymity, allowing users to send private messages to each other etc.

WISETales new Online Community Design

Our design allows only 4 functions for members which are all directly related to the main purpose of the community – sharing stories. The functions are: read and comment on stories, search for stories with particular tags or published in a particular month, and contribute stories. While it is possible to extend the purpose of the community to include, for example, supporting discussions, sharing news, personal blogs, chat tool, status updates etc., we decided to focus on the unique goal that defines the focus of the community –sharing stories– at least at the start. More communications purposes and their corresponding functionalities can be added later, once the community is formed, if it is required by the users. The homepage of the community is shown in Figure 1.

Figure 1. The Homepage of the Community

Usability Exploratory Study

We launched wisetales.usask.ca on January 31, 2008. At the time of writing, there are 21 stories in total (16 contributed and 5 seeded). In October 2008 we ran an exploratory study to evaluate the usability of the design and the interface and the appropriateness of functionality, as well as whether the users thought that the community provides an environment that supports informal learning. Thirty women in science and engineering were recruited for the study through the internet (Facebook groups, personal email invitations). We used a web-questionnaire as a tool. We did not ask if WISETales provides a learning experience in order to avoid the Hawthorne effect. The participants were asked in an open ended question what they thought of WISETales. Ninety percent of the participants (90%) said it is a great idea, but only eleven elaborated further, most of them emphasizing the value of knowing there are other women going through similar experiences, learning from each other and passing on their experiences through generations. Eighty percent (80%) said that they would join such a community. The majority of the participants (90%) found the design easy to use, attractive and 70% thought that it was easy to figure out the main purpose of the community from the design. Regarding privacy, 77% of the participants supported the need to require registration to post stories or comments, and 84% liked the anonymity option (but only 54% created anonymous accounts).

Summary, Discussion and Future Direction for the Project

We created a new online community for Women in Science & Engineering (WISETales) to share personal stories using design principles based on theories of motivation and some general design principles for online communities. We were particularly interested if WISETales serves a need in the community by helping professional women in science and engineering to connect and learn from one another by sharing their personal experiences through narratives. We confirmed our hypotheses through an exploratory study with 30 users. Our results are based on a relatively small sample of users, but in most qualitative studies, more than 15 users are considered sufficient number to account for the possible variability of answers. Yet, our sample was mostly formed by professional women (faculty, graduate students and women already working in industry). There were no high-school students among the sample, and only two of the participants were undergraduate students. So our results are somewhat biased towards women in further stages of their careers.

The timeline of most successful communities shows a long period with few contributions, which later increase exponentially. The specifics of our audience suggest that it would be impossible to expect a growth of contributions comparable to Flickr, YouTube or Del.Icio.Us. “Success” for WISETales would mean a stream of sustained contributions at a low scale (2-4 stories a month). We do not think that this goal is unrealistic. Starting a new online community is very hard. Yet, we believe that the goal of creating a community for underrepresented women to share personal stories is noble, and the area of research offers many avenues for investigation. The next stage of our research would be to follow up on the feedback received, enhance the design and investigate ways to elevate the learning curve further by incorporating a social visualization. Another study will take place to test the effects of the visualization. We are optimistic that we will be able to gain interesting insights into important questions of online community formation, what motivates participation of women in science and engineering in online communities, and how informal learning happens in them. There aren’t many repositories of gendered narratives available currently, even less so in the areas of science in engineering. WISETales will help to fill this gap.

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A new framework for smart classroom research: Co-designing curriculum, research and technology

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Abstract: This new program of research explores how technology can enable smart classrooms where learning transcends traditional class boarders, engages students and teachers with Web 2.0 approaches, and supports a community of learners in developing knowledge. We report on key aspects of our open source smart classroom environment, including an online database of student-generated, tagged, and socially connected learning objects, the integration of handheld learning devices, and supports for visualizing, sorting, and sharing collaboratively generated artifacts.

Introduction

Now more than ever, schools must prepare students as lifelong learners in a society where change is the only constant. New issues, new opportunities, and increasingly complex range of messages and materials will greet them at every turn. As the demands of the workplace and everyday life become increasingly diverse, students must become skilled at interacting with peers, solving problems and embracing this complexity. The development of these skills has become a vital piece of an educator's role in the classroom, and the objective of this research is to empower teachers to embrace new technologies that turn their classrooms into knowledge communities.

Inquiry learning often employs technology environments in scaffolding students to respond to problems that go beyond traditional laboratory and lecture activities (Collins, 2002; Slotta & Linn, 2000; Soloway et. al, 1999). The notion of "scaffolded inquiry" (Songer, 2007; Linn & Eylon, 2006) is quite relevant to the challenge of engaging students with technologies, particularly as their lives outside the classroom become increasingly immersed in technology (Tinker, 1997; Nirula et al., 2003; Swan et al., 2005). An even more transformative approach to learning is that of knowledge communities, where students collaborate with their peers and teachers to develop knowledge resources and define their own learning goals (Brown & Campione, 1994, Nirula & Woodruff, 2008; Scardamalia & Bereiter, 1992). This kind of learning complements the foundations of "Web 2.0", which are characterized by socially driven web experiences (e.g., Facebook) or semantically linked resources (e.g., YouTube, Flickr) – where learning becomes a collective product rather than the output of singular minds.

With the arrival of new technologies in classrooms, the conditions are ripe for the investigation of new approaches to teaching and learning that connect classroom communities with the world at large. At the heart of this connection between classroom and outside world is the ability to create rich and varied relations between the learners and the objects of knowledge, resulting in personally relevant curriculum that promotes deep understanding (Woodruff, 2005; Bereiter, 2002). This poster describes a new program of work that addresses the following research questions: (1) What kinds of learning activities are best suited to connecting students' home, school and informal learning environments? (2) What new opportunities for teaching and learning emerge from Web 2.0 technologies and approaches? (3) How can we employ the physical space of the classroom to engage learners and enable new forms of interaction between students, peers and teachers? In our first year, we have successfully established four curriculum projects with teachers from a variety of domains. Given space constraints, we detail here only one of the curriculum innovations that have now been completed. We continue to work with teachers from the school to revise and improve such innovations and develop a framework for smart classroom applications.

Methods

This design-oriented study investigates new ways in which technology can support communities of learners in physical and virtual spaces. In close collaboration with a local high school, we are developing a "smart classroom" in several layers, using a range of devices and approaches. At the most basic level is the portal and user registration system, which manages user accounts for each student and coordinates the grouping and collaboration services that are employed by higher-level software systems. A second important layer is that of the pedagogical architecture, which represents the logical dependencies, conditions, and grouping configurations, and links to many different kinds of content materials, devices, and user interface paradigms. This allows for the choreography of our smart classroom, managing the flow of people, roles, goals, materials and devices. A third layer is that of content, which is responsible for storing the actual materials encountered by students, such as written instructions, discussion topics, reflection prompts and notes, or rich media objects (e.g., simulations or models).

The smartroom includes functionality for a flexible "smart wall" – a large touch-surface of approximate 2 X 3 meters dimension. Students can work collaboratively at the smart wall, jointly manipulating multi-media objects and Internet enabled applications. We also support a flexible array of monitors, and a hand-held pointing device (an iTouch) that can interoperate with the Smart Wall. The smart wall can be configured in many arrangements, as shown in Figure 1.

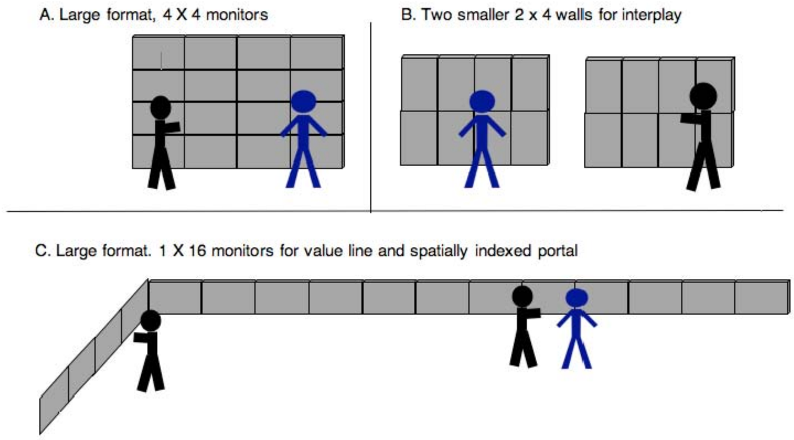

Figure 1. Concept wall in 3 different configurations: A single large wall (16 monitors), 2 smaller walls (8 monitors each), permitting exchange of digital objects, and a linear array of 16 monitors that wraps around the room.

Other important functional elements include a portal and user registration system, a Repository of Open Learning Objects (RoOLO), a Web-based Virtual Learning Environment (VLE), and Handheld Learning Devices (HLD) that include software for geotagged forms. All software elements are offered under open source license. Through the combination of the HLDs and Smart classroom technologies, and a light-weight Java-based program installed on the HLDs, students can combine captured images (using the HLD's embedded camera) with contextual information such as the submitter's name, the time and date, and more importantly, using the HLD's built in GPS tracker, the geotagged location of where the photo was taken (see Fig. 2). Students can also add relevant "social tags" from a combination of pre-set and student derived vocabulary. The information that is added by the students is then uploaded to the smartroom central server where it is then overlaid on a Google Map, using Google MyMaps technology. In the room (on the large displays) or online, students can then see the collective artifacts of their class, which comprise a community knowledge dataset. Subsequent curriculum activities are designed according to the Knowledge Community and Inquiry (KCI) model (Slotta and Peters, 2008) where scripted collaborative inquiry activities are connected into the community knowledge base. Students are able to query their various resources according to the semantic metadata they added, combining results to create interesting cross sections of the architectural entries. The instructor receives reports of student activities that allows rich interactions related to the deep structure of the instructional domain. Information can also be uploaded to students' HLDs, enabling them to become both continuous learners outside of the classroom, and socially connected to the rest of the class through their continually updated and shared experiences.

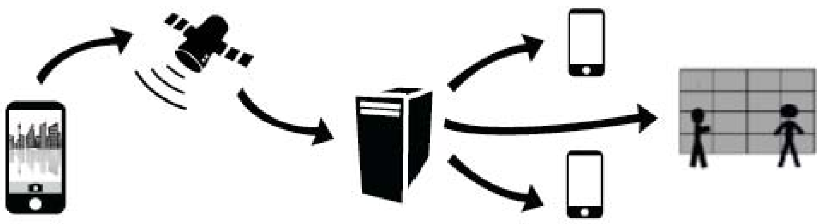

Figure 2. HLD information flow: Captured images from the HLD are geotagged and sent via wi-fi to the smartroom server where they are saved on the server and loaded onto the SmartWall; other students' receive HLD updates.

Working closely with a math teacher, we have co-designed a "knowledge community" approach in which a grade 12 class is responsible for the development of student-created artifacts that are accessible by the entire class through an online portal. Students access the portal through a website that uses an application programming interface (API) for Flickr, a popular online image hosting service. Using the website's API, students can upload, tag, and annotate their own math problems, as well as search, comment, and make connections between problems uploaded by other students in the class. This allows students to become co-creators of the community's knowledge objects as well as take control of the design of their learning environment. Working alone or in collaborative groups, students use the various configurations of the "smart wall" to offer different ways of organizing and visualizing the information. Students can also receive notifications sent directly to their HLD, when other students comment or add to any of the problems they have uploaded. Data sources include pre and post-interviews with teachers about formal and informal learning environments, the use of technology-mediated instruction, and classroom participation. Additionally, we examined the logged student data, all artifacts created by students, and curricular assessments employed by teachers.

Outcomes

Students created and uploaded 36 Math problems to the Flickr database and tagged them with specific mathematics categories – a basic set of terms was provided, but students were free to add new ones. Students then visualized the problems and solution sets in the smartroom on the large display screens using specified queries to the Flickr database. Through these visualizations students were able to see relationships/connections between problems and solutions sets that they hadpreviously considered disconnected. A problem-sorting pre-test was developed to establish the imapact of this design on student understanding of relationships. Results were positive and are currently in analysis stage. Through the combination of varied points of access, and collaborative development of artifacts by students, we have demonstrated the capacity of the smartroom to scaffold distributed intelligence within a knowledge community.

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Design of an Online Global Learning Community: International Collaboration of Grades 7-9 Science Students

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Abstract: This paper describes the design decisions made in the construction of an online global learning community for grades 7-9 science students. The collaborative learning tools of class profiles, student-scientist forums, and peer review featured in the From Local to Extreme Environments curriculum are discussed in detail. Initial evaluation of these tools and student reactions to global collaborations in this ongoing study will be accomplished through feedback during the unit and embedded surveys.

Introduction

Following is a discussion of design decisions made in the development of three online tools featured in the From Local to Extreme Environments (FLEXE) project. The three tools (i.e. partner profiles, students-scientists forums, and online peer review) comprise the primary modes of interaction within the FLEXE online global learning community (GLC). The goals of the study are to characterize student involvement and reactions to online collaborations with diverse peers from different environments and to understand how science students use different scientific data sources as evidence in their written arguments. The project is currently in pilot use and evaluation.

The on-line GLC presented in this paper is defined as the student, teacher, and scientist members of the FLEXE community that participate in FLEXE learning activities. These members represent diverse nationalities, cultural backgrounds, native languages, local environments, and scientific knowledge bases. The term global, in this study, means outside of an individual classroom. The FLEXE GLC is possible through the use of web-based technology that facilitates communication between schools and between schools and scientists in different parts of the world. Students in the FLEXE project are engaged in activities similar to the science community. Students may be challenged by cultural differences and multiple languages but are aided by the universal inquiry process of science.

Context

FLEXE is an Earth Systems Science Project developed in partnership with the Global Learning and Observations to Benefit the Environment program (GLOBE), a worldwide web-based science and environmental education program. The mission of GLOBE is to promote teaching and learning of science, enhance environmental literacy and stewardship, and promote scientific discovery in a worldwide community of students, teachers and scientists (The GLOBE Program, 2008). GLOBE emphasizes learning through student collection and analysis of environmental data using scientific protocols and newly developed student research tools. FLEXE is funded by the U.S. National Science Foundation. FLEXE expands the boundaries of the science classroom by directly involving students in a GLC. In FLEXE, students, teachers, and deep-sea scientists from around the world engage in online discussions about scientific data. The activities in the program promote student discourse on Earth systems science through comparisons of local with extreme environments.

During the spring of 2009, teachers and students from the United States, Thailand, Australia, and Germany are participating in a pilot of the FLEXE Energy Unit. Approximately 2500 students and 55 teachers are involved. Most students are enrolled in grades seven through nine in Earth Science, General Science, or a related course. Students work in pairs to complete classroom activities and submit online responses. A small number of deep-sea scientists are also directly involved in the FLEXE Forums.

Online Collaboration Tools

Many online tools have been designed to help students engage in progressive scientific inquiry and enter into diverse communities of practice. In the following discussion we describe theoretical foundations that have influenced the design of FLEXE online tools with examples of existing online tools that highlight issues taken into account during design. The advancement of computer technologies has enabled the development of educational online tools that have their theoretical foundations in sociocultural learning theories. Students are now able to become involved in communities of practice through online interactions (Kelly & Green, 1998; Wenger, 1998). Online resources and communication tools enable learners to reach beyond the traditional walls of the classroom to gather archived and real-time scientific data from peers, scientific experts, and organizations. The use of online learning communities offers an increased opportunity for students to be challenged by peers representing different environmental locations with varied experiences and scientific knowledge bases. Global membership increases the chance for students to interact with a large number of peers in their zone of proximal development (Vygotsky, 1978 in Schunk, 2004). In the FLEXE pilot, the principal contrast of domestic U.S. and U.S. - international class partnerships provides the opportunity to examine how international differences in culture, education, language, etc. affect student engagement and learning.

Researchers like Hakkarainen (2003) and colleagues have focused their studies of collaborative computer-supported classrooms on the theory of progressive inquiry. According to Hakkarainen, 5th and 6th grade students in these online collaborations are able to move "beyond intuitive explanations and toward theoretical scientific explanations" (2003, pg. 1072). Hakkarainen's findings show that students in online collaborations have opportunities not available in traditional classrooms, become aware of scientific grounds (evidence) from different perspectives and examples, and are challenged by alternative explanations that help them revise, refine and develop theoretical explanations.

Asynchronous communication is used in the FLEXE online tools described below. Education researchers have examined asynchronous online forums in studies of topics like argumentation and comparisons of in-class synchronous communication and Web-based asynchronous communication (e.g. Clark & Sampson, 2008; McNeil, Robin, & Miller, 2000). McNeil et al. (2000) describe collaboration and flexibility as benefits of asynchronous online communication. Asynchronous communications were found to change the students' role from passive note-takers to active participants that may engage with audio, video, multimedia, and simulation tools. McNeil et al. (2000) also found that students wrote higher quality responses because of peer review and the added time to reflect before replying. The benefit was noted for English as second language (ESL) students in particular.

Linn (2003) found that online discussions, in programs like CSILE and One Sky Many Voices, give students a chance to think before they respond, which contributes to knowledge integration by sustaining thinking about a topic. Major features highlighted in Linn's study and review are that online tools should be designed to specific disciplines, include an option for anonymity, have the ability to be personalized by their users, include heterogeneous groups, and take place over time spans of at least four to six weeks. FLEXE interactions are designed to allow students to work locally in pairs and establish class partnerships, which enable smaller numbers of students to participate in online class profiles. Online discussion within collaborative workspaces should be specific to a discipline and interactions with an expert(s) should be provided. Within a specific context, students should be challenged to address an everyday problem that they can personally relate to and work toward a common goal.

While existing online asynchronous communication tools informed the FLEXE design team, none of these tools were found to be directly applicable. The design team therefore constructed three online collaboration tools that addressed the challenges of scalability and ability to monitor and focus student work on specific learning outcomes of understanding energy transfer processes, energy sources, and learning through environmental comparisons. FLEXE students engage in a variety of asynchronous online communication. They are prompted to provide specific local environmental information in their Class Profiles. FLEXE Forums offer students interactions with deep-sea scientists in a scalable manner. FLEXE Peer Review engages students in meaningful interactions with a common goal of communicating results around a shared investigation. Ultimately, students construct knowledge by sharing scientific data and accessing numerous data sources.

Class Profiles

Class Profiles are designed to provide teachers and students with information about their partner class. The profiles are similar to My Space□ or Ning□ personal pages but are much more focused in scope and content. In creating the profile, teachers first discuss local environmental temperature data with their classes and submit these data to their profile. Student groups also write and post paragraph responses to questions about local environmental events and conditions. Teachers and students update their class profiles throughout the instructional unit as they complete additional activities and also communicate through the profile teacher email.

Class Profiles represent public bulletin board type communication and were carefully constructed to maintain student anonymity and appropriateness. Student anonymity is achieved throughout the unit with the use of student IDs that are assigned by the teachers and used as tags with all student submissions. To ensure student postings are appropriate and on topic, teacher monitoring of student submissions is required. Student paragraphs are reviewed by the teachers and posted to the class profiles after approval. Prompts help focus students' comments on specific topics (e.g. temperature variation or local extremes).

Student-Scientist Forums and Wrap-up Research Cruise

Two FLEXE Forums and a culminating research cruise enable student interactions with deep-sea scientists. The established ask-a-scientist model works well when one classroom interacts with a single scientist (Brown, Ash, Rutherford, Nakagawa, Gordon, & Campione, 1993) but the issue of scalability was the number one issue that had to be addressed in the design of this online tool. An innovative design was incorporated to facilitate communication between thousands of students with a few scientists. In the FLEXE Forums, scientists introduce deep-sea data sets to the students and then pose a series of questions designed to help students analyze and interpret data. The graphical data sets are described online along with an introduction from each scientist. Supporting materials include a number of supplemental online links and a worksheet with a shorter description of the data, graph of the data, and a series of questions for students to answers. After completion of the worksheet, students answer four online summary questions for review by the scientists and FLEXE team. Select student responses are identified for inclusion in feedback from the FLEXE scientist featured in each forum. The inclusion of student group IDs and school names with students' answers in the scientists' feedback provides some individual recognition and communication between students and scientists that students find exciting.

Peer Review

The FLEXE curriculum includes an online peer review tool that simulates peer review in the scientific community. Studies of online peer review at the college level have shown that the process of writing and receiving reviews from other students can be effective in helping students develop analytical skills and understanding of the nature of science (Trautmann et al., 2003). The FLEXE Peer review examines this type of online collaboration with middle grades students.

The peer review process starts with scientific reports that students write about local investigations of extremes. The design of the peer review tool included considerations of number of reviews, standardization of review procedure, and the effects of international reviewers. The design ensures that each student group will conduct and receive two reviews that they can use to improve their scientific report before final submission. Students use a standardized review template that includes yes/no, open-ended, and overall rating questions. The effects of international reviews will be evaluated through the design of two pools of reports for the peer review process; one pool for students in U.S. class partnerships and another for students in U.S. to Thailand, Australian, and Germany partnerships. Engagement in peer review with an international community is expected to increase student engagement and improve student argumentative writing.

Evaluation

The FLEXE team is currently evaluating the online tools described above. Preliminary feedback indicates that teachers and students are excited to learn about their partner classes through the class profiles and eager to interact with deep-sea scientists in the forums and other students through peer review. The online collaboration tools provide students with scientific data from different environments and cause them to consider that data in their written explanations. Additional results from the use of the system, feedback from teachers, and embedded surveys of students' reactions to online collaboration will be available for discussion at the 2009 CSCL conference.

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Designing Environments for Collaborative Learning: Facilitating the Adoption of ICT in Small and Medium Sized Enterprises in Costa Rica

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Abstract: The poster describes the design and practical implementation of a collaborative project used to improve the collaborative learning among university, industry and government with aim to facilitate the process of the adoption of information and communication technologies in small and medium sized enterprises in Costa Rica. Learning activities and spaces have been designed to facilitate the interaction of the three sectors and foster critical thinking, collaboration, problem solving, and team work skills in the participants.

Introduction

In this work, we are going to look into arguments and strategies used to design a collaborative action learning project, within the triple helix framework, to support the adoption of information and communication technologies (ICT) small and medium size enterprises (SMEs) in Costa Rica. The project was designed under the premise that in order to achieve a significant and sustainable change in the SMEs sector it is necessary to implement initiatives based on experiential and social learning processes focused on reflective thinking in the organization as well as in individuals.

Triple Helix Development Model deals with a reciprocal relationship among university, government and industry in the process of knowledge capitalization. The first scope of the Triple Helix model is an internal transformation in each of the participants. The second is the influence of one participant upon another. The third dimension is the change in the interaction and relationship among the participants with the objective to produce new ideas and create new initiatives supported in high- tech development. Therefore, the model explains what is expected from each sector, starting with the universities who are having the role of producing knowledge, being a motor of research and applying that outside of academia, and being the leader in the development process. This role of universities is very relevant in developing countries. The government is seen as a supplier of the appropriate regulatory framework to create environments of sustainable, dynamic and progressive growth; and finally, companies are the ones generating new business opportunities (Etzkowitz, 2008).

Under the umbrella of this model and in order to support the SMEs sector with sustainable strategies in a long run we suggest to develop collaborative action learning projects focus on the learning process among the actors, helping the people to learn to learn and to collaborate. These projects should address concrete problems of the SMEs, fostering companies and people's capacity to learn, and especially giving them tools to face the adoption of new technologies.

In our point of view, this kind of projects should create learning settings where:

- The actors - universities, government and industry- learn how to work together
- The enterprises develop learning capabilities, based on a collaborative learning and problem solving approach which provides skills to face the new economic scenario of the knowledge economy.

Action learning and Action Research Approach

We would define action learning as building learning environments around collaborative work (O'Neil & Marsick, 2007) where a group of people with different skills and experiences compromise to work together to analyze and solve real-world situations of everyday work (USOPM, 2006), trying to learn from their actions and from what happens to them and taking time to reflect and to insight about their practical things (Weinstein, 1999). The common elements of action learning include action learning set, problem or situation, set advisor, facilitator, and action learning meetings (Edmonstone, 2003).

The action learning approach (Revans, 1998) was taken as a point of the departure in order to develop skills of the participants regarding collaborative learning, problem solving, and critical thinking. Furthermore, it was found productive to use the approach of problem and project based learning (Dirckinck-Holmfeld, 2002) as a framework to deal with real work problems. Facilitator's role of action learning theory was played by a group of professionals who come from a university, a governmental institution, a micro business and a researcher, this group was called facilitator group and they used action research approach to drive the action learning project and explore strategies to facilitate the triple helix interaction.

The action research is a participative cyclical process focuses on change, which brings together action and reflection, theory and practice with aim to find practical solutions for matters concerning people and their learning process (McNiff & Whitehead, 2006). In its most common expression action research uses a cyclical process whereby alternating action and critical thinking, with steps of plan, act, observe, reflect and plan again (Carr & Kemmis, 1986). The facilitator group applied this cycle in each design meeting in order to understand what was happening in the project, to take decisions and plan future activities. Furthermore, the approach was to ensure to create collective knowledge with the interaction and feedback of all participants.

Designing the Collaborative Action Learning Project

This action learning project, implemented from June to December, 2008 in Costa Rica, is part of the empirical work of a research project. The aim of the action learning project was to create a learning setting in which practitioners from different sectors, fields, organizations come to work together in order to learn and share experiences, ideas and practices, solve real problems, develop new ideas, do things in different ways, and create new knowledge, regarding to implement ICT projects in the companies in order to improve their competitiveness.

The theoretical framework used to design the action learning project was supported by different learning approaches and assumptions. First, people learn better when they are actively involved in solving real problems, reflecting on the actions taken and learning from that, so when there are actions there are learning, and when there are leaning, there are actions (Revans, 1998). Second, we are social beings and learning is a matter of social participation. Participation is a process of leaning and knowing, a kind of action and a form of belonging (Wenger, 1998). Third, learning is a process of the reinterpretation and understanding of the past activities, and knowledge is created through the transformation of these experiences (Kolb, 1984).

Based on these approaches the design was focused in four aspects:

- To develop the participant's capacity to use action learning to address problems, reflection on their own action and learn from them, so they use this new knowledge as a guide for future actions.
- To develop the companies' skills to work in groups, and to develop capacities to participate productively in the networks who provide support to SMEs.
- To solve problems in collaborative way cross-boundary of all thesectors which are involved in the problem: university, government and industry.
- To develop critical thinking to produce knowledge that can help to understand the triple helix interaction.

The project's participants were two medium sized enterprises from the manufacturing sector, who are developing the information system with the university students; a public university in Costa Rica which has the role of creating knowledge and leading the project; a governmental institution, which is responsible of formulating specific policies for the promotion, development and strengthening of SMEs in Costa Rica; and a micro business consulting firm with a strong background in logistics and manufacturing, information technology management, process improvement, strategic planning and systems thinking.

The companies developed a real ICT project with the intervention of the facilitator group, which gave them the opportunity to investigate and find solution to some problems that they were facing in that moment. It did not only allow them to adopt technologies in their businesses, rather more it allowed them to foster more and deeper administrative competencies necessary to manage their business and to develop collaborative learning skill necessaries to play a better role in the knowledge based economy.

Activities of the Collaborative Action Learning Project

As a part of the project the participants were involved in different activities which were designed in order to support the participants in their process of to learn to learn, collaborate, work together and support the design, development and implementation of an ICT project in the enterprises. The activities carried out were:

- *Workshops*: were learning activities combining concepts of programmed knowledge (Zuber-Skerritt, 2001) and learning by doing. The workshops had a purpose of carrying out a rigorous diagnosis of the situation, identify the real problem and develop the project plan to resolve the situation that the companies were facing. Furthermore, these workshops were used as training sessions to prepare the participants to take a participative role in the action learning meetings.
- *Action Learning Meetings*: these communication spaces were held in order to strengthen the collaborative learning, the participants (students and companies) shared ideas, practice and experience, received feedback from colleagues, and identified action and implemented these.
- *Evaluation Workshop*: it was an exercise to reflect on the project about what went well/ not well, why yes, and why not. During this activity a dialogue among the all project participants took place in order to know the opinion, impressions, feedback, and recommendation from participants.

Lessons Learned

We are using action research as research methodology. The process was documented by audio and video recorded and each activity had careful description. This description was done using a template which has information relate to date, purpose and description of activities, methods and tools used, actors and reflections.

We also documented the experience of each company. We are now in the data analyze phase, so we have not done a more detached analysis of the intervention processes. However as part of the action learning process the facilitator group has on a systematic basis been dealing with the learning process of the individual as well as the groups and learning environments. Based on these observations we have identified some circumstantial conclusions:

- Action research approach allowed to orchestrate the setting where came together Government sector, University sector, research sector, and Productive sector to work with students and small companies to resolve real problems, among participants who were not used to worked together. The iterations were molding the group and changing it from a traditional group (individual responsibility of the work with the aim to complete a task) to a collaborative group (take group responsibility, share leadership and with the aim to learn and solve the problems).
- After few action learning meetings the participants became more aware of their purpose as a group, developed communication, listen and reflective skills, got empowerment, and were aware of how the individual performance affects the collective performance, it did possible to see a constructive solution of conflicts, there was more motivation and it was easier to achieve the objectives.
- The main challenge for the members of facilitator group was to change their individual behavior. The participants had a lot experience doing projects in their own way, they came to the project with their own organizational cultural, customs and assumptions, so was hard for them to learn to listen, reflect, ask, and learn together, from our point of view it could be homologated with the first scope of triple helix model, which is the transformation of each sphere. The experience gained in this project could provide a small scale vision about elements that could facilitate or difficult implementation of the triple helix model in a national context.
- This project has not used ICT as a mean to foster collaborative learning in the participants, however the implementation of the ICT for management and the training in collaborative learning have developed collaborative skills which will allow them to participate in learning process using technology, as e-learning and CSCL. The companies also are better prepared to participate in the National Network to Support SME.
- Related with the process of implementation of ICT the project confirms that the most important element was to identify the roots of the problems and to develop a detailed project plan. The link with the University provided the companies with new knowledge about ICT management. On the other hand the students (with the help of the supervisors) worked on real life ICT problems, and they learned to apply the theories and methods to the needs of the companies.

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eJournalPlus: Development of a Collaborative Learning System for Constructive and Critical Reading Skills

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Abstract: The authors developed reading support software "eJournalPlus" designed to assist learners in not only reading texts but also constructing their own opinions from it. Since it is difficult for learners to reach a sufficient level of critical reading skills through reading only by themselves, a collaborative learning function was added to allow learners to share their ideas and facilitate discussion in order to assist learners in considering their own opinion more critically and promoting their critical thinking.

Introduction

Reading literacy in a knowledge society is considered to be the "understanding, using and reflecting on written texts in order to achieve one's goals, to develop one's knowledge and potential, and participate in society" (OECD-PISA, 2003). Elder & Paul (2004) suggested essential points for "close reading." Those are: 1) grasping one's own purpose in reading a text, together with understanding the author's purpose in writing the text; 2) detecting the interconnectedness of the various ideas and parts of a text and understanding objectively the text's meaning system; and 3) formulating questions and offering one's own opinions about the text interactively by engaging one's existing knowledge with the text.

Developing in this way the ability to engage in a constructive interaction with the author and the contents of the text, and not only an understanding of the text, is important for the learner. Particularly for Japan's reading education, which focuses on the accuracy of textual understanding, designing learning environments that encourage this wider engagement is a pressing need.

Based on this conceptual foundation, the purpose of the present study is the development of software that assists the learner in developing critical reading skills that not only improve the learner's ability to understand texts accurately and assess their logical consistency, but also help the learner to express his or her own opinions about the text in an interactive way.

Basic Functions of eJournalPlus

The eJournalPlus application has the following functions as a support system for learning critical reading skills Oura et al., 2008).

Document underlining and comment functions

Underlining is a common reading strategy that is effective for supporting the understanding of a text (Kobayashi, 007). To make the most of this strategy, the eJournalPlus system allows the learner to underline or draw a marker line under any passages in a text.

Knowledge map function for organizing elements of the text in idea nodes containing the underlined passages

Underlining has been demonstrated to be effective for a general understanding of a text, but electronic texts sometimes suffer from readability issues (Mills & Weldon, 1987). Related to this, it has been pointed out that the visualization of text contents is very important for deepening understanding of the text (Duke & Pearson, 002; Spears, 2006). The eJournalPlus software allows the learner to make "knowledge map," that is similar to argument or conceptual map, based on the passages the learner has underlined or marked. As will be described in more detail below, with the eJournalPlus software, the learner can juxtapose the target text with his or her knowledge map and, by dragging underlined passages, intuitively create idea nodes that can be dropped into the adjacent area to make the knowledge map. The learner creates his/her own idea nodes and relates them to the elements on the knowledge map. The map is composed of the extracted passages from the text, so the learner can express his or her own opinions about, or interpretations, of the target text in detail. The aim of this particular function is to encourage the learner to express opinions that are based directly on the facts and essential points included in the target text.

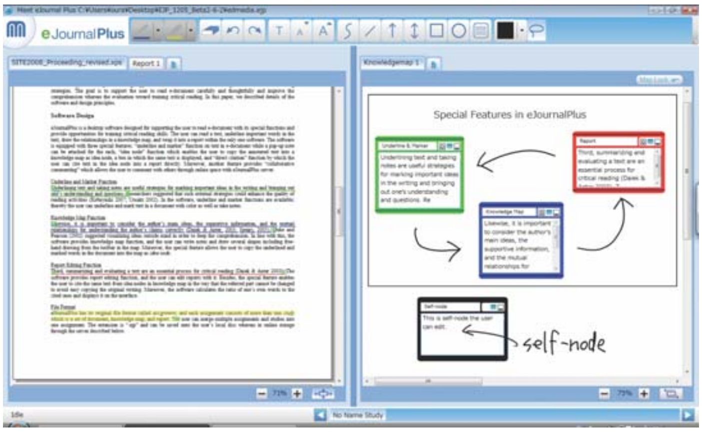

Figure 1. eJournalPlus Basic Interface (the target text (left) and its knowledge map (right))

Editor function for writing summaries and reports based on the knowledge map

Summarizing, posing questions, and expressing opinions are core activities for critical reading strategies (Daiek & Anter, 2003). Moreover, writing out or restating the main points or opinions organized in the knowledge map should promote further reflection on the part of the learner and, through that reflection, a deeper understanding of the target text.

eJournalPlus Collaborative Learning Function

Rather than a singular interpretation, the understanding of textual content is comprised of various interpretations socially arrived at through dialogue (Cambrourne, 2002). It is suggested that a more constructive and critical reading of a text is promoted through a reading process and dialogue of opinions undertaken by multiple readers. Okibayashi (2004) has also shown that, assuming appropriate instructions have been given to the learners, learners can more easily apply critical thinking to a text through interactive discussion.

Thus the authors developed a function that allows communities of learners to make mutual comments during the reading and reviewing process on the knowledge maps, and final reports, which are the results of the reading process. The aim of this collaborative process is not only to promote an individual dialogue between the learner and the author of the text but also to enhance the learner's critical reading skills through dialogue with other learners.

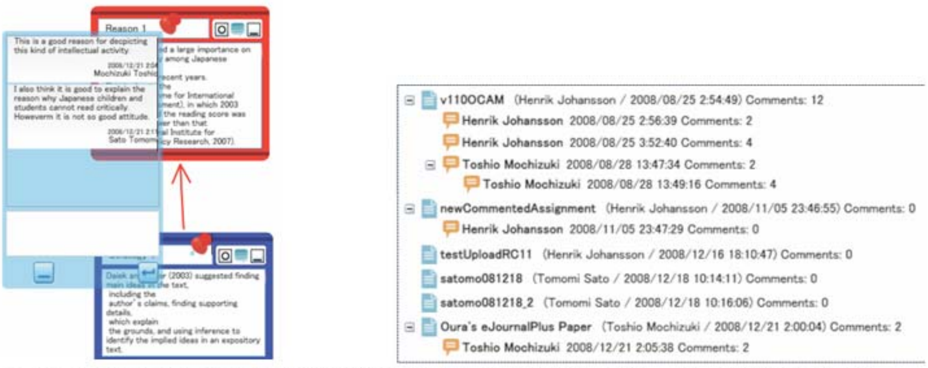

Figure 2. Push-Pin Comment Inputting (Left) and Comments on Tree Bulletin Board

It has been found that for online discussions using representation maps like the eJournalPlus knowledge maps, adequate discussion is difficult to achieve if the displays are different, representations cannot be directly displayed, and gestural deixis is inhibited (Suthers et al., 2003). Thus in order to allow comments to be directly displayed, the eJournalPlus system permits users to display their comments in precise locations with the system's "push-pin" interface (Figure 2, Left).

A user adds comments by the following procedure. At first the user uploads the target electronic text and his or her own knowledge map and report to the eJournalPlus server. Another learner can then open the published file in the comment mode and add comments by the push-pin interface, as shown in Figure 2. The file with the added comments is then uploaded again to the server. When that is done, the file is stored with the original comments and the responses to them on the tree bulletin board, an example of which is shown in Figure 2. The learner can then download the file merged with comments from other learners. Using this collaborative file, the learner can reconsider the process and results of his or her own reading, as well as the ideas and opinions the learner developed regarding the text. Since this activity is carried out collaboratively with one target text, learners should be able to enhance their constructive reading of the text contents.

Developed based on .NET Framework 3.5, the eJournalPlus Server uses Windows Server 2003, and the database is managed by Microsoft SQL Server 2008. Server clients communicate by HTTP. Electronic texts are formatted in the XPS (XML Paper Specification) format, a subset of Windows Presentation Foundation's XAML (Extensible Application Markup Language).

Summary and Future Issue

The present study explained the original design of reading support software and new functions aimed at helping learners exchange of their ideas and discussion in order to promote their critical thinking and help acquire critical reading skills. The results of evaluative testing of the basic functions of eJournalPlus show that, even when the learner is working individually, the program can assist the learner in constructive critical reading to a significant extent (Tsubakimoto et al., 2008). Through testing that also utilizes the collaborative learning function and observation of actual classroom usage of the program, the authors intend to analyze whether the eJournalPlus can enhance learners' critical reading skills.

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Using Speech Recognition Technology in the Classroom: An Experiment in Computer-Supported Collaborative Learning

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Abstract: This paper will report on a design and development project that aims to enrich face-to-face classroom contexts using the latest developments in information and communications technology. The Meety project, when used by students in a classroom with laptop computers, captures the verbal utterances of the classroom context and uses it to supply real-time information resources to the students in the classroom. Students have the option of contributing to the information resources and rating the utility of the resources supplied. This project discusses the design and development of the project as well as a simulated trial to test its efficacy.

Introduction and Purpose

The sociotechical arrangement of university classrooms has changed little over the last several decades, despite widespread changes in the emerging and evolving environment available to students and instructors outside of the classroom. For example, technologies such as blogs and wikis, and services such as YouTube, Wikipedia and Facebook, have awakened the public to new ways of interacting with media that radically diverge from the transmission model that has characterized the so-called 'consumer culture'. Changes in the culture outside of the classroom, which has been characterized as taking on more participatory tendencies (Jenkins, 2006), is leading researchers and developers to think of new ways in which classroom contexts can be augmented and enriched using new pervasive communications and computing technologies. This is one such project, which is an experiment in enriching face-to-face classroom contexts using a tool that takes advantage of some of the latest developments in computing and communication technologies. In particular, this project will describe and test the efficacy of Meety, a project developed at EdLab, Teachers College, Columbia University, which is designed to augment student and instructor interactions in classroom-based contexts. Meety is a sophisticated web-based application that combines video, sound, collaboration features, and speech recognition into a single package. The Meety project, when used by students in a classroom with laptop computers, captures the verbal utterances of the classroom context and uses it to supply information resources to the students in the classroom. Students have the option of contributing to the information resources, and rating the utility of the resources supplied. A typical use of Meety in a classroom-based context includes the following:

- One or more students in a course, using their laptop computer and webcam, record the proceedings of the class. Using an Internet connection available in a wireless classroom, the real-time, live recording is available for viewing by other students and the teacher within the course using a laptop computer.
- While the recording is in-progress, Meety is listening to the classroom-based interaction and providing real-time knowledge resources it thinks will be useful to the students and teacher. Students and the teacher can rate the resources. Meety will then alter the resources it provides based on these ratings. This set of resources are called "Meety-made" notes.
- In addition to "Meety-made" notes, users can create their own notes which get shared with the class. These notes act as a "back-chat" for further discussing the classroom-based content, the knowledge resources Meety provides, and other related issues.
- After the class ends, Meety can be used as an archive of the classroom-based interaction, with the full audio and video of the course available for playback. Additionally, all the notes generated by students, the instructor and Meety are made available.

In sum, Meety provides a venue for enhanced student participation in the knowledge sharing and creation process. This can be accomplished through the following activities:

- The activity of collaboratively-filtering the knowledge resources Meety produces requires students to be critical of the knowledge presented to them. For example, the presentation of knowledge resources should cause the student to ask, is this piece of content relevant to the discussion at-hand? Is this a worthwhile resource for my peers and myself to view?
- In addition to providing an opportunity for being critical, the knowledge resources provided can be used to augment the student's knowledge on the topic being discussed. For example, Meety may bring

up an article that provides an opposing viewpoint to the one being discussed in the physical classroom context. This should cause the student to think: does this discussion cover all the possible perspectives on the issue?

- The back-chat allows students to collectively discuss some topic outside the verbal discussion taking place in the physical classroom. The backchat allows students to clarify different points, augment positions with evidence from the web, ask questions for the teacher, or question the resources Meety provides.

A beta version of Meety is currently available on the Internet for use in classrooms (http://meety.tc-library.org). The purpose of this paper and presentation is to report on the design and development of Meety as well as report on a simulated trial of a classroom context. The hope of this project is to further experiment with the model of information delivery within a classroom context: how do embedding knowledge resources within real-time classroom-context impact the traditional face-to-face context? Further, is the model of providing information resources that can be interacted with in a classroom a model worthy of greater consideration?

Literature Review

There are many projects being produced and that have been produced that look to augment classroom contexts using pervasive computing technologies, in particular technologies that employ speech recognition technology to adapt to the situated context. For example, the Liberated Learning Project aims to use speech recognition technology to create class notes for those students who have disability issues (Bain, Basson & Wald, 2002). Other projects have used speech recognition with secondary school students, such as a project by O'Hare and McTear (1999) who used it as a way for transcribing the stories of children. And further projects have augmented speech recognition with other technologies, such as computer-vision and agents, to create a richer tele-education system for distance learning contexts. For example, a project based at Tsinghua University in China uses all the aforementioned technologies to create a Smart Classroom that "bridges the gap between tele-education and traditional classroom activities in terms of teacher's experience and seamlessly integrates these two currently separate educational practices" (Shi et al., 2003). Like the smart classroom project, others look to use speech recognition in ways that break-free of the desktop computing model. For example, Furui (2000) proposes a system that creates a wearable device for creating meeting minutes that can then be transmitted to a central repository. Each of these projects are very interesting but face a similar set of challenges, such as the accuracy and speed of the speech recognition engine as well as the usability and utility of the dictation. As speech recognition technology advances and these issues slowly resolve themselves, the applications for education and learning will continue to grow.

Designing the Tool

The Meety user interface includes two sides, a left and a right. To view the interface, visit http://meety.tc-library.org. On the left of the screen, the system captures the audio and video of the face-to-face meeting. On the right side of the screen, the system display the notes it has created based-off of the verbal utterances it has recorded and transcribed. The user has the option of viewing "Meety-made" notes, which are generated by the system speech-recognition system, "Meeters-made" notes, which are the notes created by people in the class, or "All notes" together in a single view. The students and instructors also have the option of rating up or down information resources that are supplied by Meety or by fellow Meeters. This type of system, often called collaborative filtering, allows those notes that are most useful to be more visibly present, while those least useful are buried to the bottom (Resnick & Varian, 1997).

Meety uses the newest developments in speech recognition technology, notably Microsoft's Speech API that is included with the release of Microsoft Windows Vista. Microsoft has used this same engine to provide speech recognition capabilities for navigating the GUI of the Vista operating system (Odell & Mukerjee, 2007). For this particular investigation, Meety's analysis engine that extracts keywords from the dictation uses the Google search engine to search the Internet for relevant resources (rather than other possible search engines, such as Google Scholar or a library federated search engine).

Research Methods

A simulated user trial was conducted to test the efficacy of Meety. The trial was designed in the following way: a podcast was played to Meety as if Meety was present in the lecture hall (e.g., as if a student was recording the proceedings). The knowledge resources that Meety provides was collected and coded by the researcher on a 5-point Likert scale from one-to-five which measured the extent to which the resource was relevant to understanding the content of the lecture. Since this project is only a pilot for testing the efficacy of Meety, only a single coder was employed; however, in a more extensive project independent coders would be employed and inter-rater reliability be sought. The lecture used was a 50 minute lecture by Steven Stiglitz of Columbia

University on the "Credit Crunch" of 2008, available from iTunes University (Stiglitz, 2008). The coding of the resources aimed to measure the extent to which the resources Meety provided were relevant to understanding the complex economic issues that Stiglitz discusses or to provide additional resources for learning more about the economic issues. Items rated low are completely unrelated or useless, where items rated high are very useful resources for understanding the issues Stiglitz discusses.

Results and Conclusion

During the 50-minute lecture, 90 web resources were collected by Meety. The mean score of the resources was 2.46 (1 = low relevance, 5 = high relevance) with a standard deviation of 1.87. From this, we can conclude that the average resource that Meety provided was of medium utility to the discussion at-hand. Despite this medial score, there were many high-quality resources (18 with a score of 5 and 12 with a score of 4). These resources included such things as news articles related to the economic crisis and Wikipedia entries on such things as "Market Failure," "Great Depression," "Credit rating agency," "Government bond," and "Emergency Economic Stabilization Act of 2008," all of which would have been very useful for someone unfamiliar with such economic concepts and events. Results indicate that the algorithm for choosing resources should be refined to eliminate resources that are tangential to the discussion at hand. Further, the results indicate that the social component of collaborative filtering (although not specifically studied here) would add a layer of utility and refinement to the results. Additional research is needed to explore Meety's utility in a real classroom context with student attending a lecture, creating their own notes, and collaboratively filtering Meety-made notes as well as the notes from their peers.

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Mobltz: A mobile multimedia tool for informal learning

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Abstract: We describe the design of a mobile media application for informal learning. Mobltz supports multimedia conversations and digital storytelling using mobile phones. Designed to be accessible in places in which a mobile phone may be the only Internet access, it facilitates shared understanding by privileging the "telling" of the story over the final story itself. Stories can be remixed and retold. The application is a work in progress; in the poster session at CSCL we will report on patterns of use from three informal learning situations.

Theoretical approach

Early work on mobile computing investigated the potential for mobile devices to create persistent learning opportunities "anytime" and "anywhere" as people "cross" the various contexts of their lives – institutions and settings such as schools, after-school programs, and home. However, with the dramatic expansion of mobile networks and applications, thinking about learning contexts has become more complicated. Whether on the move or sitting still, people generate and maintain social contexts via frequent, brief, routine and intimate interactions such as micro-blogging, SMS, MMS and in various online social networks. In this sense, mobile, networked devices have become portals to "attentional worlds" (Lemke, 2007) that learners build within their social networks and that continually cross into their everyday placed experiences. Today's textual and media-based micro social interactions shift one's contextual focus as network nodes link up and disassociate with one another. These interactions offer fleeting but potentially powerful new spaces in which people build understanding of each other's lives.

These patterns of interaction raise questions for research. Social theories of learning, which have played a key role in CSCL inquiry, emphasize the contextual nature of learning; however, for mobile CSCL the term 'context' is perhaps under-theorized. How do we think about emerging mobile learning contexts that are not situated in a given place at a given time as much as achieved within an ever-expanding virtual network? How do we think about building shared context in virtual worlds that are both global in scope and individual and atomized in models of participation? Finally, how do we harness emerging mobile social network dynamics for collaborative learning? With these questions in mind we have developed a social mobile media environment to support informal learning. It is called Mobltz.

Mobltz – a social mobile media environment

Mobltz is a social mobile media environment designed to support learning by enabling users to build and maintain shared context. Designed as both a media-based conversation tool and a mobile digital story telling environment, Mobltz facilitates the collaborative stitching together of images, audio, video and text to form a narrative. The core environment has four major features that differentiate it. Firstly, it is lean and simple, so that all interactions can take place from a mobile device. Secondly, it supports referential interaction in sharing of images, video and sound in the context of multimedia conversations. Thirdly, it does not privilege narrative "stories" over more casual, fractured or emergent interactions; shreds of stories and ideas live alongside long narratives, and anyone can remix and retell any story. Finally, it supports publication and broadcast of these conversations in an ongoing, media "snowball" that grows online over time in any web-based environment. The Mobltz environment consists of the following core features:

- **Signup**: Users join mobltz by sending an MMS or email containing an image, video or audio file to the mobltz email address. They system sends an SMS or email inviting them to set up an account.
- **Login**: A portal login screen offers users quick access to "featured" mobltz and other content.
- **Viewing, making and sharing**: Users can quickly see their own and friends' submissions on a "lister" screen that is divided into three tabbed sections: my stuff, my community, and everyone. Users can search for media on specific topics or sent by specific users, and can make a new moblt by selecting media items and checking "make moblt." A new compilation comprising all selected media and associated text appears in the lister. Clicking on a moblt opens it for viewing within a player. Users can share their media via a link that sends a message to a phone or email address.
- **Owning and Editing**: The creator of a moblt retains ownership rights and within the player is able to directly edit the text, order, and duration of each media element. Owners can invite others to contribute to the moblt by assigning and publicizing a unique keyword. Any media marked with that keyword will be appended to the moblt. Moblts can be made from other mobltz, so that multiple interpretations of the same stories can live side by side, authored by different 'owners.'

Why multimedia Conversations?

While mobile blogs have been a great way for individuals to tell a narrative over time, they are difficult places to have conversations, and therefore are difficult for building shared context. Collaborative blogs facilitate group submission of media, yet due to their linear format do not support in-depth conversations about media submitted. Older media are pushed to the bottom over time, frequently never to be seen or referenced again. Prior submissions are difficult to bring back to conversational life. Communication is atomized and linear, privileging a present over the past, sacrificing the common reference points that serve to reactivate collective memory and enduring community experience.

Mobltz was developed so that any media item can be visually referenced from the archive and brought back into conversational life at any time. Through search of keywords, users find media submitted from members of their learning community, from themselves, or from everyone who is connected via the Mobltz social network. Users can select any media item to stitch together (making a moblt), and can edit the order and text of that media item. Text is displayed beneath the visual media component, whether video or still imagery. The result is a multimedia piece made from collective media submissions, the URL for which can be "flicked" to any user or new contact via SMS or email.

These features combine to allow users to convey context, opinion, point of view, or a sense of place or situation in a given discussion. In pilot use cases, users harvested media elements to reference ideas, to ask questions, make further points, or draw comparisons. When compared to the content of conversations over a mobile blog, the multimedia Mobltz platform facilitated turn-taking interaction, with users frequently referencing media from prior compilations. The effect was that of *pointing*, with words like "this" appearing under recycled images and video, orienting the viewer to the visual referent as it appears. Prior work has shown that visual pointing assists in recruiting resources to enable people to work and learn together in disparate settings (e.g., Goodwin, 1994, 1996, 2003; Koschmann, 1999; Pea, 2006). Being able to point helps people achieve a shared context that facilitates understanding.

The effect in the Mobltz environment over time is analogous to gifts and photo albums that people maintain on display in homes and other built environments. The artifacts we surround ourselves with maintain a sense of past and connection to each other, serving as focal objects for eliciting joint experience. In this sense they're a part of the context that "weaves us together" (Cole, 1996) rather than a context that merely "surrounds" us. Media artifacts in Mobltz get recycled as ongoing jokes referencing past experiences, as references to topics of shared interest, as clarifications, redefinitions, and lenses for refocusing. Shared images become referential tools for achieving "common ground," a shared perspective that helps us make sense of novel experiences and cultural categories (e.g., Clark, 1996; Pea, 2006). It's our hope that through shared referencing, users from disparate cultures and settings will not only be able to communicate to solve clearly defined problems together, but will also be able to elicit shared frameworks that can help them uncover joint problems and collective solutions that have yet to be revealed.

Ownership, collaboration, and remix

While Mobltz supports the development of stories as coherent collaborative narratives, it also supports the continual negotiation of meaning as such stories evolve. When participants upload media, that media is associated with their user name, in effect providing them limited "ownership" rights. Only the person who uploaded can delete or edit original text for a media element. However, when participants stitch together media elements (forming narratives—or moblts) to make a story, they become owners of that story, and can delete or add elements, and edit all associated text. Participants during ongoing media-enabled conversations can thus remix, mashup and add to one another's works. If the originator of a media element decides to delete an element from Mobltz, every instance of that element disappears from any moblt containing that element. Mobltz thus change and evolve over time; they are participatory, but anyone has the right to withdraw participation at any time. Mobltz are representations of community conversation and interaction. Like artifacts emerging from co-located interaction, the elements and meanings of these artifacts are continually brokered and re-negotiated.

Mobltz can be recombined with other moblts or media elements to tell a new story or make a new point or elicit a new experience for the collaborator. The fragmented, emergent nature of the Mobltz experience contrasts with the stable media production environments of most multimedia tools. This may seem to challenge prior recommendations that multimedia learning environment support goal driven collaboration, media sharing, and meaning negotiation (Polman & Pea, 2001). As a distributed environment, Mobltz is designed to facilitate meaning-making across and within shifting cultures and contexts. This meaning making is an achievement that can be represented by the accumulation of evolving media artifacts constructed in interaction. While goal oriented interaction certainly offers fuel for participation, sometimes fluid, loose interaction can help participants find the commonalities that underlie the establishment of a goal.

Global media snowball

Finally, Mobltz provides functionalities to broadcast conversations or ideas globally, calling on anyone anywhere to contribute and participate via media submissions. While any moblt can be embedded in any web site (see Figure 1), when a user "opens" a moblt to public participation, that moblt will continue to accept submissions and grow over time. This launches a massive media snowball—a set of media relationships to grow via social networks (see Figure 2). Media sent via MMS or email appears automatically in the embedded moblt. For example, environmental studies students published a "soil erosion" moblt to which anyone can submit images, video or audio related to soil erosion. The result is an evolving multimedia collection that endures and grows, fueling a rich online conversation on erosion.

Figure 1. Mobltz player – can be embedded in any web site. The player cycles through an unlimited number of media contributions. People contribute by sending an MMS with the keyword [e.g., coffee].

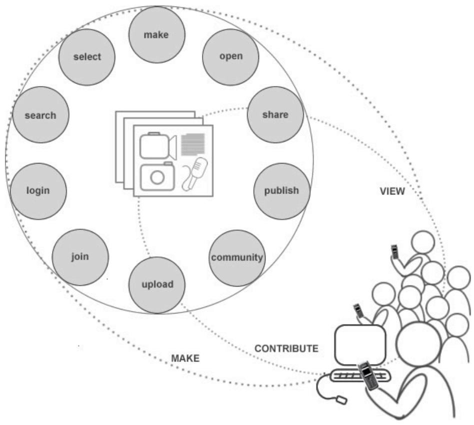

Figure 2. Community participation model. People can build and start moblts, sharing media with other members of their Mobltz community. People can also contribute to each others' moblts directly.

Ongoing research

This is a work in progress. This poster will report on the results of three pilot studies of informal learning using Mobltz. The first is an ongoing collaboration among environmental studies students and researchers at three different universities, one in the US and two in East Africa. The second is small-scale informal collaboration among friendship sets of youth in the US. The third is a case study of an ongoing mobile digital storytelling project in South Africa. Social network data will be presented, as well as an analysis of communication patterns developed with ongoing media exchange. The poster will support an interactive demonstration of the Mobltz application. We hope the mobltz site and embeddable player will be a useful tool to support collaborative learning in situations in which the achievement of shared context assists in the development of understanding.

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Collaborative Augmented Reality in Schools

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Abstract: Augmented Reality as an interactive real-time technology combining real and virtual objects in a real 3D space carries enormous educational potential. We describe a project (ARISE: Augmented Reality in School Environments) that aims to realise this potential by developing a collaborative, robust and affordable Augmented Reality learning platform for schools. The learning affordances of Augmented Reality are discussed, and an educational application is described that supports remote collaboration between students in a shared 3D workspace, where students from different countries present, discuss and manipulate virtual objects relating to their local culture. The evaluation of the application is based on a distributed summer school project involving students from two European countries. In addition to more conventional evaluation approaches, special requirements for evaluating remote collaboration in a shared Augmented Reality workspace have been met with a customised approach involving synchronised video observations in both locations with subsequent editing of the material into and a single screen giving a comprehensive overview of the collaboration from both ends. The results of the evaluation study are currently being analysed, but preliminary findings suggest that the Augmented Reality learning platform has been well received by students and teachers, and is well suited for remote collaborative learning.

Overview

Augmented Reality (AR) has a range of affordances that resonate with learning theory. Reflecting the early stage of the technology however, much of the research into AR focuses on technical issues while only little research has been carried out to explore its educational potential. One reason for this has been the lack of robust, reliable and affordable AR displays and applications that allow the technology to be evaluated in an authentic educational context. The ARISE (Augmented Reality in School Environments) project tries to fill this gap by developing an affordable AR learning platform suitable for deployment in schools, and creating educational applications that leverage the specific learning affordances of the technology. The main objective of the project is to test the pedagogical effectiveness of AR in the classroom and to facilitate remote collaboration between school students. The resulting AR display Spinnstube is based on off-the-shelf hardware components and open source software, thus keeping costs to a minimum while offering a reliable and high quality AR experience. Up to four Spinnstube devices can be arranged around a table for co-located collaboration, as the system keeps the desktop free from construction parts that might impede natural communication or restrict the movement of hands when sharing real or virtual objects. In a remote collaboration scenario, Spinnstube devices are networked to provide a shared workspace where collaborating students can view and manipulate virtual objects and communicate over an additional audio channel. In order to evaluate the learning platform, from both usability and pedagogical perspectives, three successive educational applications were developed between 2006 and 2008 and evaluated in summer school projects with students from Malta, Romania, Lithuania and Germany.

Learning Affordances

As an interactive real-time display technology that combines and registers real and virtual objects in a real 3D space (Azuma, 1997), AR has enormous educational potential. The presentation of objects in 3D lends itself to the exploration of spatial problems that are difficult to grasp in 2D media (Woods et al., 2004) and supports the development of spatial abilities (Seichter, 2007) as an important component of human intelligence (Gardner, 1983). The combination of real and virtual objects in a real 3D space gives rise to new kinds of tangible user interfaces that eliminate the artificial seam between the real world and the shared digital task space (Ishii et al., 1994) and may be more suitable for younger children (Billinghurst, 2002), a quality that resonates with Piaget's (1970) view that learning materials and activities should involve the appropriate level of motor and mental operations for a child of given age. The ability of AR to offer different views on the same object or situation can be used to facilitate extrapolation by helping learners to go beyond the information given (Bruner, 1973) and to aid cognitive development through adaptation by giving alternative views on already familiar objects or situations (Piaget, 1970). Collaborative AR systems support learning through communication and social interaction (Bandura, 1977; Vygotsky, 1978) where learners develop a deeper understanding of concepts by exchanging ideas with peers engaged in the same activity (Salomon 1993) and reflecting on their experiences (Kolb, 1984). Finally, AR engages and motivates learners (e.g., Hornecker and Dunser, 2007; Lamanauskas et al., 2006, 2008) and can provide a bridge from instruction to construction: the dynamic control of augmentation levels enables a smooth transitions from the presentation of information to active exploration and experimentation.

Remote Collaboration around Virtual Objects

With the aim of leveraging these affordances in educational applications, the project consortium has developed three successive prototypes, each reflecting the evolving technological capabilities of the AR learning platform and addressing different pedagogical approaches. The first two applications, process visualisation in human biology based on behaviourist and cognitive learning theories, and guided construction of chemical elements based on constructivist learning theories, were originally planned to include local collaboration implemented as individual activities due to practical issues. These applications are described elsewhere (e.g. Balog et al. 2007; Lamanauskas et al., 2006, 2008; Pribeanu et al., 2008). The third application, focusing on cultural exchange, involves both local and remote collaboration around cultural heritage objects and is based on social learning theories. The application was evaluated in a summer school project held over two days in Lithuania and Germany, involving twelve pairs of 13 to 14 year old students.

Preparation of Artefacts

Students prepared for the summer school by discussing suitable topics of interest, making local excursions, and creating meaningful 3D objects relating to their local history and culture. The process was supported by a novel 3D sculpting tool for the Spinnstube, and a desktop-based tool to create 3D box objects from photographs. Thus, the preparation involved local collaboration between students preparing and discussing the artefacts used to anchor remote discussions in the summer school, and in addition students had an opportunity to familiarize themselves with the Spinnstube AR display.

Introduction by Video Link

Before starting their Spinnstube session, students had the opportunity to get to know each other and discuss organisational issues relating to their collaborative Spinnstube session through a live video link using the VoIP software *Skype*. Students took up the opportunity enthusiastically and despite some language problems (the project language was English) most students used up all their allocated time to talk to their counterparts, exchange contact details, and in some cases even arrange further Skype meetings outside summer school.

Spinnstube Remote Collaboration

Following the Skype session, students moved on to their Spinnstube collaborative session with the same partner. Two Spinnstube AR displays were in operation at each location, making it possible for two pairs of students to take part at a time. Due to the specific requirements of the visualisation software, the room was semi-dark. One technician was present in the room on stand-by for technical problems, and the students' teacher was available for operational and organisational questions. No language support was given.

After taking their seat in the Spinnstube, students put on a pair of shutter glasses to gain stereoscopic 3D vision, and a headset for communication via the audio link. Once the partner's presence was confirmed via the audio link, each student could either start their own presentation by loading artefacts into the AR display and talking about them, or follow their remote partner's presentation, inspecting the displayed artefacts and listening to their counterpart, occasionally asking questions.

The presenting student then continued by asking their counterpart questions about the presented content, both to test the partner's understanding and to discuss similarities or equivalents in their own local culture. This part also included the presenting student erasing part of the artefact on display in the shared workspace and asking their counterpart to reconstruct it. As both students were able to observe the reconstruction process, they could discuss the progress and result. The Spinnstube sessions took approximately one hour each with students switching roles at half time so that each side had a chance to present their content.

Evaluation

The evaluation of the application takes into account pedagogical, usability and social interaction aspects, and involves different researcher teams using both quantitative and qualitative approaches to increase validity and reliability. Of special interest in the context of evaluating remote collaboration in a shared AR workspace is the synchronised video observation of summer school sessions involving two high-quality video cameras in each location audio-recording the spoken communication and video-recording participants' gestures and facial expressions (front-view) as well as the 2D double image from the projection surface (rear-view). The resulting material can be edited into a 4-in-1 overview that comprehensively documents the remote collaboration from both ends and thereby gives a more detailed picture of the remote collaboration than possible with traditional techniques. A thorough analysis of the material is currently under way.

Conclusions

Evaluation results for the first and second applications have confirmed that many of the specific learning affordances of AR can be leveraged in a school context to create effective and enjoyable learning activities. Diverse representations of related issues offered in the human biology application proved effective in conveying complex content. Spatial 3D representations of atoms and molecules, together with a haptic user interface in the chemistry application, were well received and led to a deeper understanding of the matter among students. Finally, the AR display dramatically improved students' motivation and engagement, confirming similar reports in the literature (e.g., Hornecker and Dunser, 2007). Regarding the suitability of the Spinnstube AR display as a collaborative learning platform, the picture is less clear. Due to fundamental design issues, co-located collaboration is only possible when each participant uses their own AR display, which proved impractical in the first two summer schools. As for remote collaboration, the evaluation results from the last summer school are still pending. Anecdotal evidence however suggest that the system is very well suited for remote collaboration as it enables students to view and manipulate virtual objects in a shared 3D workspace in real-time and simultaneously communicate over an audio link.

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iSocial: A 3D VLE for Youth with Autism

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Abstract: This poster provides an introduction and brief illustration of iSocial, a 3D-Virtual Learning Environment to support social competence development for youth with Autism Spectrum Disorders. We report the results of a field test of a partial implementation of iSocial in the Fall of 2008. Of note are some key lessons learned in how to adapt a successful clinic-based approach to the new medium, as well as lessons in the identification of needed social orthotics and identity representation for supporting social interaction for this special population. Despite numerous challenges in the implementation, the learners and guides were highly engaged in their virtual learning and responded positively to the experience.

Introduction

According to the Center for Disease Control (2007), from 1994 to 2005 the number of children and youth ages 6–21 years receiving services for Autism Spectrum Disorders (ASD) increased from approximately 20,000 to 200,000. Children identified with ASD have deficits in social competence that can lead to problematic social behavior and social isolation (Stichter et al., 2007). Specifically, children identified with high functioning autism (HFA) or Asperger's Syndrome (AS) are typically characterized as having a desire to be social (Myles & Simpson, 2002), but lacking the social skills to do so. The outcomes of these deficits, if untreated, can lead to a lower quality of life as well as deficits in other developmental areas such as language and cognition. Identification of, and intervention for, these social skill deficits must be a focus of instruction if students are expected to achieve increased success and independence (Office of Special Education Programs, 2003; Rogers, 2000). To date there is an extensive body of research that supports cognitive behavioral strategies for social skills training that are typically implemented in structured face-to-face instruction for individuals with ASD (Rogers, 2000). However, access to evidence-based interventions for social skill instruction is limited. New technologies, such as internet-based 3D-Virtual Learning Environments (3D-VLEs) have potential to provide access to intervention, qualified guides and social cohorts while maintaining fidelity to core features of the programs.

Virtual Learning Environments for Social Skills Training

Virtual environments offer many advantages for individuals with ASD in that learners can proceed at an appropriate pace, can have repetition of training, be given gradual increases in challenge levels, learn about constructs via multi-media rather than simply text and be engaged interactively in tasks. Standen & Brown (2006) note three key areas in which VLEs are well suited to youth with ASD. First, VLEs allow users to learn by making mistakes but without suffering real consequences and without trying the patience of their peers or teachers. Youth with ASD are often denied real world experiences because their caregivers are afraid of the consequences of allowing them to do things on their own. Secondly, VLEs are endlessly plastic in that they can be manipulated in ways the real world cannot. For example, scaffolding in the form of suggestions that may appear in the interface or highlighting of certain features in the scene can be provided at the beginning of a task and then withdrawn as the user proceeds. Thus, VLEs can be customized to each user and their needs. Thirdly, rules and constructs can be conveyed through experience, not simply words or models of what others can do. For example, rules for how to greet a person or interpret facial expressions can be experienced and practiced in contexts that offer high fidelity to natural settings.

iSocial: a 3D-VLE for curriculum activity

iSocial is a 3D-VLE-based intervention for social and behavioral outcomes for youth with Autism Spectrum Disorders. iSocial seeks to adapt and implement in a 3D-VLE a clinic-based curriculum with demonstrated impact for improving social competence. The 10-week curriculum, Social Competence Intervention based on a framework of Cognitive Behavioral Intervention (SCI-CBI), challenges thinking patterns and includes the following key components: use of meta-cognitive strategies, self-monitoring and self-regulation and exposure and response situations. In each unit, the lesson plan follows a consistent structure of learning and rehearsing skills. Initial results from work to develop SCI-CBI indicate promising trends for growth (across pre- and post-intervention assessments) among youth with ASD.

Adapting SCI-CBI into a 3D virtual space requires that all physical aspects of the curriculum be modeled and all activity as well as how the space responds to activity be programmed. We have chosen to develop a new environment rather than working within existing VLE, such as Second Life, to ensure that we can implement the full range of features we envision, guarantee privacy and security for our participants, be responsive to potential school-based requirements and develop within an open source framework. iSocial is being developed using Sun Microsystems' Project Wonderland (https://lg3d-wonderland.dev.java.net/) as a toolkit for creating collaborative 3D virtual worlds. Project Wonderland is an open source project offering a client server architecture and set of technologies to support the development of virtual and mixed reality environments. In Fall, 2008, using a grant from the Thompson Center for Autism and Neurodevelopmental Disorders and a grant from our university research board, we developed a pilot implementation of one of the five units of the SCI-CBI curriculum and undertook a field test with four youth. An award from AutismSpeaks will enable us to extend our design and development work over the next two years.

For a brief introduction to what the iSocial experience might be like, imagine a youth, John, sitting at a computer in his school classroom or lab. A local teacher-facilitator is nearby, but she has already sat with our youth during orientation and earlier lessons and allows our youth to work with minimal supervision. Upon login our youth sees that others are already online and is greeted by the online guide (a teacher trained in the implementation of SCI-CBI online). John can go to his virtual room which holds trophies and awards for previous accomplishments in iSocial and provides reviews of what has been achieved so far. However, his online guide is calling the youth together to start the "rules of the road" activity. In this one-hour session John and his four peers receive instruction and modeling from the guide, and by watching media, can try out skills in game-like contexts, rehearse skills through interacting with teammates, and test themselves. The tryouts, rehearsals and assessments are both cognitive and behavioral, as the youth (and guide) are represented by 3D avatars (digital representations of self in the virtual world) that allow them to move around, virtually interact with objects and others, and have a sense of their presence in the environment. Figure 1 shows some sample scenes from iSocial. In one part of the lesson (left) students must take turns to try to match faces. Turns are managed by students telling each other that they have finished their turn and that it is the other person's turn. Students offer each other encouragement and hints in order to beat the game. In another part of the lesson (right) students review appropriate and inappropriate conversational manners, and are required to produce examples of each. In one lesson students plan a trip to Los Angeles together, and in another students play a role-playing game where they are lost at sea.

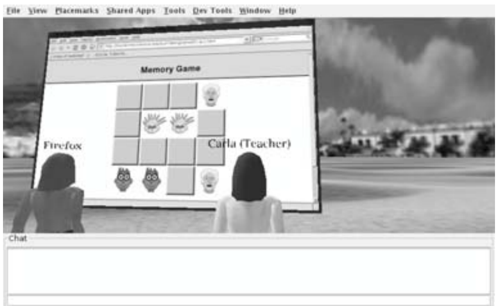

Figure1. Sample screen shots of youth and guide interaction in iSocial.

Lessons learned from early results of the field test

The unit on "conversational turn taking" from the five-unit SCI-CBI curriculum was developed for delivery in the iSocial VLE. Two separate virtual groups undertook the unit and consisted of two youths (boys on the autism spectrum, ages 11-14), an online guide, as well as a technical "helper" in the VLE, and a facilitator for each youth who sat physically at the youth's computers as the lesson was carried out. For each group, the unit consisted of two training sessions of one hour and then four one-hour lessons delivered bi-weekly. The key purposes of the field test were to (1) assess the efficacy of design decisions for adapting the clinic-based curriculum into the new medium, (2) identify issues with system usage and (3) generate ideas for needed social orthotics. Data collected during the field test consisted of a technology competency survey administered at the beginning of the study, social presence surveys, adapted from Bailenson, Beal et al (2001), administered at the end of each session, screen and audio recordings of all participants' sessions within the VLE and videotaped recordings of participants with their facilitators physically using computers for each session.

The prototype iSocial turn-taking unit used in the field test was adapted from the face-to-face SCI-CBI curriculum delivery. The benefits of using a curriculum with empirically demonstrated improvements in social competency are obvious, but lead to challenges for how to adapt to a virtual environment. An identical implementation of the face-to-face curriculum in the VLE was not feasible. For example, having learners use worksheets face-to-face is a task with low complexity and provides for relatively simple classroom management; however, in iSocial, distributing a dynamic turn-taking worksheet and using it effectively is highly complex. Many face-to-face activities relying on paralinguistic cues such as eye contact cannot be supported currently in the VLE. It was necessary, therefore, to redesign certain aspects of the curriculum to make them more suitable for virtual instruction.

One of the more successful adaptations was a replacement for a face-to-face logic puzzle. The logic puzzle was predominantly text based and relied heavily on learners being able to work collaboratively with paper and pencil and receive feedback from the instructor. The activity provided learners opportunities to practice the conversational skills of the lesson such as staying on topic, using appropriate tone of voice, initiating conversation and using proper turn-taking strategies. Such an activity is amenable to the affordances of classroom instruction but does not translate directly to virtual instruction. We designed a substitute activity that lacked the managerial complexity of the logic puzzle and leveraged the visual affordances of the 3D-VLE while at the same time providing opportunity for verbal practice of targeted skills. Learners participated in a structured "spot the differences" game in which two similar pictures were displayed with subtle differences. Learners took turns, encouraged and helped one another to find the differences in the pictures while remaining engaged and on-task. A less successful example was an activity in which learners were to plan a hypothetical trip to Los Angeles. In the classroom, this activity is supported by handouts and worksheets. When we replaced handouts and worksheets with static posters and images, the interactivity of the classroom activity was lost in translation. When learners worked through this activity they exhibited little motivation, were easily distracted, engaged in off-task activity and showed little cooperation or spontaneous conversation.

Our findings for system usage show iSocial to be easy to use and enjoyable. However we also found many challenges for the coordination of activity. The online guide sometimes had trouble managing instruction in the VLE, due to the lack of nonverbal and paralinguistic prompts. For example in the classroom the guide notices subtle cues from students as they are starting to drift from instruction, and she can use those cues to start processes to bring the student back to attention. This was form of control was more difficult to exert online. Further, communication with the facilitators who physically oversaw learners was limited. Facilitators could hear and see what was happening in the VLE but could not communicate with the online guide. Hence, when learners would engage in undesirable behavior such as gazing out the window or excessively clicking mouse buttons or keyboard keys, the online guide lacked effective tools to coordinate with physical facilitators to bring learners back on task both physically and virtually. In addition, the prototype environment was built with minimal tools to control what learners could and could not do within the environment. As a result, learners had the same control over many functions of the environment that the online guide had. This became problematic when learners chose to explore the limits of the VLE and inadvertently caused problems such as closing shared windows, taking control of a collaborative application when it was not their turn or stopping a video. Such issues were distracting, which typically slowed the rate of instruction and impeded the flow of the lessons. Consequentially, the online guide was unable to address the same amount of instruction in one hour in the VLE as is typical in a face-to-face class, causing instruction to be sometimes rushed. It may well be the case that virtual instruction proceeds at a different pace than face-to-face; however, reducing distractions with control and coordination mechanisms is an obvious target for future iterations of iSocial.

The early findings outlined above provide numerous points of departure for further design, development and research into utilization of 3D-VLE technologies for facilitation of collaborative virtual social competence instruction for individuals with ASD. Perhaps most encouraging is the observation that, despite shortcomings, learners' experiences in iSocial were enjoyable and their perceptions were positive. Generally speaking, learners were able to operate within the environment with minimal difficulty, engage in instruction, follow directions and interact with others. Upon completion of the field test, all participants expressed dismay that they would not be participating in more lessons and indicated a desire to continue using iSocial. Participants also asked that they be invited to participate in future studies. We believe that the lessons learned from the field test provide a foundation upon which to build and improve virtual technologies for individuals with ASD.

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Fostering Online Collaborative Learning Using Wikis: A Pilot Study

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Abstract: A classroom that operates as learning community should not be bounded to one weekly face to face meeting. Collaboration and social interaction are enabled to continue online using Web 2.0 technologies. We examined the affordances of wikis to support online collaborative learning within a learning community. The study was conducted with 24 students in an educational psychology graduate level course.

Purpose of the Study

Wikis are Web 2.0 technologies that allow every visitor to become an editor of a given topic at any time and from any location. The largest and perhaps most well-known wiki is Wikipedia. Wikis might have the power to transform classrooms into online learning communities unbounded by time and space constrains. Nevertheless, empirical evidence to support or refute this argument is currently lacking. In this study we examined the affordances of wikis to support online collaborative learning (CL). The wiki environment became our means for online collaboration and social interaction in addition to our face to face (F2F) meetings. Our purpose was twofold: (a) assess students' attitudes about their CL experiences using a wiki (RQ1), and (b) investigate the CL processes evident in the wiki environment, as well as characteristics of a wiki that may support online learning communities (RQ2).

Theoretical Framework

When a classroom is transformed to a community of learners, the teacher and students work collaboratively to help one another master complex topics. Online learning communities provide support for individual learners who can test assumptions, try out new ideas, and ask questions in the company of other learners with common interest. Fostering a learning community (online or offline) is consistent with a sociocultural perspective on learning, which views learning as active, reflective, and social (Brown & Campione 1994; Rogoff, 1994). A sociocultural perspective on learning also emphasizes that learning is mediated by psychological tools that help people regulate their thinking and interactions (Wertsch, 1994). Thus, from this perspective, different technological tools afford different opportunities for collaboration and learning within a community of learners (e.g., Hmelo-Silver, Chernobilsky & Nagarajan, in press; Suthers, Vatrapu, Medina, Joseph, & Dwyer, 2008).

Methodology

Participants were 24 graduate students enrolled in a F2F, educational psychology graduate level course taught (in Greek) during the fall of 2008 at a private university in Cyprus. The class met once a week for three hours. The sample consisted of mostly female (90%), in-service teachers with 1-3 years of teaching experience (90%), ages 22-47. Besides two students, the rest of them reported that they had never used a wiki before.

MediaWiki -- an open-source platform originally written for Wikipedia -- was used to build the wiki environment for this study. The wiki environment allows editing, formatting, and linking of shared wiki pages, asynchronous personal talk and public discussion via special wiki pages, email notifications for changes in the environment, and access to history documentation for each page.

During week 4 of class, students were introduced to the wiki environment for 15 minutes at the end of the class. Then, students were asked to use the wiki environment in distance (i.e., from home or school) to participate in a warm-up "introduce yourself" activity. This activity revealed minor technical difficulties (including login procedures and posting/editing) that were resolved via email communication between the investigator (first author) and students. For weeks 5 and 6 students were randomly assigned to four online groups of 6 students. Class did not meet F2F. Instead, students worked in their online groups within the wiki environment. Groups were asked to discuss a classroom case scenario and to work collaboratively to produce a consensus response to their groups' assigned question.

The twofold purpose of this study required a mixed-method research design that incorporated both qualitative and quantitative data collection and analysis. Data sources included online discourse and history documentation archived in the wiki environment, groups' consensus responses, and quantitative and qualitative data collected from an anonymous survey administrated immediately after the completion of the activity.

Analysis and Results

To assess students' attitudes about their CL experiences using the wiki (RQ1), we examined students responses to the survey (N = 20). The survey included a total of 27 items. First, 25 Likert-type items were designed to measure five constructs of interest: 1. Communication and Interaction; 2. Reflection; 3. Technology Satisfaction; 4. Overall Satisfaction; 5. Frustration. Subscales were adapted from previous studies that reported good psychometric properties in terms of factor structure and internal consistency (see Yeo, Taylor, & Kulski, 2006; Ioannou & Artino, 2008). High internal consistency (Cronbach's alphas > .80) was confirmed using data from our 20 participants. Using a response scale from 1 (completely disagree) to 7 (completely agree), means were quite high ($6.29<M<6.66$) for the positively worded subscales 1-4, suggesting our use of wiki technology for an online group activity was positively endorsed by our students. On the other hand, the mean score for the frustration subscale was very low (M = 1.51) indicating that students' level of frustration during the activity was generally low.

Second, the survey included two open-ended questions. We asked students if there was anything about (1) the technology and (2) the structure of the activity that hindered their collaboration. The vast majority of the students had nothing negative to respond. A couple of students reported that (1) they lost some work while editing a wiki page concurrently. In fact, MediaWiki has a process for resolving editing conflicts, but students were not aware of that. Another student reported that (2) fewer group members would make collaboration easier.

To understand the CL processes evident in the wiki environment (i.e., how students interact and arrived to a consensus), and how characteristics of a wiki that may support online learning communities (RQ2), we employed a combination of qualitative, quantitative, and illustrative techniques. Specifically, we used the coding-and-counting approach to computer-mediated-discourse analysis (CMDA) described in Herring (2004), followed by the Chronologically-oriented Representations of Discourse and Tool-related Activity (CORDTRA) technique described in Hmelo-Silver & Chernobilsky (2004) and Hmelo-Silver et al. (in press). The online discourse of each group was coded for student collaboration, statement complexity, monitoring, and other content (broken into more detailed subcategories; see Figure 1). Our coding scheme was adapted from Hmelo-Silver and Chernobilsky (2004) who studied student CL processes during problem-based activities in the STEP online environment. The unit of analysis (segment) was decided to be a consistent 'unit of meaning'. In most cases 'a contribution' on the wiki was a unit of analysis that was classified into a coding category. One coder coded the whole discourse, and a second coder independently coded 23% of the discourse (group#3's discourse), after being trained by the first coder. The inter- rater agreement was satisfactory – 89% for segmentation into units and 87% for coding of the units. We, then, counted the frequency each coding category was used by each group. Our subsequent analysis focused on two selected groups: Group#3 demonstrated high levels of participation and productive discussion: more than 90 contributions were recorded in the wiki environment (not counting instructor's feedback), and 70% of discourse was coded in the collaboration and statement complexity categories. Group#1 was less successful with regards to the above criteria.

To construct group#3's CORDTRA, we used the group's coded discourse and information recorded in wiki history documentation (see Figure 1). Time of contribution is running at the top of the diagram in chronological order. The discourse categories, wiki features, group members, and action taken (expanding, deleting, or editing information) are listed on the right of the diagram. Each time point represents a discourse category, a corresponding wiki feature that the specific student is using, and the type of action taken. We explore CL by going back and forth between the CORDTRA and the coded discourse.

Group#3 began with some task and tool -related talk, explanatory questions, and monitoring/planning statements. Soon after that, students started brainstorming. A lot of new ideas, elaborations and transforming statements were posted. Only three of the group members were active in the discussion. Students generally agreed with each other's ideas. There were no disagreements; only a couple of modifications of ideas. A number of explanatory questions and prompts were present as students sought to reach common understanding of the problem in the case. Contributions were generally sophisticated and well-grounded in theory (transforming statements) moving the task forward. There were fewer simplistic contributions of facts and theories (telling). Active discussion of ideas lasted for approximately four days. Then, some tool-related and monitoring/planning discussion took place as students proceeded with constructing their solution. The group used one wiki page for their public discussion and the associate front page for the construction of their solution. Features such as personal talk, history documentation, and email notification (self-report) were not utilized. As students moved to the front wiki page to construct their solution, the discussion was almost completely abandoned. For three days students refined their solution. They copied and pasted information from the discussion page into their solution, re-arranged paragraphs, expanded and revised content, added and deleted sentences or paragraphs, and played with headings until they had a coherent assay. In general, ideas included in the solution reflected what was previously discussed among group members.

Group#1 demonstrated quite different patterns of collaboration. Due to space limitations, we only present Group#3 in this companion paper. The poster presentation will include: screenshots of the wiki environment, case scenario and questions, coding scheme, coding-and-counting CMDA results for each group, CORDTRA diagrams for both groups #1 & #3, discussion about the inferences we can make from the diagrams, and methodological limitations.

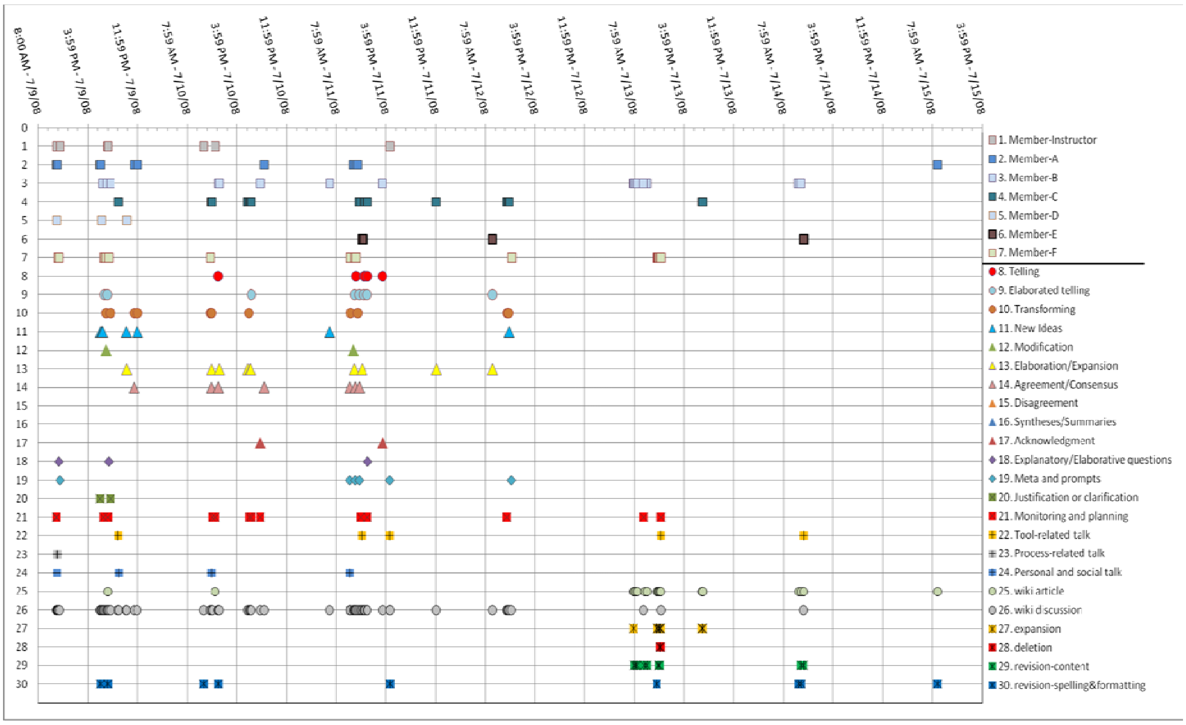

Figure 1. CORDTRA for Group #3.

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Designing Wikis for Collaborative Learning and Knowledge-building in Higher Education

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Abstract: A wiki design that facilitates collaborative learning, knowledge-building, and student reflection was implemented in three graduate courses. Empirical data collected from interactions in the Resources area where students added new resources and commented on peer contributions is analyzed and reported in this poster. The goal is to test the effectiveness of the proposed design for collaborative learning and for the development of a knowledge-building community driven by wiki participants.

Introduction

The ubiquity of the Internet and easy access to information on the World Wide Web today provide educators with unforeseen opportunities to use online technologies for collaboration and knowledge-building. While a number of Web 2.0 tools – wikis, blogs, and social bookmarking tools like del.icio.us have inherent capabilities that enable collaborative learning, it remains important to identify instructional design that will facilitate and ensure knowledge-building among participants. This project explores the usefulness of a wiki design for knowledge-building among participants in three graduate courses where wiki interactions were analyzed using both quantitative and qualitative methods.

Wiki design

A wiki has been defined as "a freely expandable collection of interlinked Web pages, a hypertext system for storing and modifying information – a database, where each page is easily edited by any user with a forms-capable Web browser client" (Leuf & Cunningham, 2001, p14). Notwithstanding the inherent capabilities of wiki technologies for promoting student collaboration, the student interaction required for a wiki to benefit learners involves the definition of parameters in educational activities (Phillipson & Hamilton , 2004). If educators hope to achieve higher levels of student participation and knowledge construction, wikis have to be designed to that effect. The wiki design proposed in this project is based on theories about collaborative learning and knowledge-building communities (Jonassen & Kwon, 2001; Moskaliuk & Kimmerle, 2007; Palloff & Pratt, 2005) and supports the characteristics of knowledge construction detailed by Piaget(1970), Mezirow(1990), Vygotsky (1962) and Scardamalia and Bereiter (1994). While most wikis contain areas for discussion and collaboration, this decentralized, non-teacher controlled wiki provides areas for students to -Share and adapt to new knowledge in the form of resources (e.g. research articles, online videos, facts and statistical reports) -Pose questions about course topics, discuss peer questions and negotiate understanding or meaning based on prior knowledge and experiences as well as individual environments -Reflect on their individual learning process with respect to different topics in the course and on their learning through wiki interactions The above design corresponds to Salomon's (1993) proposal that successful CSCL should engage individual learners but encourage interdependence among learners by information-sharing and continuous joint thinking.

Methodology

The wiki design proposed above was first implemented in a graduate course with 14 students (six male and eight female) who were in-service teachers, educational technologists, administrators, and faculty developers in K-12 and higher education settings. The students met once a week for three hours over a 14 week semester where they learned about new technologies in education and experimented with their use. A small number of students was considered appropriate in order to study collaborative learning and meaning-making as posited by Stahl (2006). The instructor was the sole administrator but students could edit all parts of the wiki in the graduate course (Readings, Resources, Calendar, Assignments, Discussions, and Individual Reflection Pages). While the instructor provided Readings and Assignments areas, all other areas were maintained by the students. This poster focuses on the Resources area, where students created hyperlinks, added attachments or embedded resources on course topics.

A mixed approach was adopted to analyze the discourse in the three areas of the wiki (*Resources*, *Discussion*, and *Reflection*) where students interacted. While the participation of students on the wiki was not equated to learning in this study, it was considered important to count the number of visits as well as contributions by students in each area. Further, in the *Discussion* area, the number of times that students initiated a comment or responded to a comment was counted, and in the *Resources* area, the number of times a student contributed new information, stated that they have viewed new information provided by others, and commented on the content of that new information provided by others was counted.

Quantitative data was considered insufficient to understand the process of knowledge-building in a group, therefore the interactions in the *Resources* area were open-coded in two stages. In the first stage the actions/interactions of students were mapped and described. In the second, themes related to knowledge construction were attributed to different comments by students and to their actions. The same data was open-coded in the same two stages by two research students and inter-rater reliability calculated as a percentage of agreement. Eventually, interactions in all three areas (*Resources*, *Discussion*, and *Reflection*) will be analyzed to determine a process of interaction in each area. This procedure will be repeated for all three courses where the wiki design is used to compare the process of interaction in each area in the three courses.

Results and Conclusion

Students were not required to contribute to the *Resources* area of the wiki, the instructor told them that they were "welcome to" add any resources they thought appropriate. Student contributions to the wiki were thus not in response to an instructor-initiated question or prompt. In the first four weeks of the course, 71% of the students added new content at least twice and 86% read/heard/viewed and commented on the new resources added by their peers at least once. On average during the course, 36% of students added new content at least once a week and 57% commented once a week. Students' use of the wiki varied as the course progressed. The least wiki activity was observed in weeks eleven and twelve of the 14-week course.

The unit of qualitative analysis in the *Resources* section was each new resource that was added. An interaction analysis map was first created for each resource, identifying the direction of student responses with respect to the resource added. Student contributions fell in the following areas: -Introduced new resource (NR) with relation to course content, relation to peer-contributed resources. -Supported comment. Resource NR 'solidifies' existing knowledge/experience. -Made apparent content of resource NR as different from existing knowledge; Questioned new information -Offered clarification/explanation/context/examples -Reported new learning or exposure to knowledge and way of thinking unknown before -Reported change in understanding or behavior or approach -Reported application in practice or use of resource NR

The above is only a preliminary analysis of the data. The actions reflect stages of knowledge-building (exposure to new knowledge, accommodation and assimilation of that knowledge, negotiation of understanding and identification of application) that will be refined to present a model of interaction in the *Resources* section. The above wiki design is being implemented using the same wiki software in two more graduate courses of the same size taught by different instructors. The interactions will be analyzed in a similar manner and compared to determine if the wiki design is effective in other contexts and with other groups of learners.

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Designing with Learners for Game-Based Collaborative Learning: An Account of T-Rex Group

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Abstract: This presentation discusses our design approach to incorporating learner voices in developing a game for learning Earth system science, Voyage to the Age of Dinosaurs (VAD). We will particularly focus on the account of a group (T-rex) of 4 participants as to what kind of meanings they are attributing to the artifacts they are creating during the workshops and how these meanings from learners' voices are contributing to our design.

Introduction

This presentation discusses our design approach to incorporating learner voices, in developing a game for learning Earth system science, *Voyage to the Age of Dinosaurs* (VAD). The goal of VAD is to provide an immersive experience by recreating and replaying the traces of Earth's history using intelligent agent technology and 3D multi-user game environment. Much literature has documented the difficulties learners have in understanding the Earth as a complex system with naïve conceptions often developing early in childhood (e.g., Barnett et al., 2004; Gobert, 2000; Lee, 1999; Sneider & Ohadi, 1998; Tsai, 2001). At the same time, the learning technologies that support the understanding of Earth's structure and dynamics may still lack the basis of research-based design principles and research into how people learn using such technologies.

We have been working with two Singapore secondary schools in the three-year collaboration in order to develop a culturally appropriate learning design that reflects diverse voices of stakeholders using an informant design process (e.g., Druin, 2002; Scaife et al., 1997). Our design approach addresses important issues in the Earth Science education in various ways. The initial stage of the design explored learners' Earth science conceptions and how technology could support alternative ways of perceiving and understanding Earth's processes. We are using dinosaurs and their fossils as conceptual and motivational anchors for the learning of Earth system science, which will be further discussed in presentation. Through the design approach of engaging learners in various activities, we are investigating how learners immerse themselves into Earth system concepts and how associated emotions affect their conversations and artifacts about Earth's processes. This presentation will discuss our design approach and look at the account of a group (T-rex) of 4 participants as to what kind of meanings they are attributing to the artifacts they are creating during the workshops and how their meanings are contributing to our design.

Informant Design and Earth Science Conceptions

This project has the opportunity to engage schoolteachers and students from two secondary schools (U.S. grade 7-10) as active design partners throughout the iterative design process. The first phase of this project is focused on working with the Singapore teachers and students in order to understand their needs and conceptual challenges and to tease out their ideas about meaningful learning environment. Our design approach starts with the understanding of learners' conceptions of the Earth processes as people of all ages have alternative conceptions about the causes for earthquakes (e.g.,Tsai, 2001), interactions among natural phenomena such as volcanoes and earthquakes (e.g., Barrow & Haskins, 1993), and lack a deeper understanding of the Earth's process, such as plate tectonics (e.g., Gobert, 2000).

Gobert (2000) studied students' (fifth grade) models of the Earth's interior and its causal and dynamic processes for plate tectonics, which requires understanding of the various Earth's mechanisms. The students' diagrams were used to understand their conceptions such as a simple causal mechanism of volcanic eruption (i.e., only heat or only movement as cause) and revealed how students hold onto such conceptions over the series of interviews and adversely affect understanding. For our workshop, we developed a set of open-ended questions for dinosaurs, fossils, and important concepts from their geography textbook, and ask them to write, draw diagrams if appropriate, and explain in a focus group setting. This was conducted with 10 students in each school on separate days. We collected all the artifacts created by the participants and recorded (video and audio) how they describe their understanding during the discussions and build onto each other's ideas.

The second workshop was focused on exposing students' hands and minds to contexts and real-world applications and giving them a chance to develop a script to make their own movies. This workshop was held over two days during school holidays in order to give students an opportunity to work together in groups of four (a total of 16 students from two schools), outside of school in a different environment, to brainstorm and develop ideas about dinosaurs, fossils, and the prehistoric environment by drafting stories about dinosaurs based on their interests and ideas. Each group made a short movie using the props (both provided and improvised by students) at the end of the workshop. We also collected the created artifacts and video-recorded their processes of working together as a group for the two days.

Becoming the T-rex

The design and research of this project adopt the notion of distributed cognition and emotions, which views cognition and emotions beyond a person's properties as shared and spread among people, artifacts and symbols (Salomon, 1993; Stets & Turner, 2008). Computer technology provides means to experience and understand in relation to the represented situation, otherwise impossible. The design of learning activities using such technology should embody the processes and situations of the particular events or the knowledge creation (e.g., volcanic eruption or inquiry process). Novel opportunities through technology, such as traveling to microscopic worlds or to outer space, can initially provide some excitement. At the same time, technological capabilities of interacting with other learners within virtual space provide another dimension of distributed thinking and sharing feeling. Emotion arise not just from the interesting content, but more often in response to relational meanings around the content (Planalp, 1999).

In an attempt to design and research a program that takes advantage of the affordances of technology and provides meaningful experience to learners, we examined how learners were working with each other and with symbols and artifacts in order to develop and express their ideas and emotions. In the below, we summarize the T-Rex group's account. We will first provide a brief understanding about the four members of the T-rex group, who were all in different groups during the first workshop. We will then briefly introduce how they came together and contributed to the group production of the short movie clip.

Four T-Rex Members with Different Characteristics

In terms of the first workshop on the earth science conceptions, regardless of their exposure to formal lesson on these topics, students' depth of understanding and explanations were mostly shallow, but the level of vocabulary and scientific terms used varied quite a bit. Many students tried to remember some facts or images and fit their explanations to what they remembered (from lessons, textbooks, television programs, popular books, magazines, etc.). Irene, Tony, Victor, and Weilong were not exceptions. They pulled their ideas from different resources, and their characteristics played a big part on how they approached the questions. Irene and two of her girl friends were in the focus group together. It seemed that she was perceived as a "smart" one among them. She had watched many documentaries before and tried to remember what she had seen before. She was also concerned about spellings of different terms and her "bad" drawings when we asked them to draw. Irene started talking about volcano when discussing earthquake and plate tectonics as she thought volcano causes earthquake and lava also has something to do with making the plates move or break apart.

Tony is very expressive and even exaggerative in describing Earth's events verbally as well as visually through drawings. He uses various analogical expressions, which often included human figures or emotions and dramatic descriptions of catastrophe and urgency of situations. He was especially excited when talking about volcanoes and his initial drawing highlighted volcanic eruption as the main disaster that the dinosaur could have encountered. During this workshop, Tony was good at posing "why" questions to the members, which sparked further conversations and constructing ideas together. Victor was partnered with a friend from a primary school. He was very open to talking about what he imagined based on what he heard and saw before. His mother seems to influence his science knowledge as he referred to what he heard from his mother during the conversations. However, he imagined plates as "blades" inside of the Earth that shakes the ground to cause earthquake, and also inside of the Earth as full of lava. Weilong, unlike others, went through the topic in his recent geography class. His responses were more dry and proper with terms. He talked about the events very objectively and did not draw the Earth's processes until the facilitator requested again, which showed minimal illustration of the events. In the presentation, we will include actual drawings and conversations that characterize four members.

T-rex's Ideas about Dinosaurs

The common characteristic of the movies across different groups was "role-playing" in the second workshop. They liked to play the role of paleontologists who find fossils of dinosaurs. The climax of their stories tended to include dinosaurs fighting before their death and burial. Dinosaurs' actions in these scenes usually reflect how they were depicted as fossils in previous scenes about fossil findings. These common themes reflect aspects of what students were interested in knowing about dinosaurs, but at the same time seem to be influenced by the IMAX movie they watched earlier in the workshop in which paleontologists excavate dinosaur fossils and scenes recreate what might have happened to the dinosaurs. One of the distinctive aspects of the T-rex group's movie making was their creation of and excitement over the volcanic eruption scene, which we will be able to demonstrate their movie and the process during the presentation.

Their movie takes places in two main settings: present time fossil finding site and the same location 100 million years ago. The main characters include two paleontologists and two dinosaurs (Confuciusornis and

Dilong). When they started filming their movie, they naturally positioned in certain roles. Irene became the narrator of the movie, which interestingly resonates with how she was being concerned about "getting things correct." Throughout the preparation, practice, and filming, we heard her practicing the pronunciations and confirming with other members repeatedly. Tony, on the other hand, took on many roles on and off the stage: playing one of the paleontologists, maneuvering dinosaur props, providing ideas for sound and other effects and finding ways to make them. Tony's expressive character, especially how he includes emotional aspects for the concepts, made a significant contribution to the T-rex group's work. Victor also played one of the paleontologists and helped with effects. However, he mostly followed what Tony suggested him to do instead of him finding his position in the group and he seemed to be content with his roles. Weilong took the camera for filming and also took on the role of the movie director, which also interestingly connects with his dry and 3rd person viewpoints of events. When Tony and Victor were busy with preparing effects, Irene and Weilong spent most of their time with planning the scenes and fine-tuning their scripts for narration.

Design Elements and More

T-rex group used various design elements to express their ideas and related emotions, such as paleontologists having mustache, driving jeep, crying when could find any fossil, and dancing when found one, and volcanic eruptions as sudden event with lava (using a red disposable poncho) covering a large area. Tony, for a quite long time during the planning and filming session, insisted and searched for something to represent lava. In the presentation, we will demonstrate the artifacts, filming sessions, and conversations that show how they weaved their ideas into the design, and discuss and demonstrate how our further workshops and VAD prototype are unfolding for the project by incorporating learner voices.

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Bridging School and Home: Students' Engagement with Technology-Rich Activities

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Abstract: This poster describes ongoing work that examines students use of a computer-based learning environment designed to bridge school and out-of-school learning contexts by incorporating affordances of both formal and informal learning settings. Data presented illustrate sixth grade students' use of online chat in class and at home and present an initial examination of chat interactions (in both mixed-gender and single-gender peer groups) while their agents are involved in a competitive game.

Introduction

Teachable Agents (TA), an interactive computer-based learning environment (LE) called was created to promote the development of higher-order cognitive skills for problem solving in science and math (Biswas et al., 2005). Within TA students teach computer agent through well-structured visual representations that help to shape and organize student thinking. The TA environment, when combined with adequate scaffolding and feedback can provide educational opportunities for students to develop metacognitive skills and thereby improve their subsequent learning. To leverage the cognitive and social aspects of learning, several novel technological tools and features have been developed to help both teachers and students to monitor learning and to facilitate more use of TAs in the classroom and at home. TA presents students with opportunities to engage with formal classroom content in an environment that presents students with features of informal learning settings including an agent-based game context and support for distributed collaboration (chat).

One of the goals of moving the TA environment to out-of-school settings was to create an application that can help shift the standard "practice" model of homework into one that prepares students to learn when they come to class the next day. Using an online application in this TA environment, named the Triple-A Game Show, students can "play" and chat together while completing homework in preparation for the next day. Students can log on from home or school. Students teach their agent and customize its look. Their agents then participate in a game show with other students' agents online. The game host asks agents to answer questions and the agents show their thinking. Within the game show, as well as embedded throughout the LE, a chat feature was available to students (see Figure 1).

Study Objectives. Study One was undertaken to examine the degree to which students used the online chat feature to discuss assignment content (science content) and to examine any general use patterns occurring at home and school. The objective of Study Two is to examine the interactions between boys and girls (in both mixed-gender and single gender peer groups) while playing the gameshow.

Figure 1. Screenshot of TA Gameshow.

Study One: Analyzing Chat Patterns at Home and At School

The chat data analyzed here were collected as part of a larger study that took place at a suburban middle-school in early 2007; fifty-eight sixth-grade students participated in a three-week global warming instructional unit. The chat feature embedded within the TA environment allowed for three basic levels of conversation privacy among the participants. The first level, a lobby, is a public space that allowed for all participants to view all the text that was entered within the space. The second level (the game show feature of the environment) is a semi-public space that allowed for a fixed number of participants playing the same game to enter and to view all text entered by other students in this space. The third level, whisper, allowed for two students to instant message each other; only these two students could view the text. All of the text entered into these spaces was recorded, with informed consent from students and their guardians. Students engaged in a total of 24 chat sessions; 14 of the sessions took place in students' science class and 10 sessions took place during out-of-school hours.

The decision to parse chat logs into interactions was informed by the nature of chat dialogue which tends to contain many inter-line references where at times content is only interpretable in relation to other lines of text. Additionally, researchers' intention was to capture the extent to which the chat feature engendered discussion among students. An iterative comparative approach--in which coders frequently engaged in extended comparisons of data within and across the chat logs to develop understandings of the relationships between the data was used (Strauss & Corbin, 1994). This approach allowed the analysis team to create a typology of the chat interactions among the students and to begin to analyze their communicative aspects. Chat logs were first analyzed for content related to three primary types of content (i.e., domain knowledge and task goals (subject); the learning environment's general technical functionality (technology); and the specific functionality of the game feature in the TA environment (game)). Interactions that did not include talk related to these three types of content were deemed irrelevant, and not coded. Relevant interactions were then coded along several dimensions (results not presented here due to space) including major functions of chat (i.e., evaluative; directive; descriptive; and help seeking and giving). Also noted within each of these interactions was the students' setting (i.e., school or out-of-school), each of the participants involved (which ranged in number from 1 to 7), the level of privacy in which the text appeared (i.e., lobby, game show, or whisper), and the number of total lines of text entered across an interaction's participants.

Results indicate that out-of-school settings engender more discussion overall from students (i.e., more interactions). These interactions included more students and were longer indicating that not only are students discussing more, there are different, more desirable patterns of interaction produced in the out-of-school setting. A total of 1483 relevant interactions were identified. Within each of these relevant interactions, 1021 of interactions occurred out-of-school, and 463 of interactions occurred in school. Across all of the chat logs, 19.4% of the 19,941 lines of text were deemed a part of a content relevant interaction, a higher percentage of which were produced out-of-school (30.5% vs. 18% in school). An average of 1.9 students participated in each interaction across all 24 chat sessions. The number of participants per interaction was significantly higher when students were out-of-school than in school ($p=0.015$). Overall, 1.5 students participated in each school interaction, and 2.1 students participated in each out-of-school interaction. Finally, students' interactions tended to be longer when they were not in school ($p=0.162$); there was a greater number of relevant lines of text per interaction when students were out of school.

Study Two: Interactions During Competition

Study Two comprised a secondary analysis of the interactions identified in Study One. Interactions were analyzed for comments that were: competitive/aggressive (any talk of who will win, who will lose, top scores, challenging other students, bragging about scores; can contain aggressive, intimidating tone and/or words), teasing (any instances where students are made fun of for their status within games), self-deprecation (any belittling remarks directed toward themselves), and encouraging/complementing (any kind of encouraging talk, could be complementary of work done or standing within game). Interactions containing comments that met the definitions above were given one or more codes to capture the presence of any of the kinds of talk defined above. A total of 419 interactions took place while the students were playing the game show, 242 (58%) of which fit into the aforementioned categories.

Talk amongst boy-only and girl-only interactions is very different in tone (see Table 1 below). Although competitive talk is expected to occur, when boys played games with other boys, almost five times as many competitive or aggressive interactions took place than when girls played games with other girls. Examples of the single gender boy statements include: "u goin down", "prepare to lose", and "on the contrare. it is you who dies". In addition, interactions containing teasing occurred more often in boy-only interactions than in girl-only interactions. Examples of teasing statements in interactions include: "your name and background suck" and "lol [you're in] last place". Meanwhile, self-deprecating comments occur twice as often among girl- only interactions than boy-only interactions and encouraging comments were identified in more than twice as many girl-only interactions than boy-only interactions. Examples of self-deprecating statements made by girls include: "i better not screw up again", "my person is stupid [student talking about her agent]", and "i suck".

When boys and girls interact, girls actively participate in aggressive discussions. Boys made the majority of teasing statements within these interactions, however, and they continue to make far fewer self-deprecating comments than girls (see Table 2 below).

Of all the interactions taking place via the whisper function (N=35), 86% are girl-only, 8.6 % are boy-only, and 5.4% are mixed-gender. The whisper feature provides a private place for students to talk and share evaluations of themselves or their ability in science without outside viewers and comments; this appears to be an especially appealing feature for girls.

Table 1. Interactions by Category and Gender Composition

Interaction Categories	Single-Gender Boys	Single-Gender Girls	Mixed Gender	Total (n=419)
Competitive/Aggressive	61 (14.5%)	13 (3.1%)	39 (9.3%)	113
Teasing	20 (4.8%)	3 (0.7%)	19 (4.5%)	42
Self-deprecation	9 (2.1%)	17 (4%)	10 (2.3%)	36
Encouraging/Complementing	6 (1.4%)	14 (3.3%)	6 (1.4%)	26

Table 2. Percent of comments made by boys and girls in mixed-gender interactions

Type of Comment	Boys	Girls
Competitive Statements (N=204 across 39 interactions)	52%	48%
Put Down Statements (N=54 across 19 interactions)	70%	30%
Self-Deprecating Statements (N=18 across 10 interactions)	28%	72%

Conclusions

These results are preliminary and ongoing analyses include linking individual students' participation in the chat sessions to classroom achievement. Additionally, analysis of the function of students' contributions to interactions (or moves) described above (evaluative; directive; descriptive; and help seeking and giving) is ongoing; this analysis is based upon a sequential analysis technique which many researchers argue is necessary in order to understand how students are making meaning of knowledge representations embedded in the environment, discussion, and science concepts that are being coordinated in activity (Suthers et. al., 2007).

There are three important aspects of this work. First, in designing engaging computer-based technologies that connect school to out-of-school settings via the web and then examining the influence of setting on patterns of students use, this research contributes to a growing literature on how to leverage aspects of formal and informal learning contexts including extended, more inclusive interactions out-of-school. Second, the context of the study has implications for researchers interested in embedding game-type activities in educational materials with a goal to increase student engagement. Specifically, Study Two documents chat comments that point to different patterns among boys and girls engagement that have implications for how designers conceive of individual students' motivation. As games and online learning environments continue to be part of science instruction, an increased awareness of the dynamics that are structuring students' participation in technology-based activities can benefit teacher, designers and developers as they seek to create safe, engaging spaces for all students. Third, this emerging research illustrates how chat supports students' collaboration as part of their use of a complex science learning environment.

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CoPe_it!: Argumentative Collaboration towards Learning

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Abstract: This paper presents CoPe_it!, an innovative web-based tool that supports collaboration and augments learning among members of diverse communities. The tool fosters the means to manage individual and collective knowledge during a sense-making or a decision-making session. We demonstrate its applicability for Communities of Practice (CoPs) by examining it from both a learning and an argumentative collaboration perspective. Arguing that argumentation is an essential element of the learning process, we comment on related design issues. Through a use case, we discuss how the proposed tool makes it easier for users to follow the evolution of collaboration and comprehend it in its entirety.

Introduction

It is widely recognized that one of the best ways to keep a knowledge worker's competence high is through continuous learning. Most organizations already support learning activities through seminars and other traditional learning activities. Nevertheless, these means of "codified and transferred" learning are not sufficient (Robey, Khoo & Powers, 2000). Collaborative environments, aiming at supporting collaboration among groups of people forming Communities of Practice (CoPs), are believed to be one of the most promising solutions to promote what is known as "collective intelligence" or "organizational memory". The term CoP is used to define a group of people with common disciplinary background, similar work activities and tools, as well as shared stories, contexts and values.

In this paper, we address the need for innovative software tools for CoPs that can appropriately capture, represent and process the associated data and knowledge. Such tools should shift in focus from the collection and representation of information to its meaningful assessment and utilization. They should facilitate argumentation (i.e. discussion in which reasoning and disagreements exist, not only discourse for persuasion, logical proof and evidence-based belief), the ultimate aim being to augment collaborative sense making and/or decision-making. Learning theories involved with communities and collaborative work conclude that these settings do foster learning (Hoadley & Kilner, 2005) and that CoP members engage in the process of "collective learning". Argumentation is an essential learning element as it permits CoP users to develop their point of views and refine them, share their knowledge, and learn to negotiate opinions to reach a solution that will be accepted. In this context, our work focuses on the development of a web-based tool, namely CoPe_it! (http://copeit.cti.gr/), which is capable of tackling the diversity and complexity of the above issues. The ultimate goal is to enable users follow the evolution of an ongoing collaboration and meaningfully aggregate data towards the resolution of the related issues.

Many tools are already available to support learning activities in diverse settings. Generally speaking, they can be classified into two categories: those providing computer-supported collaborative learning, and those promoting argumentative collaboration. On the one hand, learning systems are mostly designed to support a learning paradigm (typically the classroom learning example), where specific roles are assigned to users (Dimitracopoulou, 2005). The distinction between student and instructor is present in most times and learning takes place through the design of specific activities. On the other hand, most argumentation systems rely on Toulmin's model (Toulmin, 1958), where emphasis is given on the identification of structural elements (e.g. claims, alternatives, positions etc.) and the deployment of a meaningful reasoning algorithm (Erduran, Simon & Osborne, 2004).

The proposed approach

Before building a tool to improve collaboration practices, we conducted a series of interviews with members of diverse CoPs. The major requirements revealed were:

- *Information overload management* (including filtering and processing of various knowledge resources) is a requirement that stems from the increasingly complex environment created through the proposition of many views and ideas.
- *Support for different collaboration modes*, since enforced formality may damage the effectiveness of a CoP.
- *Expression of tacit knowledge* must be supported to augment learning.
- *Integration of diverse information,* such as information from various applications, online sources and previous sessions.

- *Data processing and decision-making support:* the tool should play an active role, by calculating the trend of the discussion and indicating the most promising solution.

CoPe_it! addresses the knowledge sharing and learning taking place in CoPs (Lave & Wenger, 1991) by allowing distributed collaboration over the Web. Existing decision-making collaborative tools restrict their users to abide with a specific formalism that constrains how they can interact with the system. Such constraints prescribe the available actions and may lead users to change their usual ways of collaborating in order to use the system's features. Thus, sophisticated tools may lead to failures due to the extra time and effort users need to dedicate to the system to learn it, as well as their inflexibility. CoPe_it! addresses these issues by supporting a varying level of formality. This *incremental formalization* gives an unprecedented flexibility, allowing the rules enforced by the system (i.e. its formality) to vary, thus supporting - for an evolving collaboration space – activities ranging from the informal collection of ideas and resources to the production of a formal and highly interrelated environment.

CoPe_it! provides a number of different visualizations, called *projections*. Actually, projections are alternative representations of the collaboration space, which better serve our incremental formalization approach. Each projection has its own consistent set of data, relationships and actions. CoPe_it! supports switching between projections, while keeping data consistent. Different projections support a particular level of formality; the more informal a projection is, the more intuitive the user's actions are. Such an informal projection is not useful in situations where support for advanced decision making processes must be provided. It requires fixed semantics and high formality in order to be understandable by the tool. A switch to a projection of a higher level of formality disregards less meaningful data and knowledge items, resulting to a more compact and tangible representation of the collaboration space.

Using CoPe_it!

We present a use case where a community of medical doctors deals with the treatment of a patient, diagnosed with a specific disease. In order to elaborate the case, they begin a discourse and propose alternative treatments. Each treatment is presented as an idea and doctors argue about them through diverse collaboration items (see Figure 1).

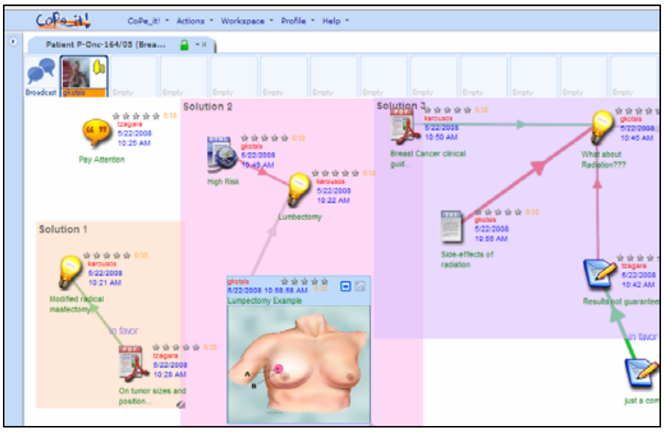

Figure 1. A discourse taking place between medical doctors.

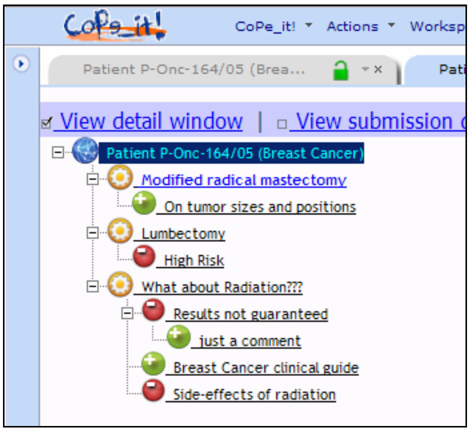

Figure 2. A formal projection of the discourse.

As the discussion goes on, doctors can add relationships (by drawing lines) between the collaboration items, in order to clearly denote their relation (e.g. "argument in favor" or "argument against"). More visual cues are used to denote other semantics (color, thickness). When the discussion gets more mature, doctors may switch to a more formal projection (Figure 2) in a semi-automatic manner. In this projection, the tool triggers a decision making support mechanism, through which the most prominent alternative (according to the underlying argumentation) is always indicated (1).

Discussion and concluding remarks

CoPe_it! facilitates argumentative collaboration, thus fostering learning between members of CoPs. The incremental formalization approach adopted permits collective understanding to occur at the pace of each user (Karacapilidis & Tzagarakis, 2007). The use of alternative projections and the ability to switch between them enhance the acquisition and the representation of tacit knowledge. CoPe_it! does not impose any premature structure, as the users can select the projection they wish to work with, as well as the activities they want to perform. Taking into account situational differences, we believe that our approach is generic enough to address a number of diverse settings.

An evaluation of CoPe_it! has been already conducted in diverse CoPs (from various professional fields, including management, engineering and learning). 67 users from these CoPs have evaluated the tool and the results were encouraging. The evaluation was conducted through questionnaires that contained: (i) two sets of closed-ended questions, aiming at evaluating the tool's 'perceived usefulness' and 'perceived ease-of-use', and (ii) a number of open-ended questions, through which users were asked to comment on the tool's advantages, disadvantages and/or limitations, as well as to suggest areas of improvement. Results obtained show that 66.1% of the users confirmed that the tool helped them organize the collaboration efficiently, 73.6% that it was easy to learn, 71.1% that it was easy to use, 72.5% enjoyed its use, while 66.1% admitted that it was worth the effort. Furthermore, users admitted that it stimulated interaction (63%), made them more accountable for their contributions (64.3%), while it aided them to conceive, document and analyze the context in a holistic manner (59.4%). However, users were skeptical about whether they will consider the tool as their first choice for supporting their future collaboration sessions (37.3%). Having further elaborated their answers to this issue, we concluded that this was due to the change of the way they were accustomed to work. As far as ease-of-use was concerned, 82.6% of the users were able to easily understand the tool's features and functionalities, 79.3% found it easy to use all available options, while 75% agreed that the achieved results after an action were clear. Nevertheless, only 52.3% could easily understand the contents of a workspace (this happens in data-intensive situations; efforts to provide a more flexible representation of a workspace are underway).

The open-ended questions revealed that users considered the ability of the tool to represent and manipulate the structure of an argumentative collaboration, along with its various visualization options, as its strongest features, setting it apart from Web-based forums. Users also commented positively on the tool's ability to provide multiple views of collaborative sessions. When asked for the tool's disadvantages, respondents mentioned the cluttering of the workspace (due to the numerous arrows that appear in some workspaces), and the inability to make references from a workspace to another. With respect to improvements, most comments were around the need of providing awareness mechanisms that can inform on changes that happen within a workspace, the ability to reuse items between workspaces (by copy-paste), and the integration of video/audio conference tools in order to enhance real time collaboration.

Summarizing, we argue that CoPe_it! is able to fully support the evolution of a cognitively-complex collaboration, while it also provides the means for addressing the issues related to the formality of knowledge building systems. It aims at contributing to the field of social software, by supporting argumentative interaction between people and groups, enabling social feedback, and facilitating the building of social networks.

Endnotes

(1) More details about the use of CoPe_it! can be found at http://copeit.cti.gr/site/examples.html.

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The 'Talk Factory' software: scaffolding students' argumentation around an Interactive Whiteboard in primary school science

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Abstract: Interactions between students can be ineffective when they fail to understand how to talk together and what they should aim to achieve (Dawes, Mercer & Wegerif, 2004). Research suggests that argumentation skills need to be taught explicitly to children and recent work developed students' collaborative argumentation as a means of improving their understanding of science (Aufschnaiter, Erduran, Osborne & Simon, 2008).Talk Factory is designed to generate graphical representations of the content and processes of students' collaborative argumentation in real time to assist with these difficulties. We discuss the theoretical underpinning of our work and our participatory design approach.

Introduction

Currently there is a need for software tools that are designed to scaffold students' engagement in scientific argumentation in the classroom. The aim of the study discussed is to scaffold children's engagement in the process of scientific argumentation by designing, testing and evaluating software -The Talk Factory- that will generate graphical representations of the content and processes of children's collaborative argumentation in real time.

The discussion in this paper is organised into two sections. In the first section we place our work in the field of existing research and justify its importance. In the second section we discuss our methodology in designing and evaluating the software. In our conclusion we report the issues we will raise in our presentation at the conference.

Argumentation, computer supported collaborative learning and science education

Research has illustrated that argumentation is an important component for the learning of science (Osborne, Erduran & Simon, 2004; Maloney & Simon, 2006; Sampson & Clark, 2008) For example, Osborne et al (2004) noted that students' engagement in the argumentation process promoted their conceptual understanding in science. However, current research suggests that argumentation is difficult for students (e.g. Dawes et al, 2004), and that little attention is paid to developing children's argumentation skills (Newton, Driver & Osborne, 1999).

Dawes et al (2004) argue that the talk that takes place in classroom is often uncooperative and off task, and this may be because students lack a clear understanding of the purpose of the activities they are engaged in. They claim that students need to learn first how to listen and talk, before they can engage in argumentation effectively. Based on this assumption they developed an experimental teaching programme for primary school students that focused on the teaching and learning of talking skills. Their results suggest that teaching children how to use talk effectively, and developing their awareness of the importance of this talk during science lessons, increased their understanding of science.

Another field of research focused on using computer supported scaffolds to encourage undergraduates to construct different components of argument. For example, Okada (2008) reports the initial findings of a study that focused on scaffolding young secondary school students' scientific argumentation with evidence-based dialogue maps, using computer software (Compendium). Initial findings illustrated that dialogue mapping can serve as a new way of scaffolding students' argumentation

Another approach that has focused on the structuring of discussion is *computer-supported collaboration scripts* (Stegmann, Weinberger & Fischer, 2007). For example, McAlister, Ravenscroft & Scanlon (2004) designed some online activities involving a mediating interface to be used during synchronous peer discussion, which was evaluated with higher education students in a distance learning context. Learners were required to select from a predefined list of sentence openers such us 'I think', 'I agree because', 'why do you say that?' and then to add their own text to the sentence. Preliminary findings suggested that the argumentation process was more coherent when the statement openers where used compared to the use of a simple unstructured interface.

The tools described above are designed for adults or secondary school students and hence might be unsuitable for primary school students as they are text-based. However, the key dialogue skills that these tools are designed to promote are also very important learning requirements for children developing argumentation skills in Key Stage 2 science (7-11 year olds). Building upon the work of McAlister et al (2004) our work focuses on exploring whether some features of online learning tools can be adapted to scaffold argumentative talk in Key Stage 2 science. Our main focus has been the development of a simple software tool that logs incidences of key dialogic processes as they occur in students' arguments, and makes these available to the students graphically, so they can reflect upon the efficacy of their argumentation skills.

Participatory design of the Talk Factory software

Four year five classes in a UK primary school (9-10 year olds) and three science teachers participate in the design and evaluation of the software. Based on our reading of the literature (Mercer et al, 1999; Dawes et al 2004), and on our discussions with teachers, we decided upon six positive and negative elements of argumentation to represent (explain reasons; explain disagreements; ask others; not giving reasons; interrupt; not paying attention). These elements were considered by the teachers to be the most relevant to incorporate in a scientific argument, and they represent features of argumentation as defined by Maloney and Simon (2006). The processes of argumentation are represented in the Talk Factory as six talk rules. In addition sentence openers are displayed, to guide students' understanding of how to begin dialogic responses that follow these rules (Figure 1)

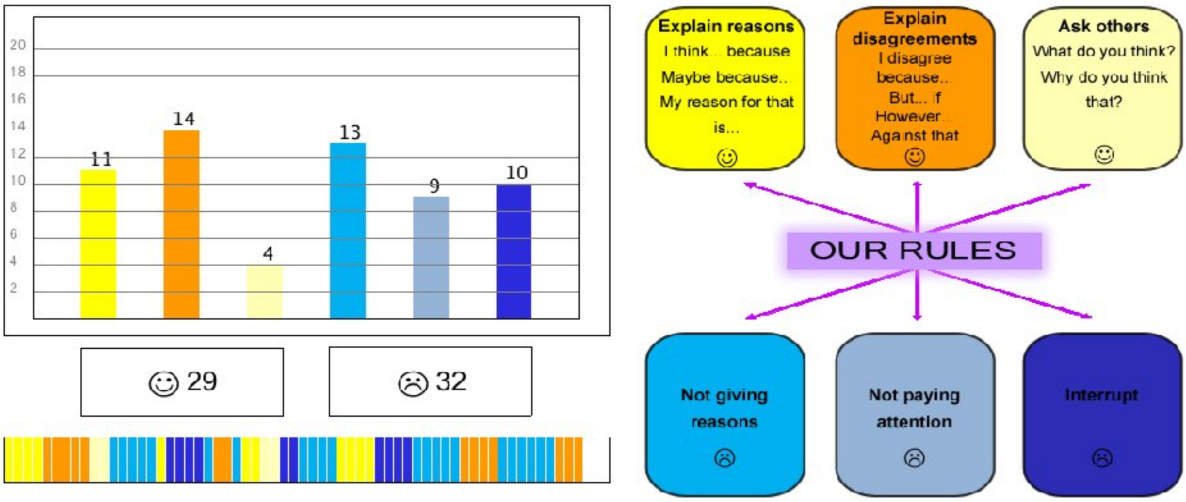

Figure 1. Representing arguments in Talk Factory

The software requires the teacher to tap (on the IWB) on each rule as a child makes an utterance, and the software transforms the teacher's input into a bar graph quantifying the occurrence of key argumentation processes, so as to make the data available to the students and the teacher. The horizontal bar represents the sequence of events. In addition a summed number is given for both desirable events ('happy face') and undesirable events ('sad face'). The teacher can use these numbers to help the students to improve their metacognitive awareness of, and hence engagement in, the process of class argumentation. Students' understanding of bar graphs was assessed before deciding to use these to represent argumentation processes. The 'rules' diagram and the graphs in Figure 1 illustrate the core features of the Talk Factory. Additional features vary according to the context of the task and include providing each student/group within a class, with their own screen space in which to represent their own current understanding of a task. The software is designed based on a hypothesis testing approach (Howe and Tolmie, 2003). This approach involves deploying a series of tasks where pupils firstly debate their knowledge to reach a consensus about the hypothesis to be investigated, secondly design practical controlled investigation of their hypothesis, thirdly perform the investigation, and finally, discuss the outcomes together.

The second phase of software development has focused on the iterative learner-centered design and testing of paper prototypes in a pilot class with a group of children. During this phase paper-based software prototypes were evaluated by children in terms of their usability. Also, the researchers met the teachers and demonstrated prototypes and audio-recorded the teachers' feedback, which was incorporated into subsequent versions of the software prototypes. In addition, the same class participated in piloting the first version of the software and students' feedback was implemented in further iterations.

Finally, the third phase has focused on the evaluation of the software and involved two intervention classes and a control class. This phase included the following stages of data collection:

(a) videos of pre-software lessons of the intervention classes;
(b) pre-test to assess students' argumentation skills and domain knowledge;
(c) two introductory lessons where students produced the set of talk rules presented in Figure 1.
(d) following the 'talk' lessons, children in the intervention classes took part in a series of science lessons using the software, and children in the control class took part in the same lessons using a version of the software that does not include any scaffolding features.
(e) post-testing to identify any changes in students' argumentation skills and domain knowledge.

Data Analysis

We are adopting both quantitative and qualitative methods to compare the occurrence of content (e.g. key words such us 'because', 'I think' and process (e.g. claiming, justifying) of argumentation events between the intervention and control classes. Firstly, this includes a comparative quantitative analysis of content events. The occurrence of content events is being coded using NVivo. The number of occurrences of each key word is statistically compared, across control and intervention classes using SPSS. Secondly, the process events in the intervention and control classes will be coded and counted using NVivo. The analysis of argumentation processes is concentrated on the extent to which students in the two groups have engaged in claiming, justifying, and opposing the arguments of each other. We are using elements of the framework developed by Maloney and Simon (2006) to code the process events. The numbers of occurrences of each coded event will then be statistically compared across the two groups using SPSS. These data are supplemented by qualitative analysis of video footage of the control and intervention classes. The focus of this analysis is on identifying how the software features or lack of them, and the affordances of the IWB mediate the content and process events. In addition, quantitative analysis of pre and post testing, using SPSS, is conducted to assess the software's effectiveness in improving students' argumentation skills and domain knowledge.

Conclusion

In this paper we have described the theoretical underpinning of our work and some of the features of the Talk Factory. A key aim of our work is to develop a new theoretical understanding of how graphical representations of the content and processes of argumentation might be effective in scaffolding learner argumentation and improving domain knowledge in Key Stage 2 science. In our study two tools are involved, the software and the IWB. In our presentation we hope to demonstrate further how these tools can mediate students' scientific argumentation, and promote their understanding of science. We will report in detail on findings about whether the Talk Factory can improve students' argumentation by developing their awareness of language use. In particular, our focus will be on the differences between the use of the software including the scaffolding features described above, and a version that does not include any scaffolding features. In addition, we will demonstrate the use of the software and highlight successful ways in which teachers used the software to engage their students in argumentation. Implications for teaching and future research will be discussed in the light of these findings.

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Software Design Principles for Video Research in the Learning Sciences and CSCL: Two Studies Use the Perspectivity Framework & Orion™

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Abstract: Collaborative analysis of digital data has become an important factor for research in the learning sciences and the computer supported collaborative learning (CSCL) communities. The purpose of this investigation was to deduce design principles to inform future video research software as well as social network development. To uncover these design principles, a meta-analysis was conducted of two dissertational studies that applied the *Perspectivity Framework* and the video analysis tool, Orion™. The first was a qualitatively-informed quantitative study; the second applied balanced mixed methodology—also referred to as *quisitive research*. The 7 design principles found include: stakeholder involvement; elastic coding; collections as selections and vice versa; applied authenticity; unfolding interpretations; layered critique; and revision tracking.

Introduction

Over the past decade, the analysis and interpretation of video and audio data have become important components of the research process in the learning sciences and computer-supported collaborative learning communities. While research using video is now an essential part of the design method for learning systems, established research approaches used for analyzing digital data have yet to yield design principles that promote the design of "Generation 2 (Gen 2.0)" digital video and audio analysis software. The approaches we are referring to are interactional ethnography (Green et al., 2007), epistemic mediation (Roth, 2007), amplification of mental functioning (Pea, 1985), observational investigation and theory articulation (Smith & Reiser, 2005), ethno-methodology (Garfinkle, 1967; Koshmann, Stahl, & Zemel, 2007), critical design ethnography (Barab, 2004), and digital video design ethnography (Goldman, 2004). This paper addresses how using the Goldman & Maxwell's methodological approach called the Perspectivity Framework (2002) and the video research tool Orion™ led to the emergence of design principles that may be applicable to future video research designers as well as social network environments. Both Dong and Lansiquot used both the framework and tool in their dissertation studies. In this paper, we deduce and construct design principles from these two recent empirical studies.

Perspectivity Framework

The perspectivity framework proposes that negotiating the meaning of events by layering stakeholder points of viewing produces a clearer understanding of the complexity involved in knowing what happened in a given time and place. The framework addresses the need for interacting with the artifacts or representations that are continually being created in the process of communication about meaning. As Rowland points out: "We come to know through interpretation, dialog, and negotiation of meaning with… others, through a conversation with manipulation of the materials of a situation" (Rowland, 2004, p. 43).

The framework acts as a conceptual scaffold to address the journey from bits and segments (video-data-in-the-small) into meaningful stories and valid results (video-interpretations-in-the-large). This framework is open, flexible, and inclusive of the diverse theories and methodological approaches that have emerged (and will continue to emerge) as researchers use digital video into their research. In the learning sciences, the theoretical approaches include constructionism (Papert, 1991), situated cognition (Lave &Wenger, 1991), anchored instruction (Bransford, 1988), design theory (Kolodner, 1995), and computer-supported collaborative learning (Stahl, 2006), to name but a few. The methods run the full range from quantitative to qualitative, and to what Goldman and colleagues (2002) have called quisitive research—a form of research that includes triangulating multi-modes and diverse research methods.

Dissertation Studies Use Framework and Tool

The first study conducted by Dong was a qualitatively-informed quantitative study dissertation study of emotions and cognition. The qualitative audiotaped interviews complemented the quantitative data to explore how students responded to different interface designs: black-and-white versus color images, for example. Her research premise, building upon Miller's (1956) working memory model, Sweller's (1994) cognitive load theory, and Mayer's (2001) cognitive theory of multimedia learning was that colored, aesthetically pleasing design induces positive emotions from students. The induced positive emotions enhance information processing in the working memory, which solves the problem indicated in the three theories above that the capacity of the working memory is limited. Therefore, the induced positive emotions enhance multimedia learning. The researcher consolidated the data, selected chunks of audio interviews, and then uploaded the audio chunks into the Orion digital media database, where she coded, analyzed, and interpreted her data.

Lansiquot conducted the second study, a three-month, mixed-methodology dissertation study that examined how ancient interactive iconography impacts social studies and critical writing skills. Groups of three first- and second-generation immigrant middle-school students constructed museum labels (textual descriptions of artifacts) using an application that Lansiquot (2008a, 2008b) designed called Scope Out™, an experimental online revision tool that makes iconography interactive. This revisions tool was designed with Lansiquot's Visual Scope Theory in mind, which allows for unique observations "from different perspectives." (Herein lies the close connection of Lansiquot's theory to Goldman's "Points of Viewing Theory" (1998) that is based on observing using video and analyzing data from diverse perspectives.)

In Lansiquot's Scope Out, students are able to alternate from a larger picture to its separate parts and back again. Video was taken while students used this revision tool. The design of this study enables students and researchers to easily use of Orion to review chunked footage of group interaction and to rate their thinking (i.e., chronological and spatial thinking, use of evidence, multiple perspectives and diversity, interpretations, and significance) as a reflexive activity (Goldman-Segall, 1993; Lansiquot, 2007; Lansiquot & Goldman, 2008).

Construction of Design Principles

Using the framework and the tool as a supplement to Dong's quantitative study enabled her to reach more valid conclusions for her research questions. When interviewing her participants using an audio recorder, she became engaged not only with their responses but also with the research questions in new ways. The use of Orion and the perspectivity framework made the layering and inter-connectedness among the qualitative data layer concrete in ways she did not expect. The coding of the audio data became elastic (Davenport, 1995), stretching and unfolding her interpretations. The numerical coding was not only a significance rating, as Goldman-Segall had pointed out in 1993; the numbers on Dong's Likert scale became infused with the deep engagement of her "stakeholders' or participants in her study.

Lansiquot's study was designed as a quisitive methods study. The quantitative study overlapped with the qualitative, each informing the other at every moment. Moreover, using the perspectivity framework and Orion enabled her to compare her numerical codes as a triangulation activity. She was also able to engage students in the coding of the data in much the same way as Goldman-Segall had done at the Bayside Middle School from the early 1990s. The design principles that became important to Lansiquot included stakeholder involvement. When kids saw things that other kids did, they learned from each other, and Lansiquot learned from them at the same time. Stakeholder involvement created an applied authenticity to the relationships from text, video, and audio data. Lansiquot (2008a, 2008b) points out software design and problems being addressed should be as close as possible to the real world. The structure of the software should mimic the structure of the problem domain. Using Orion, she was able to keep what Vygotsky (1978) calls "the zone of proximal distance" very close. Elastic coding also enabled her to see the themes more easily. Most importantly, the notion of review, layered critique, and revisions became key design principles, much as it had for Goldman-Segall's digital ethnography study at the Hennigan School in the late 1980s. Goldman-Segall (1998) had found that Geertz's (1973) thick description could be applied in multimedia studies enabling the layering of viewpoints. Lansiquot added the idea of revisions to the mix, a critical part of the way researchers reach conclusions and learners learn when using new technologies.

Conclusion: Design Principles

By analyzing the use of the perspectivity framework and Orion in two studies, researchers found 7 design principles (see Figure 1). Most of these seven principles have recently informed the design Orion 2.0™, to be found at http://www.videoresearch.org. Orion 2.0 is the most recent version of a digital video-audio-text analysis tool and is available upon application.

In future investigations of design principles, researchers will conduct an expanded analysis of design principles in both commercially available video tools and learning science research environments to deduce a larger range of design principles that will enable CSCL design researchers to build software that takes advantage of the affordances of social networking environments. Possible software to be studied includes Pea's (2007) DIVER tool, Hay's Video Case Tool, and MacWhinney's (2007) TalkBank.

In conclusion, a large range of emerging tools will need to be studied to benefit not only designers and researchers but also learners and teachers in schools who need to use research tools in their own investigations. A future is envisioned where tools will be open platforms with easy-to-use applets for specific kinds of research. As we move into an age of change, the focus of our tools will be on community activity and, yes, social activism to enhance our current individuated notion of learning, teaching, and research.

1. *Stakeholder involvement:* CSCL community building is at the core of design principles for designing more valid conclusions. CSCL members should focus on community analysis while providing individual researchers with the opportunity to keep their data open to only those who have permission for sharing.

2. *Elastic coding:* This principle addresses flexible tagging and rating schemes that can easily be translated into graphical representations - for example, graphs and spreadsheets.

3. *Collections as selections and vice versa:* This principle will enable groups to create a finer grained selection from the array of related video or audio data clips and also move from finer grained selections to collections that are new groupings.

4. *Applied authenticity:* The structure of the software design should (whenever possible) match the structure of the problem domain.

5. *Unfolding interpretations:* Learning environments should be designed so that users can survey past actions and performance as video already allows. User controlled animation and saved user-written revisions allow for discussion.

6. *Layered critique:* Creating layers of data for critique will enable users to see new juxtapositions and relationships among data.

7. *Revision Tracking:* The need to revise and keep track of revisions and changes. With video-audio-text data, the challenge of this design principle being implemented may be a glimmer in our eyes, but it should be included in this list. Simple saves of selected clusters would be a good beginning for this to principle to be actualized.

<u>Figure 1.</u> Design principles

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http://www.videoresearch.org

Connecting Online Learners at a Distance: The Promise and Challenge of Using Metaphors as Reference Points

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Abstract: This experimental study probed the effectiveness of three kinds of objects (videos, theories, metaphors) as common reference points for conversations between online learners. Outcome measures were learners' levels of tacit-knowledge (TK) of specific concepts related to their practice (teaching). Learners' level of detail-focus was examined as a mediating variable. Results showed a positive effect of detail-focus within Metaphor condition for two of three TK indicators examined. Implications for online conversation design are discussed.

Introduction

We argue that a lack of shared practice between online learners is a major factor in the shortcomings of attempts to create valuable online learning conversations. Wenger, McDermott, & Snyder (2002) describe shared practice as "a common repertoire of experiences, stories, tools, and ways of addressing recurring problems," (p115) and consider it a critical foundation through which people can negotiate meaning. This importance can be understood through Polanyi's (1966) theory of knowledge as a tacit-explicit duality: in conversation, we express explicit dimensions of our knowledge, but their meaning is rooted in the unspeakable tacit dimensions. Without a shared practice as a reference point for understanding what others mean by their words, online conversations will remain at a superficial level, or result in miscommunication (Carroll et al., 2003).

One way to address the problem of a lack of shared practice is to give online conversants an example of practice to refer to. This "common reference point" can create a bridge between individuals' tacit understandings and the explicit comments made in conversation. Thus an effective common reference point will serve two functions: one, it will be a tool that conversants can use to help construct meaning from one another's statements; two, it will help them make statements that most usefully reflect their underlying tacit understandings. We suggest that to serve these purposes, an effective common reference point should have two distinguishing features: (1) it must be a rich representation of practice so that participants can easily relate to it, and (2) it must be conceptually framed so that it will be understood similarly by everyone involved. Importantly, these two characteristics do not vary independently. A rich representation of practice (e.g. a video) inherently contains many details and participants may focus on different ones, thus interpreting the meaning of the video differently. In contrast, an object with a strong conceptual framing (e.g. a theoretical description of a practice) may be more abstract and thus difficult to connect with the feel of experience (Kessels & Korthagen, 1996).

What might a balance of these characteristics look like? Metaphors are a kind of object frequently used to provide a reference point for understanding new information. Nonaka (1991) discusses the power of metaphors as "a way for individuals grounded in different contexts and with different experiences to understand something intuitively through the use of imagination and symbols" (p. 100). They allow us to understand one domain in terms of another (Clark & Cunningham, 2006) and support abstract thought by allowing us to project from well-structured concrete domains to less-structured ones (Lakoff & Johnson, 1980). In this sense, metaphors can be thought of as providing a balance between rich representation and conceptual framing.

In the current study we used an experimental design to investigate the effectiveness of videos, theories and metaphors as reference points for online conversations where participants discuss their local practices. Context was support for student-teachers in "translating" learning theory to teaching practice. The primary research question was if the type of reference point used would affect student-teachers' tacit-knowledge of the learning theories. Learners' level of detail-focus (Cohen & Weaver, 2005) was examined as a mediating variable. We hypothesized that the metaphor would be the most effective reference point but that a high level of detail-focus would reduce this effect since learners could get distracted by the details of the metaphor and not attend to the overarching conceptual framing.

Method

Participants

58 of 81 (72%) secondary-level pre-service student-teachers at a large Midwestern university.

Treatment and Conditions

Participants were randomly assigned to one of six discussion groups. Two groups were assigned to each type of reference point. The three conditions were each given two 2-week long discussion tasks related to a model of learning (inquiry then transmission); differing only in how the model was depicted (Table 1). Thus each group received two reference points (transmission and inquiry) in the same format (video, theory, or metaphor).

Table 1. Study Condition Reference Points

	Video Condition	Theory Condition	Metaphor Condition
Transmission Reference Point	2:39 minute video of a teacher giving a presentation…	One way to characterize teaching thinks about learning as the transfer of expertise…	One way to think about a classroom is like a restaurant where the teacher serves…
Inquiry Reference Point	3:03 min video of a teacher asking a small group of students probing questions…	Another way to characterize teaching thinks about learning as a process of making sense of one's world…	Another way to think about a classroom is like a garden where the teacher's job is to nurture support growth of their "plants"…

The Detail-Focus Mediating Variable

The Detail-Focus scale was created based on an adaptation of Cohen et al.'s (2001) Learning Style Survey. Three 4-point Likert-style items asked student teachers to rate how often each of a set of statements characterized them to assess the degree to which they focused on particular elements of a situation. A mark of 4 indicated a high degree of attention to detail. Internal consistency as measured by Cronbach's α was .624.

Tacit Knowledge (TK) Indicators

Participants were asked to respond to a set of five reflection questions based on a video prompt adapted from Beck and Marshall (2002). Reflections were scored with respect to the following TK indicators.

Quality of Interpretation

Four 7-point Likert items assessed the degree of interpretation exhibited by the reflection, the quality of this interpretation, the degree to which learning theory was used to interpret classroom events and the quality of the learning theory use. A mark of 7 indicated a high quality of interpretation. Inter-rater reliability between two raters with one-point deviation allowed was 75%. All differences were reconciled. Cronbach's α was .880.

Focus on Deep Learning Structure

This was indexed in two ways. First each reflection was scored on Overall Focus on Teaching / Learning using a 7-point scale where 1 indicated a focus solely on classroom management and 7 indicated a focus solely on teaching and learning. Second, each reflection was broken into idea units which were scored for whether or not they referred to either learning theory. This was used to calculate the Percentage of Idea Units Using Theory. Inter-rater reliability between two raters was 75% for the first scale with a one-point deviation allowed, and 85% for the second scale. All differences were reconciled.

Procedure

An e-mail was sent to all secondary student teachers enrolled in the online seminar to solicit participation. It was explained that the seminar had been redesigned and that a study was being conducted to understand how to most effectively support student teachers online. Student teachers were asked to permit the researchers to access their coursework submitted as part of their normal participation in the seminar. In the first week of the seminar, student teachers completed the Detail-Focus measure. In weeks 2 through 5, the groups participated in two 2-week discussions of their classroom experiences through the lens of first a transmission and then an inquiry view of learning. They were asked to discuss how these approaches were and were not being used in their classrooms and ways they recognized the conceptual approaches in their classroom practice. In week 6, learners were asked to reflect individually on a classroom video for the tacit knowledge measure.

Analysis Approach

The goal of the study was to investigate the effects and interaction of reference point type (Condition) and participants' level of Detail-Focus with respect to the Tacit Knowledge Indicators. It was also necessary to take into account the potential effect of differences between groups within each Condition. A Hierarchical Linear Modeling analysis was carried out with SAS statistical software version 9.1 using the Proc Mixed procedure. Analysis of covariance was used to test for mean differences in the outcome variables between Condition adjusting for level of Detail-Focus. Condition was a three level fixed effect factor, Detail-Focus was a continuous covariate, and Group nested within Condition was a random factor. Interaction effect of Condition by Detail-Focus was included in the models. Multiple comparison tests were carried out using a Tukey-Kramer adjustment to ensure overall type I error for all pairwise comparisons in mean outcomes was less than / equal to 0.05. If the overall effect was not significant (p > 0.05), no pairwise comparisons were considered.

Results

Models satisfying convergence criteria were found for each TK indicator. For all, there was a negligible effect of Group within Condition, thus interpretations focus on the fixed effect factors and interactions. The interaction of Condition and Detail-Focus was significant for Quality of Interpretation (F(2,45)=4.4, p=.02) and borderline significant for the Deep Learning Structure indicator of Overall Focus on Teaching / Learning (F(2,43.7)=3.16, p=.05). No significant effects were found for the Deep Learning Structure indicator of % of Idea Units Using Theory. For the outcome measures in which an interaction effects was found, the slope of the line relating Detail-Focus to the TK indicator was estimated separately for each condition. A significant or borderline significant positive slope was found within the Metaphor condition for both Quality of Interpretation (slope=1.35, t(45)=3.47, p=.00) and Focus on Teaching / Learning (slope=.74, t(43.9)=2.05, p=.05). Pairwise differences in mean outcomes between conditions were calculated for each outcome measure at low (25th percentile), medium (50th percentile) and high (75th percentile) levels of Detail-Focus. For Quality of Interpretation, differences were found at low levels of Detail-Focus between the Metaphor and Video condition (difference=.88, t(45)=2.61, p=.03) and Metaphor and Theory conditions (difference=1.05, t(45)=2.70, p=.03). No significant differences were found for Focus on Teaching / Learning. Put together, these results show a positive effect of Detail-Focus on Quality of Interpretation within the Metaphor condition with individuals at a low level of Detail-Focus performing significantly worse than their Low-Detail counterparts in the other two conditions (Figure 1). A similar, though less dramatic pattern was seen for Focus on Teaching / Learning.

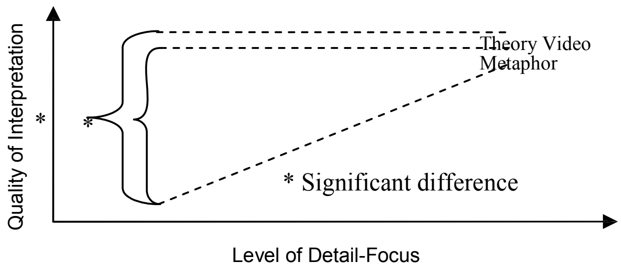

Figure 1. Quality of Interpretation versus Level of Detail-Focus by Condition

Discussion

While we had hypothesized that the metaphor would be the most effective reference point with the effect reduced for learners with high level of detail-focus, our results indicated the opposite conclusion. It seems that high detail-focus learners work well with all three kind of reference points, but learners with a low level of detail-focus have difficulties using metaphors as common reference points. A follow-up qualitative analysis of learner's comments indicates that this may be because low-detail learners (re)interpreted the metaphors in ways other than intended, adding and interpreting details based on their own experiences with cooking or gardening rather than those provided. It is suggested that a adding a pre-conversation phase in which the meaning of the reference point object is explicitly negotiated may address this issue. Future work will examine different ways to structure the conversation around the reference point object to better promote common interpretation and use.

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Explicit References in Chat-Based CSCL: Do They Facilitate Global Text Processing? Evidence from Eye Movement Analyses

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Abstract: Chat-based Computer Supported Collaborative Learning (CSCL) often suffers from limitations due to the communication medium. A frequently reported consequence is the lack of discourse coherence and by this a lack of cognitive coherence in the learning process. To overcome these deficiencies, the implementation of explicit references with chat messages caused higher learning results. We analysed eye movements during a chat-based CSCL scenario to gain indications of learners' use of explicit references for text processing.

Introduction

Probably the most important prerequisite for successful computer-supported collaborative learning (CSCL) is a successful communication process. Due to the medial properties of synchronous chat communication, a, frequently reported negative phenomenon is the somewhat 'chaotic' discourse structure, i.e., often the group discusses several topics in parallel, so apparently related turns are, in contrast to spoken conversations, sometimes not adjacent. Hence, chat-based communication usually suffers from communication deficits due to incoherence of contributions and related problems (e.g., Herring, 1999). Participants are frequently not able to identify the relationships among individual contributions – a phenomenon called co-text loss by Pimentel, Fuks, and de Lucena (2003).

To improve matters, the learning protocol approach (Pfister & Mühlpfordt, 2002) as a special variant of scripted collaboration in CSCL was suggested. Similar approaches have been developed (Kollar, Fischer, & Hesse, 2006). It proposes that synchronous chat-based discourses can be improved by controlling learners' discourse interactions by implementing a set of discourse rules in the virtual learning environment. Among other features, learning protocols define the sequence of participants' contributions, they require to assign a contribution type (such as 'question', 'explanation', etc.) to each contribution, and, most importantly, they require participants to explicitly indicate the reference of their contribution. Learners indicate what the referred to element of the current contribution is. This might be a previous contribution from the chat-history, or a fragment of some additional learning material, such as a common text, images, or diagrams provided by the learning environment accessible for all participants. The system automatically visualizes the referential relation with an arrow. As a result, the relationship of a contribution to previous contributions can be directly perceived on the screen, by simply following the connecting arrows. Theoretically, these explicit references should increase the coherence of the discourse and, as a consequence, improve global text processing, understanding and learning performance. In previous studies the potential benefits of learning with this kind of learning protocols in contrast to an unstructured chat discussion could be demonstrated for specific knowledge domains (Pfister & Oehl, in press). Especially, it was found that it is the referencing function, i.e., visualizing relationships among contributions or between a contribution and additional fragments, which is of major importance with respect to learning outcomes (Mühlpfordt & Wessner, 2005; Stahl, Zemel, Sarmiento, Cakir, Weimar, Wessner, et al., 2006). However, so far it is still unclear in which way these explicit references influence the cognitive processing of learners within a CSCL setting in order to provoke higher learning results, as reported.

Studies in research on CSCL usually gain their scientific findings from pre-/post-tests, video or logfile analyses. Although eye movements have proved to be a valuable source of information for the study of cognitive processes, they are hardly regarded in the field of CSCL. There are only very few eye tracking studies in research on learning. A crucial reason for this is the lack of suitable observational schemes. To bridge this gap, we proposed a categorial coding scheme for global text processing in CSCL on the base of established well-defined eye movement measures (Oehl, Pfister, & Gilge, 2008). In the current experimental study, we analysed eye movements during a chat-based CSCL scenario with learning protocols to gain indications of learners' use of explicit references. We suppose that explicit references enhance the coherence of the learning discourse and therefore simplify the learners' global text processing. As we know from previous studies, the explicit references chosen by learners are not automatically right, i.e., the referred to element of any current contribution of a learner could be false. Because of this, we addressed a second research question to our current study: How text processing is affected by true or false explicit references and which gaze patterns could be observed?

Methods

In this experimental study students (N = 24; 18 female and 6 male) from different faculties and of different age

(M = 23.17; SD = 4.17) volunteered as participants. To observe the gaze patterns of text processing within a usually rather complex chat-based CSCL scenario (e.g., different synchronous contributions, many gazes back and forth within the chat history and the whole interface, etc.), we simulated an about 20 minutes long standardised learning discourse with confederates about the topic 'earthquakes' within a learning protocol environment, based on the ConcertSuite® or ConcertChat® software, a platform for collaborative learning developed by the Fraunhofer Institute IPSI, Germany. All participants were randomly assigned to the experimental treatments, following an experimental design with two factors and two levels each (2x2-factorial-design). The first factor (between subjects design) was the type of learning protocol used for the learning sessions, i.e. participants either learned with a learning protocol with or without explicit references. Within the treatment without explicit references (simple chat), these were substituted by equal textual hints. The second factor (within subjects design) was the type of explicit referencing balanced over all participants, i.e. all participants had to cope with a defined number of chat contributions by the confederates within the standardized learning discourse whose explicit references could be either true or false. Eye movements, as dependent variable, were recorded by the head-mounted eye-tracking device iView X™ HED® and encoded with the software Interact® (version 6.10.4). For the eye movement analysis a categorial coding scheme had to be defined (Oehl, Pfister, & Gilge, 2008). Participants' eye movements were finally encoded according to two information categories: (i) behaviour and (ii) point of interest. The first category (i) behaviour comprised all possible behavioural actions of learners within the learning protocol scenario (reading, searching, browsing and writing). The definitions of the variables were based on gaze patterns, i.e., significant and well-defined eye movement measures in terms of fixations and saccades (e.g., Hyönä, Lorch, & Rinck, 2003). The second category (ii) point of interest indicated the point within the learning protocol environment, the (i) behavioural category was related to (common learning material, discourse contributions within the chat-history, etc.). The variables within each category were mutually exclusive and the combination of two variables out of the two categories resulted in one definite eye movement code for global text processing. Three trained raters encoded the recorded eye movements according to the developed categorial coding scheme. On average each participant's experimental session resulted in about 400 definite eye movement codes. For each category of the coding scheme high inter-rater reliabilities could be obtained: (i) behaviour ($\kappa_M = 0.86$) and (ii) point of interest ($\kappa_M = 0.91$). With regard to the guidelines for the collection and standardised analysis of eye movements proposed by Scott and Findlay (1993), this coding scheme meets the required quality standards of objectivity and reliability.

Three research questions were addressed to this experimental study: 1) Text processing between the two learning protocol treatments, i.e., with or without explicit referencing, is different. It is supposed that text processing of contributions with explicit references is intensified because of a higher coherence. 2) Text processing of contributions with true and false references is different. It is supposed that false references especially in the treatment with explicit references are confusing for text processing. 3) Less text processing is necessary to make a chat contribution without explicit referencing than with explicit referencing.

Results

Results showed different text processing between the two experimental treatments of the first factor (type of learning protocol, i.e., with or without explicit referencing). If explicit references were provided, learners read current contributions 25% more frequently (M = 2.21 times, SD = 2.21 times) $t_{(46)} = 5.339$, $p < .001$. Furthermore they spent on average 0.10 seconds per word more on reading the current contribution (M = 0.73s, SD = 0.14s) $t_{(46)} = 2.978$, $p = .005$. Additionally explicit references caused learners to search the reference scope about 2.7 times more frequently $t_{(46)} = 9.67$, $p < .001$ and to read it twice as long (M = 3.48s, SD = 1.82s) than without explicit references (M = 1.70s, SD = 1.20s), $t_{(46)} = 4.009$, $p < .001$. With respect to the second factor (type of explicit referencing, i.e., true or false), the following gaze patterns for text processing could be observed. Within the experimental group with explicit references, participants read current contributions with true references 20% longer (M = 17.02s, SD = 2.76s) than current contributions with false references (M = 14.20s, SD = 2.94s), $t_{(22)} = 2.415$, $p = .013$. Moreover, they read false reference scopes (M = 4.46s, SD = 1.69s) approximately 70% longer $t_{(22)} = -3.089$, $p = .003$ and about 25% more frequently $t_{(22)} = -2.282$, $p = .016$ than true reference scopes (M = 2.51s, SD = 1.39s). Within the experimental condition without explicit referencing, participants' text processing in terms of reading duration of current contribution or reference scopes was not affected by true or false hints serving as substitutions for explicit references. However, participants within the learning protocol treatment with explicit references needed nearly 28% more time to find the true reference scope than subjects within the learning protocol condition without explicit referencing, $t_{(22)} = 7.506$, $p < .001$. Nevertheless, no difference could be observed with regard to reading true reference scopes. On average learners within the experimental group with explicit references read the true reference scope M = 0.297 times (SD = 0.14) and about M = 1.18 s (SD = 0.84) per false referencing. The experimental group without explicit referencing read true reference scopes on average M = 0.32 times (SD = 0.26) and about M = 1.15 seconds (SD = 1.28). Instead the experimental group without explicit referencing read other previous contributions to the chat history absolutely about 3.3 times longer, $t_{(22)} = -3.053$. $p = .005$, and per word about 2.5 times longer, $t_{(22)} = -3.055$, $p = .004$, as well as about 2 times more frequently, $t_{(22)} = -1.827$, $p = .044$ if false references were presented. With regard to participants' own contributions to the chat discourse, different text processing in preparation of a contribution could be observed. If participants had to define an explicit reference accompanying their contribution, they needed on average approximately twice more searching time and browsing time in the chat history and the text material until they made their contribution (M = 48.30s, SD = 22.36s) compared to participants in the experimental treatment without explicit referencing (M = 25.14s, SD = 12.90s), $t_{(22)} = 3.108$, $p = .005$.

Conclusion

Studies in research on CSCL usually gain their scientific findings from pre-/post-tests, video or logfile analyses. Although eye movements have proved to be a valuable source of information for the study of cognitive processes, they are hardly regarded in the field of CSCL. A crucial reason for this is the lack of suitable observational schemes. To bridge this gap, we proposed a categorial coding scheme for global text processing in CSCL on the base of established well-defined eye movement measures. Experimental results of eye movements showed that explicit references caused a more intensified text processing among learners. They read current contributions more often and longer compared to learners without explicit references and especially they were caused by the explicit references to relate the current contribution better to the referred to element of the learning material or of a previous contribution. However, if the explicit reference was false, learners had bigger problems to disintegrate the false reference in order to find the true reference scope. In this case, learners in the condition without explicit referencing needed less time to find the true reference scope. Moreover, they used their time to read previous contributions, if they were provided with false references. With regard to participants own contributions learners without explicit references made faster contributions to the chat discourse compared to learners with explicit referencing. But the need to identify a true element to refer to, caused an intensified text processing in terms of searching and browsing the learning material as well as the chat history.

Taken together, explicit references provoke an intensified text processing regarding the receiver of a chat message – no matter if the referencing is true or false, and they demand an intensified text processing regarding the producer of a chat contribution. However, the current experimental study addressed only text processing in terms of eye movement analyses in a first preliminary step. Of course further questions have to be addressed and discussed especially how eye measurements predict dependent variables such as learning performance or grounding in communication? These questions are focussed on in further research to give advanced guidelines for (chat-based) CSCL.

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Analyzing technology-enhanced knowledge practices in an engineering course

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Abstract: The role of educational technology on facilitating advancement of knowledge was investigated in a term project "Multimedia Product" in the Metropolia (former EVTEK) University of Applied Sciences. The purpose of the study was to investigate how the technology under investigation – Knowledge Practices Environment (KPE) – facilitates working collaboratively with shared knowledge objects. It appears that students used KPE mostly for managing and sharing project documentation; and that task was usually delegated to one team member. Students found that organizing items in the content view helped them to get an overview of the tasks, knowledge objects and their interrelationships. On the other hand, the flexibility of the KPE, especially the possibility for all team members to edit and change anything openly might also be a challenge; it requires systematic organization of materials. More research is needed before KPE's potentials and pitfalls in shared knowledge advancement can be reliably assessed.

Introduction

New educational technology provides challenges but at the same time potentialities to develop practices of working in higher education. The emphasis on knowledge work in modern society requires new kinds of competencies also from students: knowledge workers should be able to collaboratively produce new knowledge and manage increasingly complex knowledge objects (Knorr Cetina, 2001; Muukkonen, Lakkala & Paavola, in press). At the same time, modern collaborative technology requires and enables novel practices of working with knowledge. This development presents requirements to collaborative technology in educational settings: it should provide students with *affordances* for creating new knowledge together.

The present study focuses on technology's role on facilitating knowledge creation in a collaborative design process. A theoretical background is provided by the so-called *knowledge-creation approach* to learning (Paavola & Hakkarainen, 2005) which characterizes learning as a collaborative process of advancing and producing shared knowledge objects, like documents, practices, and product designs. This approach to learning is called 'trialogical' because it emphasizes the role of shared objects produced instead of concentrating on individuals' learning (a monological approach) or just on interactions between people (a dialogical approach).

The collaborative technology under investigation, Knowledge Practices Environment (KPE), is developed in a 5-year EU-funded project Knowledge-Practices Laboratory (www.kp-lab.org), that aims at creating tools, theories and models for promoting innovative practices in education and workplaces. KPE has been specifically developed to provide tools for the joint development of knowledge objects as well as for planning, organizing and reflecting on related tasks (see Markkanen et al., 2008). KPE is a virtual environment where students are able to build shared working spaces *('shared spaces')* for managing their projects; each shared space includes a set of basic, integrated tools and functionalities like wiki, note editor, commenting, chat, semantic tagging and semantic search – for working with the knowledge objects. The design of KPE builds on the ideas of Scardamalia & Bereiter (2003), implemented in the Knowledge Forum software to afford collaborative knowledge building.

KPE has features aimed at supporting collaborative working with knowledge objects: the contents of a shared working space can be viewed from different perspectives: In the *content view,* the user can work on the knowledge objects (files, tasks, web links, notes, wiki pages etc) and their relations (see Figures 1 and 2); the *process view* focuses on tasks, responsibilities and the temporal dimension of the project; and the *community view* lists participating users, their current presence and their activities. Various tools and functionalities are highly integrated in the basic views to enable versatile and the flexible connection, organization and reflection of all information related to the knowledge objects and processes. Furthermore, KPE enables object-bound and threaded commenting on all items in the content view (task items, files, web-links, notes).

The present paper is based on a pilot data collected in an engineering course aimed at learning collaborative design practices. The aim of the study is to investigate the role of the new technology in supporting collaborative work with knowledge objects. More specific research questions are: 1) How was KPE actually used by the engineering students? 2) What were the experienced benefit and pitfalls of the technology? 3) How was the content view used by the students to organize the knowledge objects?

Methods

Setting

The investigated course was a higher education course, "Multimedia Product", conducted in the Metropolia (former EVTEK) University of Applied Sciences during spring 2008. The goal of the course was to learn collaborative design practices and project-based working methods in the context of designing multimedia products for real customers. Participants were 25 international students in seven teams.

Two design teams (team 1 and team 2) were investigated in more detail. Team 1 (music video team) consisted of four engineering students whose task was to create a music video for a Finnish rock music band. Team 2 (website team) consisted of four engineering students whose task was to build a dynamic and interactive website for a health organization in Ethiopia.

Data collection

The data collected from the course included the videotaped sessions of students using the KPE, database materials from all design teams (i.e. the content and process views), classroom observations and student questionnaires after the course. The student questionnaires focused on the usability of the KPE.

In addition, combined "stimulated recall" and interview sessions with the leader of two teams were videotaped after the course. Stimulated recall was conducted by having an interactive session with the student, lead by researchers, where the database content of his group's virtual spaces are discussed and evaluated (Lyle, 2003). Two design teams' content and process views were used as a "mirror" stimulus to the session. The focus of the stimulated recall sessions was on the students' actual experiences of using the KPE tool.

Data analysis

Answers to questionnaires from all 25 students and the database content of all seven teams' shared spaces were used for analyzing how the students, in general, used KPE in their design work and experienced its benefits and pitfalls. Two team leaders' stimulated recall interviews and their database contents were used to examine, in more detail, how the affordances of the content view was used for organizing the shared knowledge objects.

Qualitative analysis was conducted to the combined stimulated recall and interview data, and student questionnaires by choosing sections from the students' explanations that specifically described the usage and benefits or pitfalls of KPE in the team project. The database contents of two investigated teams' shared working spaces in KPE were analyzed qualitatively to get an initial idea on how the students organize their shared spaces. The analysis was centered in the set-up and visual arrangement of the two teams' content views.

Results

1) The usage of KPE

Engineering students used KPE mostly for managing and sharing project documentation and setting up schedules for their projects. Only one or two team members used the environment; teams tended to divide the labor so that the members responsible for project documentation were also responsible for managing the group's shared working space. Therefore, students did not use KPE for collaboratively working with and elaborating on the knowledge objects. The possibility to attach comments on the knowledge objects in the content view was used by the teacher; she used it for commenting teams' design documents and giving feedback to students work.

2) The experienced benefits and pitfalls of KPE

Engineering students reported several benefits of the KPE. It facilitated the sharing of documents because there was no need to transfer documents back and forth between the team members, computers and applications. KPE also facilitated version control because it was easier to share the correct version of the document. Another advantage was that the environment afforded having a visual overview of the documents, tasks and their relationships with each other.

Disadvantages were also mentioned. KPE became available late in the course and there were still many bugs and delays. One student opined that the content view can become messy if there are lots of items. The student hoped for a possibility to lock the position of content items to better manage the shared view.

3) Organizing knowledge objects in content view

Two teams' usage of their shared space was analyzed in more detail. The Website team's content view (see Figure 1) was spatially divided in two parts; the task items (white rectangles) and the links connecting task items were arranged on the right side of the view; the content items (black rectangles) representing project documentation were arranged on the left side of the view. Furthermore, the content items were hierarchically arranged so that the project definition document was placed on the top, and documents created during the design process (mock-ups, testing plans, questionnaires) were placed underneath.

Similarly, the Music video team's content view (see Figure 1, right) was spatially divided in two parts: most of the content items representing project definition, meeting memos, mock-ups and tests were placed on the right side of the view, and the task items (white rectangles) were arranged on the left side of the screen. The music video team arranged its content items around a wiki page, containing the documentation for music video project. Overall, the organization of the shared view in the Music video team appears more elaborate than that of the Website team: it has more items (i.e. knowledge objects and tasks), the structures are deeper and most of the items are linked together.

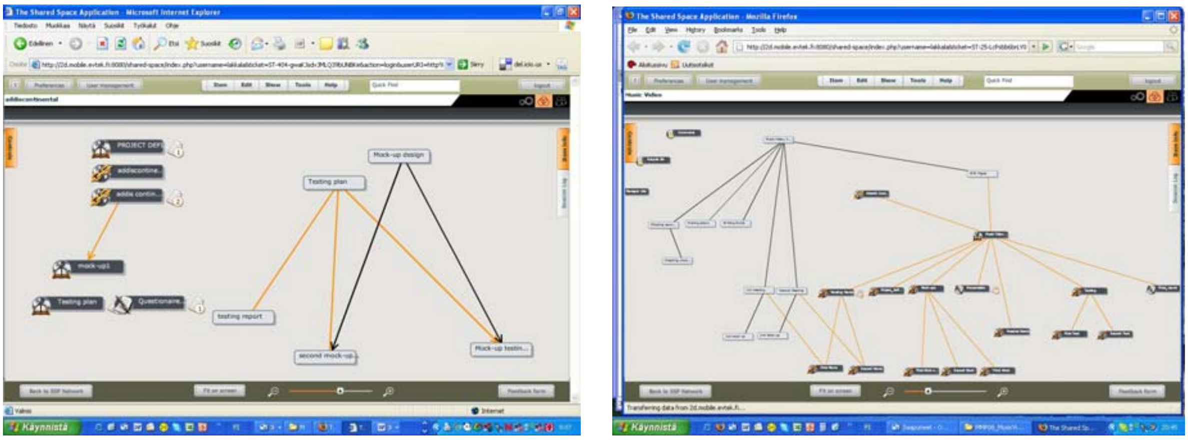

Figure 1. Screenshots of the contents and organization the website team's (left) and music video team's (right) content views.

Discussion

Contrary to expectations, students did not use KPE for collaboratively working with knowledge objects. Lack of genuine collaboration might be partly due to the fact that KPE became available late in the course, when students had already adopted other tools. Another, perhaps more likely, reason is that for genuine collaboration to emerge, technology needs to be coupled with pedagogical practices that direct students towards collaborative working practices (Bielaczyk, 2006). This conclusion is supported by the fact that student teams appeared to resort to rather strict division of labor when organizing their work, typical for project work in engineering area.

The possibility to flexibly organize and link materials in a team's shared space appears to facilitate creating an overview of the items, tasks and their interrelationships. On the other hand, the possibility for all team members to flexibly edit and change anything might become a challenge, because it requires systematic organization of material. More research is needed before KPE's potentials and pitfalls in shared knowledge advancement can be reliably assessed.

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Context and Scripts: Supporting Interactive Work-Integrated Learning

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Abstract: Computational support for work-integrated learning will gain more and more attention. We understand informal self-directed work-integrated learning of knowledge workers as a by-product of their knowledge work activities and propose a conceptual as well as a technical approach for supporting learning from documents and learning in interaction with fellow knowledge workers. The paper focuses on contextualization and scripting as two means to specifically address the latter interaction type.

Motivation

Following Machlup (Machlup 1962), we describe a knowledge worker as an employee of an organization whose essential operational and value creating task is the production and distribution of knowledge. This specifically entails the engagement within four types of knowledge work: creating knowledge, acquiring knowledge, transferring knowledge and applying knowledge (Kelloway & Barling 2000). In our opinion, learning is both a by-product and an enabler of knowledge work (de Hoog et al., 2008). Technical support for learning and especially for learning while doing knowledge work has to be developed to support knowledge workers in increasing their productivity – this was postulated by Peter Drucker (1999) to be one of the major challenges of the 21st century. The goal of the EU-founded APOSDLE[1] project is to enhance knowledge worker productivity by supporting informal self-directed work-integrated learning (Lindstaedt et al., 2007) in the context of knowledge workers' everyday work processes and within their computer-based work environments. This paper will describe the APOSDLE projects' approach to work-integrated learning and the APOSDLE (software) system supporting knowledge workers in work-integrated learning.

Work-integrated learning within the APOSDLE project

The APOSDLE project aims at providing technical support for informal self-directed work-integrated learning. This support should be provided by means of a generic application that is not domain specific. Two workplace learning studies have been carried out within the APOSDLE project to empirically examine actual work-integrated learning behavior of knowledge workers (see Kooken et al., 2007 and more in general Feldman, 2004; Cross and Parker, 2004; Dalkir, 2005). The following results are most relevant:

- Interpersonal help seeking is the solution most often applied by a knowledge worker in order to find the knowledge she needs. This is complemented by other sources of material such as (digital or paper) documents.
- When searching for documents, difficulties are experienced in trying to figure out what one is looking for, not being able to decide on what is important to know and not knowing where to find the documents.
- When trying to find knowledge in documents the main problems are that the information is too specific for immediate use, the information is not sufficient to solve the problem and no information can be found at all.

Resources for supporting work-integrated learning are *documents*, such as text documents, images or video's on the one hand and *interaction* with other people on the other hand. We will shortly explain our approach for the first kind of resources and than go into more detail for the second. In order to computationally support such highly interactive, flexible, and domain-independent types of learning we have to apply intelligent technologies which are able to handle uncertainty, imprecision and continuous change. Lindstaedt et al. (2008) describe how scruffy technologies can be applied for user context detection, user profile maintenance, and knowledge resource recommendation.

Supporting work-integrated learning through interaction with documents

The main challenge for APOSDLE is that the learners and domain are not known in advance. This rules out standard instructional design approaches, including the construction of specific learning material. In APOSDLE the existing documents in the organizational repository are the only resources available for supporting learning. The solution for this challenge is to define some generic components that can be instantiated at the moment the learner asks for information from documents. The first generic component is establishing the goal of the search. For this we use the basic classification of learning goals developed by Anderson and Krathwohl (2001). From user experience with earlier APOSDLE prototypes, it became clear that these abstract learning goals are hard to understand for users. We decided to rewrite these learning goals as a set of predefined questions or request as proposed by Gehry (1991). This leads to questions like: What must I do? How do I do it? Am I doing it right?, or requests like: Show me…!. By presenting these questions and/or information types to learners, one can help them in their orientation and choice of learning goals.

The second generic component has to do with the content of the material. Apart from a topic, this content can have a meaning that goes beyond the immediate content covered. As APOSDLE is domain independent, this second meaning should be applicable across a wide range of domains. The concept we use is the *material use* of a document (see de Hoog et al. 2002). Material use reflects the role a document, or part of a document, can play in supporting learning. Examples of material use we employ are definition, explanation, how-to and checklist. As can be easily seen, these material uses do not depend on a domain. An explanation can occur in any domain, the same holds for definition.

In APOSDLE we link the first generic component (learning goals, questions) to the second (material use). Each learning goal is associated with one or more material uses. Next we develop for each material use a template that is instantiated when a learner selects a question (learning goal) if she is using the system. This template is filled with a document, or a snippet of a document, retrieved from the organizational document repository, that matches the topic and the material use(s) associated with the question. In addition, hints are provided about how to learn more about the question and the topic. These hints are also based on the selected learning goals and the associated material use(s) and are intended to support the learning functions proposed by Simons (2000).

Combining generic learning goals (questions) and generic material uses, enables us to overcome some of the problems caused by the need to be domain independent. We do not claim that this solution is optimal, it is to be expected that domain tailored learning environments with their own specifically designed learning material will do better. However, this advantage is offset by the costs involved in building these systems, but also by the fact that they are quite often separated from the workplace and cannot flexibly adjust to problems and learning needs that arise during daily work.

Supporting work-integrated learning through interaction with fellow knowledge workers

As literature (Feldman, 2004; Cross and Parker, 2004; Dalkir, 2005) and the APOSDLE workplace learning studies suggests, interaction with other people is a major source of learning at the workplace. The interaction itself can be understood as a process consisting of several steps and activities. We modeled this process in order to be able to understand and support the different activities that have to be carried out for a successful interaction between a knowledge seeker on the one hand and a knowledgeable person on the other hand.

The contextualized interaction process is a general model of interrelated events occurring while two or more knowledge workers interact with each other, e.g. communicate, collaborate or coordinate their activities. The three phases of the contextualized interaction process correspond to Simons (2000) learning functions for self-directed learning as explained above. Typical preparatory functions are carried out within the pre-interaction phase, while executive functions are mapped onto the interaction phase. Finally, closing functions are applied within the post-interaction phase.

The APOSDLE model of contextualized interaction includes an approach for supporting interaction of knowledge workers through guidance. Scripts are used to provide guidance on different granularity levels and fading levels. We differentiate between interaction scripts on macro and on micro level as described by Dillenbourg and Hong (Dillenbourg, Hong 2008). On macro level the *interaction guidance script* will guide interaction partners through the overall process and helps them to internalize the process phases. This is visually done by an APOSDLE system wizard component. It makes the process phases and steps visible to the knowledge workers. Scripts on micro level will help knowledge workers to individually use each process phase as efficiently as possible for problem solving and learning. We developed *interaction scripts* for all process phases. For the pre-interaction phase we developed a request script by adapting problem formulation scripts (Nückles et al. 2007) and social scripts (Weinberger et al. 2003). Considering Dillenbourg's work we further formulated the request script for different fading levels (Dillenbourg, Hong 2008) which depend on the knowledge workers increasing internalization of the process phases.

Summary and discussion

In the previous sections we described the conceptual and practice driven approach to work-integrated learning in the APOSDLE project. Based on a formal model of the interaction process we especially showed how contextualization and scripting are applied to improve learning at the workplace while knowledge workers are interacting. This approach has been implemented in prototypical software which was used in a field evaluation together within four application partner organizations. First evaluation results are promising and showed the overall validity of the underlying concepts and models in real world scenarios. Thus a generic work-integrated learning process was modeled from interviews with application partners. It shows the interconnection of learning from documents and learning from interaction with others as basic strategies of knowledge workers to solve a work related problem which approve the presented approach.

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[1] Advanced Process-Oriented Self-Directed Learning Environment, www.aposdle.org

Supporting Collaborative Learning Across Social Media Applications

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Abstract: The lifelong learner of our times may use multiple social media applications to keep in touch with the emerging knowledge and with the relevant people in his domains of interest. However this kind of activity is not supported by the existing applications. This poster proposes a scenario and an application to help users manage their social learning activities in order to find the most relevant and most trusted information produced in the network.

Introduction

The domain of Computer Supported Collaborative Learning aims to provide support for students learning together using computer technology. The way people learn in a social environment has been studied for more than half a century (Vygotsky, 1934/1986) and the fact that people learn socially is now generally accepted. Learning can be done in formal environments like school and higher education but can also be performed continuously through the learner's life. This lifelong learning can be done through postgraduate specialization courses taken by the learner from time to time or can be performed through the participation of the learner in a community of practice (CoP) (Lave & Wenger, 1991). A CoP is a group of people specialized in a domain that interact exchanging information and producing knowledge for that domain. The newcomers in the group learn by acquiring the community's knowledge and sociocultural practices.

The usage of communities of practice in CSCL has grown a lot due to the fact that the Internet has spread all over the world and the tools for online collaboration have become very evolved. The list of tools for the CoP started with mailing lists, forums, wikis and blogs and continues now with complex social networking environments. These environments allow the members of the community to produce content, to maintain and develop social connections, to find relevant content and to discuss it. All these features can be used inside a community of practice for lifelong learning. The problem emerging here is that the next step for these communities is their scattering across multiple social networking environments, and this is what is happening these days. The members of the communities are using multiple applications for creating, sharing and discussing content. The learner, especially the newcomer (or novice) will have difficulties to follow the relevant conversations, to retrieve the best content and to find quickly the needed and most trusted information.

This poster aims to describe the learning scenarios for a user in this kind of communities and to describe an application that aims to help the learner to manage his interactions with the community. The paper continues with a section that discusses the learning scenarios where this application could be used. The next section presents some preliminary results that we obtained using this application. The final section presents the conclusions of the work performed so far and the directions for future work.

Learning Scenario

The scenario that we considered is one where the learner is a member of a community that uses multiple social applications (blogs, video sharing, photo sharing, social bookmarking). The tutor is simply a more experienced member of the community. His role is to guide the learner, help him to become an advanced or expert member of the community, introduce him to the community's artifacts. This scenario is a typical CoP learning scenario and it is well defined in (Lave&Wenger, 1991).

The relation between the tutor and the learner is one of the most interesting aspects of this scenario. This relation has the following characteristics:

- Interchangeability – the learner and the tutor can change roles for some specific sub-domains of the community where the learner might be more knowledgeable
- Acknowledgement – the tutor acknowledges the fact the learner follows him and tries to guide him in a direct way – communicating and providing feedback. If the relation is not acknowledged, the learner just follows the expert tutor and learns by reading the content provided by this one.
- Trust – the tutor is part of the learner's network. Therefore the tutor trusts him and also trusts the content provided by the tutor. The content on a specific subject created by a trusted user will be more relevant to a learner than the content recommended by a classical search engine.

- Strength – the relations can be of multiple types and strength. We classify the relations considering the most used names in the social applications and we describe which are their characteristics and their relevance for our work
    - o "Friendship" – bidirectional, acknowledged relation. Both users acknowledge the relation inside the application. It is the strongest relation that can be usually detected in a social networking application
    - o Follower – unidirectional, usually not acknowledged, usually the relation between a learner and his tutor. The learner subscribes to the content added by the tutor or comments on his blog or adds him to his blogroll. This relation shows that the follower watches the content produced by the followed. This relation usually implies trust between the follower and the followed.
    - o Followed – unidirectional, usually not acknowledged. This is the inverse relation of the one above. The "followed" relation doesn't generally imply trust as the tutor can't have any idea or control over who's reading his content. This is the weakest relation considered.

A final aspect of the learning scenario is that the user can learn from various types of content: slides, videos, text. These are posted in social environments and it might be very relevant for a learner to retrieve them when needed. The only way available to do that is by using the metadata for that content, the tags with which the authors have annotated their content.

Considering those aspects we consider that we can help the learner in his activity by:

- Profiling the user and his peers in the network based on their interests. Their interests will be obtained from the tags that the users and their peers are using to annotate content
- Providing relevant search results and recommendations based on content provided by the most trusted users in his network.
- Providing relevant tutor recommendations for a given subject.

For a tutor, this application could be relevant to monitor the activity of his followers, to manage, analyze and retrieve the content they produced and to identify the most knowledgeable learner on a given domain. As the relations are interchangeable the tutor can also use the application to keep in touch with the new discoveries in the domain he's interested in.

Description of the application

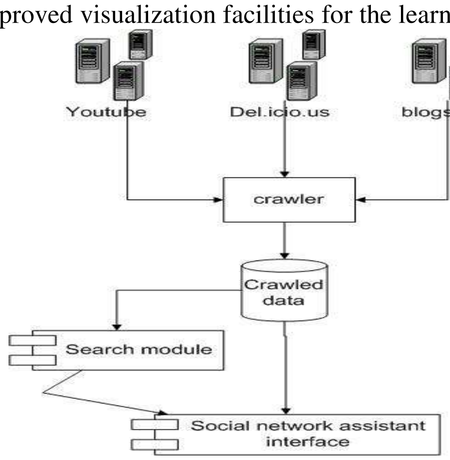
We have decided that the purpose of the application should be to manage the network of the learner providing personalized search and recommendations, providing relevant results that the learner can *trust* as they are provided by his community of practice.

In order to achieve these goals, the application needs to monitor the learner's existing network, indexing resources for future search, discover potential new peers, answer the learner's queries and perform recommendations.

The monitoring part is made of a knowledge acquisition module that fetches data from the social networking applications that the learner uses. The module uses the specific social applications' APIs to extract data about relations, content and annotations produced by the learner and his peers and the peers of their peers.

The search module uses the data indexed by the monitoring module to provide the user with results and recommendations. The search is performed using a tag search algorithm – FolkRank (Hotho, 2006). This algorithm allows search on all the types of documents indexed by the monitoring tool – videos, photos, presentations, bookmarks, considering only the tags added by *trusted* users for those specific documents.

Finally the last module of the application is the user interface. This aims to provide results and also to offer improved visualization facilities for the learner's network.



Preliminary results

The first results were the analysis of some user networks in order to see their structure, their dimension, the number of resources, the problems that could appear in search. For example, using data obtained from the monitoring tool we have analyzed the network of a random active user on Youtube.com and we have searched some concepts that are used by people in his network. The user had 826 other users connected with him on the first two levels. These users created a number of almost 10,000 annotation on movies with more than 17000 tags. These numbers are for one user and for only one platform. If the user would have used also a blogging platform and a social bookmarking one, the numbers would have been much bigger.

After gathering the data we have analyzed the tags used in the network using tag clustering and we have discovered that depending on the communities that a user belongs to, the tags can have different, ambigous meanings. For example, we have identified in the same user's network the term "eclipse" with two different meanings – astronomic phenomenon and music item – and probably if the study would have contained a social bookmarking platform as well, we would have also identified the meaning "software application". This means that we need to consider the semantic differences between words inside a user's network because even when searching a user's network, which we expect to be a focused space, we can find polysemantic words. We also used Markov Clustering Algorithm (vanDongen, 2000) to find clusters of tags. These clusters can help the user to rapidly identify the topics discussed inside his network. An example with the first 3 sets of tags for the user that was discussed above is presented below:

- obama 2008 mccain Election president barack Hillary Clinton convention DNC democrat campaign primary presidential elections voting vote Republican Democratic
- metallica hetfield kirk lars ulrich else matters
- vista windows apple PC macintosh jobs

Conclusions

We presented a learning scenario and an application for managing the learner's activities in a distributed community of practice. We believe that the learning scenario is adapted to the learning process in the Web 2.0 communities and we have developed an application that helps the user adapt to such an environment and to obtain maximum benefits from it. We have also studied the structure of the data existing in such a network in order to improve the existing tag based search algorithms.

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Design Distributed Scaffolding for Modeling a Complex System

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Abstract: Based on the expert-novice analysis, we developed a distributed scaffolding curriculum for modeling air quality (DSCMAQ) to facilitate high school students' model-based reasoning in a technology-enhanced learning environment (APoME) which provided the Modeling Air Quality (MAQ) software associated with gradual complex learning tasks. Three studies had conducted to evaluate the effects of DSCMAQ on students' modeling practices. In these three studies, students worked in a small group to complete DSCMAQ and their modeling abilities were improved after DSCMAQ.

Introduction

In current science education reform, models and modeling have been regarded as necessary to scientific literacy (National Research Council, 1996; AAAS, 1993; Gilbert, 1991; Linn & Muilenberg, 1996; Perkins, 1986). As constructivist epistemology becomes more widely adopted, most science educators now agree that scaffolding students by building models to help them understand scientific phenomena is an effective instructional method (Sins, Savelsbergh, and Joolingen, 2005; Jonassen, Strobel, and Gottdenker, 2005). However, researchers have pointed out that students face a variety of problems during the model-building process (Coll, & Treagust, 2001; Kawasaki, Herrenkohl, and Yeary, 2004; Sins, Savelsbergh, and Joolingen, 2005) so scaffolds are needed for model-based learning. Since there are multiple students with different zone of proximal development (ZPD) in a classroom context, a single teacher can't provide scaffolds for all students at the same time (Brown, Ash, Rutherford, Nakaguwa, Gordon, and Campione, 1993). A software-based support (Guzdial, 1995) was suggested to embed several kinds of supports in software such as building blocks for building a model & visualizing the connections between pieces of a model (Guzdial, 1995), evidence hints & metacognitive hints to support students' scientific reasoning (Knowledge Integration Environment, KIE, Linn, 1995; Davis, 2003), and supportive, reflective & intrinsic prompts (Model-It, Jackson, Krajcik, and Soloway, 2000).

Distributed Scaffolding for Modeling –Based Learning

According to a scaffolding design framework proposed by Quintana, Reiser, Davis, Krajcik, Fretz, Duncan, Kyza, Edelson, and Soloway (2004), the Modeling Air Quality (MAQ) software included the following features: (1) a visual conceptual organizer (the advance organizer in the building phase, see Figure 1); (2) an expert guidance for applying science content and modeling practices (supportive prompts in the testing and applying phases, see the right corner in Figure 1); (3) explicit disciplinary strategies for students' creating artifacts (data analysis tools); (4) representations to reveal underlying properties of data (viewing data from horizontal distribution, vertical profiles, trend graphs, difference graphs, and a one-hour interval loop of pollution density figures); (5) multiple views of the same data (viewing data horizontally and vertically) and malleable representations (everywhere in the MAQ software); (6) restricting a complex tasks by setting useful boundaries and using ordered & unordered task decompositions (the complexity of the tasks increasing from the testing to applying and evaluating phases); (7) constraining the space of activities by using functional modes (constraining the space of activities in the four phases of the MAQ software) and automating nonsalient portions of tasks to reduce cognitive demands (the computer program is in charge of calculating pollutant density associated with variables and distances from pollutant sources); (8) facilitating navigation among tools and activities (the interface designs allow students to navigate among data analysis tools, the advance organizer, supportive prompts, setting of inputs, and the result for each trail).

Finally, we developed a distributed scaffolding curriculum for modeling air quality (DSCMAQ) including two parts: background knowledge (unit 1 and 2) of air quality and model-based reasoning in a technology-enhanced learning environment (APoME) which provided a MAQ software and learning activities from unit 3 to 5 with gradual complex tasks to facilitate students' modeling practices. We conducted a series of studies to examine the effects of scaffolds. In these studies, students worked in a small group to complete DSCMAQ so that they could gain more learning supports from peer discussions and whole-class discussions when sharing ideas or responding to the teacher's questions.

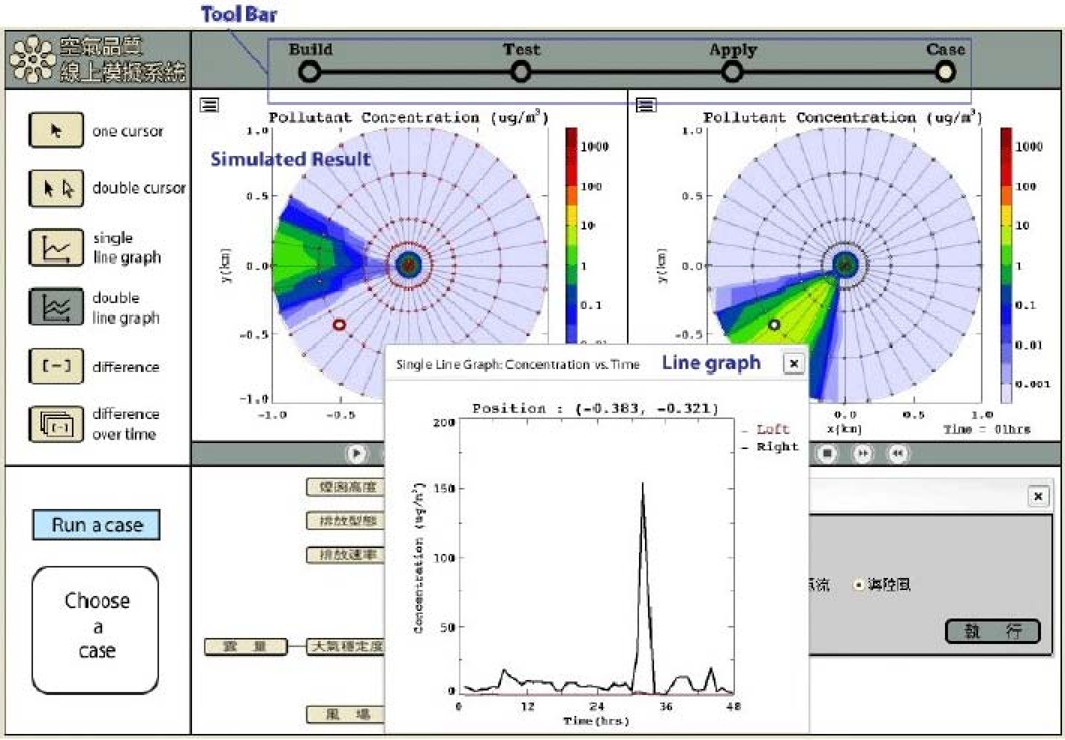

Figure 1: Interface of the MAQ software

Methods

In order to examine the effect of distributed scaffolding, design-based research is used to conduct a series of studies with various scaffolds and instructional design. For study 1, 28 tenth graders were grouped into 8 groups (4 groups selected randomly as the focus groups) to complete the first version of the MAQ software which provided an advance organizer to help students identify and connect major variables related to air quality. After revising the MAQ software based on the findings of Study 1, we conducted Study 2 (34 senior high school students in 10 groups) in order to promote students' abilities in planning, experimental design and identifying relations. After adding explicit prompts with inquiry cycles in activity sheets, Study 3 (24 tenth graders in 12 groups) was used to explore how students identified relations and modeled air quality.

Results

The interviews of the focus groups in Study 1 showed that most students' ability in making conclusions was improved distinctly but slightly in planning, experimental design, and identifying relations after the intervention. Students in Study 1 made significantly progress in conceptual comprehension ($t=3.319$, $p<0.003$). Study 2 showed that students' modeling abilities were improved significantly ($t=3.841$, $p<0.001$) after the intervention; especially, in planning and experimental design but still slightly improved in identifying relations (see Table 1). Study 3 using explicit prompts in inquiry cycles helped students verify learning tasks during modeling air quality so students' overall modeling ability were improved significantly after the intervention ($t=4.832$, $p<0.000$); especially in identifying relations (see Table 2). It is hoped that the present study can at the very least serve as a foundation for future research in identifying and explaining the elements and functions of model-based teaching and learning (MBTL).

Table 1: Summary table of paired-t test in Study 2 Table 2: Summary table of paired-t test in Study 3

	Pre-test		Post-test		t	P
	mean	S.D.	mean	S.D.		
Planning	0.88	0.66	1.5	0.622	4.706	.000**
Experimental design	1.09	1.279	2.22	1.539	3.588	.001**
Identifying relations	2.22	1.913	2.56	1.703	0.938	0.355
Total	4.19	3.021	6.28	3.040	3.841	.001**

	Pre-test		Post-test		t	P
	mean	S.D.	mean	S.D.		
Planning	1.35	0.573	1.35	0.573	.000	1
Experimental design	1.78	1.476	2.35	1.027	1.769	0.91
Identifying relations	2.35	1.191	5.22	3.059	4.513	.000**
Total	5.48	2.626	8.91	3.088	4.832	.000**

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Scaffolding for computer supported writing to learn activities in vocational training

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Abstract: Dual-T project investigates how ICT can support learning activities involving sharing and reflection about professional experience in order to harmonize school learning with practical experience. In this study we tested the effects of low and high scaffolding on collaborative writing activities on professional procedures. We expected longer, more correct texts to emerge from strongly scaffolded activities than from weakly scaffolded activities.

Theoretical frame

Recent research on initial vocational training education has shown the existence of a gap between field knowledge and knowledge taught in vocational schools (Filliettaz, 2008). One of the main issues concerns knowledge and skill transfer between school and workplace (Eraut, 2004). In our project, we are interested in identifying original technological support and pedagogical designs for professional skills learning and transfer in vocational educational training (VET).

In this context, we adopt a "writing-to-learn" approach (Hayes and Flower, 1980; Hayes, 1996). It assumes that writing promotes the acquisition of knowledge, since domain knowledge should be retrieved, reorganized and incorporated into a linear and understandable form. Extending this cognitive view, Galbraith (1999) claims that knowledge transformation leads to knowledge constitution, which makes writing a promising instructional tool.

Professional procedure learning and transfer is a critical issue in VET. Anderson's ACT-R (1993) model claims that procedure acquisition is based on learning from declarative traces of initial problem solving. Writing could then be a powerful tool for constructing and refining the declarative representation of procedures.

Moreover, confrontation between learners' conceptions and experiences should promote reflexive thinking and epistemic monitoring, embodied in the written productions (Crook, 1994; Littleton & Light 1999; Spek, Johnson, Dice & Heaton, 1999). In addition, collaborative writing activities should support not only individual knowledge acquisition but also the collaborative dimension of domain knowledge building. Tynjälä, Mason and Lonka (2001) show that studies of the effects of collaborative writing on learning are still rare (Gielen, Dochy, Tops, Peeters, 2007; Keys, 1995). Most of the research is done on the improvement of the writing process and writing skills. We consider that a peer collaborative approach to writing-to-learn in a VET context should be valuable in terms of knowledge building, procedure understanding and acquisition. Thus, in this research we are interested in investigating the impact of collaborative writing activities on the construction of a mutual declarative representation of the procedures. This is the basis for deep understating of procedures thus for acquisition and transfer.

Computer supported collaborative writing to learn activities can be supported by many types of tools. Considering our context and the population we are working with, we turned mainly towards wiki tools. One of the main advantages is the powerful information sharing and collaboration features that we used for other activities in this research project. They also afford users the added advantage of reducing the technical skill required to use these features, by allowing students to focus on the information and collaborative tasks.

Using scaffolding to engage students in reflection and deeper data processing has been shown to be successful in a number of domains. Research noted that different type of scaffolds may leave to different learning effects (Ge&Land, 2004, Rosenshine, Meister & Chapman, 1996). In this study we intended to use scaffolding in order to support for better writing to learn activities thus for deeper reflection, knowledge organization and transfer. We built the guiding questions on the basis of the work of Lin & Lehman (1999) and respecting the "how", "why" main approaches.

Research questions

The goal of this research was to develop and assess computer-supported learning designs based on collaborative writing activities and their impact on learning experience and outcomes. Based on previous findings on peer assisted writing to learn in VET (Gavota, Betrancourt, Schneider, Richle, 2008a), this research investigates the role and the types of scaffolding appropriate for activities supporting professional procedure understanding and learning.

We assumed that high scaffolding is supposed to guide reflection and improve self-regulation, but it can prevent the apprentices from handling complexity and therefore be inappropriate to support transfer. Low scaffolding would also mobilize valuable knowledge but would be associated with less organization and poorer productions. We expected that highly scaffolded activities produce better quality explanations then lowly scaffolded activities as well as better quality quotes. We also expect that high scaffolded activities support better long term learning and transfer of the knowledge then light scaffolded activities.

Method

Participants

We worked with 2 third year classes of dental care apprentices. 29 apprentices participated in the study: 15 of them were in the first class and 14 in the second class. Each class corresponded to a condition in a between-subject quasi-experimental design.

Material

In order to support apprentices' collaborative writing activities, we used a wiki embedded in the ELGG social software platform. This study engaged apprentices in writing, explanation, rewriting and commenting activities. Since the activities were closely linked, we chose not to use the wiki's "discussion" page but to spatially integrate all the activities on the same page, in order to facilitate the information linking and processing (Van der Pol, Admiraal & Simons, 2006).

We also used a subjective "learning questionnaire" containing four open questions about the importance of the activity, the tasks they considered the most useful and the things they considered having learned from each task.

Task

The activity was integrated in the "administration course" and aimed at learning how to produce a quote for a treatment. Students had to individually fill in a digitalized quote form and explain the procedure they used to fill in the quote as well as the content that they filled in (medical treatment procedure). Furthermore, a peer had to read, verify and comment on the work of a colleague, and eventually change what she considered wrong. In the end, the teacher orally discussed the entries with the students and clarified their correctness.

The tasks were identical for both classes. The only difference was that the first class had scaffolding questions in order to guide their explanations of the "filling in procedure", the "treatment procedure" and the commenting activity. The second class was asked to do the same activities as the first class except that they didn't receive any scaffolding questions..

At the end of the activity we administrated the subjective "learning questionnaire". We wanted to foster students' reflection on their learning and on the activities they thought helped them most. A week after this activity, students took a test on creating quotes.

Analysis and results

The study took place in the beginning of December 2008 and the final results will be available for the conference. This analysis mainly takes into account initial quality (correctness) of the quotes (filled in individually), explanations' quality, final quality of the quotes (after peer intervention), quality of comments and explanations from peers.

The formal quality analysis of explanations and comments is based on a modified SSQS scale (Ransdell and Levy, 1996). The measured dimensions are grammar, formulation, exactitude, and layout features. One to five point evaluation scales are used by multiple independent judges.

The content quality of initial and final quotes as well as the content quality of explanations and comments is assessed with the help of the teacher, by using a detailed evaluation grid.

The history of the written productions and quotes are easily accessible from the wiki. Text and quotes evolutions and quality of interventions is assessed on the basis of a previously used coding scheme: types of interventions (correction, completion) are identified as well as their quality (appropriateness, correctness).

The correspondence between the quote, the explanation as well as the quality of comments will be analyzed qualitatively. This will allow us to analyze the usefulness of the visually integrated writing tasks and the appropriateness of using a wiki to support collaborative writing activities in a VET context. Moreover, we will be able to discuss ergonomic aspects of this type of tools with regard to the learning tasks.

We also will analyze the subjective "learning questionnaires" and compare the initial students' performance (in the experimental activity) with the final one (at the test).

Discussion

Our research refines theories in computer supported writing to learn field which has been very little treated. Previous studies (Gavota et al., 2008(a),(b)) showed the feasibility and utility of this type of approach. Collaborative writing activities take advantage of apprentices' knowledge and professional experience heterogeneity, thus representing a promising instructional tool to foster reflective and meaningful learning in vocational education. Relevant information about scaffolded peer assisted computer supported writing activities will be identified with the present study. More precise peer assisted writing design issues will be revealed and refined with regard to VET context characteristics.

From a practical point of view, useful design issues in collaborative writing-to-learn activities will be identified. Ecological study in a vocational training context will allow design refinement thus conception of useful general rules for the use of computer supported collaborative writing-to-learn activities in a VET class. In our studies we hope to identify and propose useful, pertinent guidelines for instructional designers and teachers regarding the pedagogical scenarios and appropriate electronic tools

This dual (theoretical and practical) approach supports for valuable advancement into comprehension and utilisation of collaborative designs in computer supported writing to learn.

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Fostering collaborators' ability to draw inferences from distributed information: a training experiment

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Abstract: One important way in which learners can co-construct new knowledge is by drawing collaborative inferences from distributed information. However, groups rarely use members' complementary knowledge resources to their best potential. In this experiment, student dyads were trained to apply collaborative inferencing strategies. Training improved students' knowledge co-construction during subsequent, unsupported collaboration. The best performance during transfer was achieved when a specifically designed inference tutoring tool had been employed during training.

Introduction

In groups of learners as well as groups of professionals collaborating on joint problem-solving tasks, the solution-relevant knowledge is often distributed across persons. A major challenge for these groups is to pool group members' unique, or "unshared", information (Stasser & Titus, 1985), and to co-construct new, solution-relevant knowledge from members' complementary knowledge resources (e.g. Dunbar, 2000). We propose that an important means of knowledge co-construction is by drawing *collaborative inferences* from distributed information.

To study the collaborative drawing of inferences more closely and in a controlled setting, we have developed a *murder-mystery problem-solving task*, which is given to pairs of university students who have to find the murderer in a fictitious homicide investigation. Each student reads and returns a set of "interrogation protocols"; then the dyad discusses the case and has to agree on a solution. To succeed, students need to draw 12 inferences, yielding the motive, the alibi, and one further piece of evidence for each of four suspects. The information enabling these inferences are partially distributed between the students, so that not only collaborative inferences, but three types of inference can be investigated: *collaborative inferences* from information that is distributed between students; *individual inferences* from information that is located with one student, and *shared inferences* from information that is shared by both students.

In the case of a collaborative inference, one student might, for example, know that the victim in the murder-mystery task was drugged around midnight, and the other student might know that suspect Helga drank whisky with the victim around midnight. If students exchange their complementary information, they can collaboratively draw the inference that Helga might have slipped the drug into the victim's whisky. However, even though such collaborative inferences allow for the co-construction of important new knowledge, students have substantial difficulties drawing them: In a previous study, students drew less then half of all possible collaborative inferences (Meier & Spada, 2007). Thus, the aim of the study at hand was to enhance students' ability to better use their complementary knowledge resources by drawing more collaborative inferences.

Training Experiment

The aim of the training experiment was to teach students specific collaboration strategies that had been derived from a detailed analysis of successful and unsuccessful inferences in students' dialogs from our previous study (Meier & Spada, 2007): In order to make efficient use of their complementary knowledge resources, collaborators first of all need to realize that some of their own information makes sense only when considered together with information held by their partner, and thus that they need to *discuss information with their partner even if they cannot yet judge its relevance for the final solution*. Second, a very important moment for the successful drawing of a collaborative inference is when one's partner has pooled a new fact to which one holds matching information. The processes of holding this new information active in working memory and connecting it with previously learned information, retrieved from long-term memory, are very vulnerable to disruption during an ongoing discussion. Thus, collaborators need to *react attentively to all new information they learn from their partner during discussion*, e.g. by first signalling that the information is new to them, and then searching for matching information that allows for a new, solution-relevant inference. Finally, the *search for interconnections between pieces of information (i.e. their elaboration and connection with previously learned information*) should permeate the whole problem-solving process. In the experiment, 36 dyads of female university students were trained with a specifically designed task, and then collaborated without further support on the murder-mystery task (Table 1).

Training Interventions

Three training interventions were designed (Table 1): First, a *training task* required collaborators to diagnose a patient with one out of three fictitious tropical diseases; to do so they had to draw several collaborative inferences. After finishing their own collaboration, students received the correct solution along with an explanation of the inferences leading to it, and were prompted to discuss their own problem-solving and to plan ahead for their upcoming collaboration on the murder-mystery transfer task. Second, a *strategy information text* summarized the three collaboration strategies outlined above. It was read before collaboration on the training task. Finally, a computerized *inference tutoring tool* supported the application of these strategies by providing immediate feedback and adaptive prompts during collaboration on the training task (but not the transfer task), based on an online assessment of inference patterns in students' dialogs. The aim of the inference tutoring tool was to not only inform students about useful collaboration strategies (resulting in declarative strategy knowledge), but also to help them learn how and when to apply these strategies (i.e. to acquire procedural strategy knowledge, DeJong & Ferguson-Hessler, 1996). The tool was, in this study, yet controlled by a human observer who followed collaborators' discussion of the training task and identified, with the help of a checklist, when relevant pieces of text information were mentioned and relevant inferences were drawn. *New Information Feedback* was given whenever a student pooled a new piece of information, immediately following the student's utterance. Collaborators heard a specific sound and saw the following message: "New information! Matching information is located with {Name A}/ {Name B} / both of you." Thus, it alerted collaborators to a specific piece of information, and prompted them to search for matching information. In doing so, it also modelled the immediate and attentive reaction to new information during discussion; at the same time, it served as positive feedback for pooling information. In addition, *Complete Inference Feedback* ("Well done! You have just discovered an important connection") was given whenever an inference had been drawn. During the last five minutes of their discussion, collaborators additionally received reminders and hints to help them consider information and inferences that were still missing. Together, the tutor messages were designed to remind collaborators of the necessity to pool their information and combine it by drawing inferences, and to ensure that collaborators drew all or nearly all possible inferences and thus could experience a successful problem solution.

Table 1: Design of training experiment

<table>
<tr><th>Control</th><th>Training Task Only</th><th>Informed</th><th>Tutored</th></tr>
<tr><td rowspan="5">--</td><td></td><td colspan="2">read strategy information text (10 min)</td></tr>
<tr><td colspan="3">Training Task (medical diagnosis): individual reading phase (20 min)</td></tr>
<tr><td colspan="2">collaborative discussion (25 min)</td><td>…with inference tutoring tool</td></tr>
<tr><td colspan="3">written justification (5 min)</td></tr>
<tr><td colspan="3">collaborative reflection phase (10 min)</td></tr>
<tr><td colspan="4">Transfer Task (murder-mystery)
- individual reading phase (30 min)
- collaborative discussion (30 min) and written justification (10 min)</td></tr>
</table>

Design and Procedure

Four different training conditions were realized (Table 1), with nine dyads in each condition: *Control Dyads* did not receive any training prior to their collaboration on the murder-mystery task. *Training Task Only Dyads* solved the training task and reflected on their own collaboration, but did not receive any explicit strategy instruction. *Informed Dyads* read the strategy information text prior to their collaboration on the training task, and *Tutored Dyads*, in addition, were guided by the inference tutoring tool during training (but not transfer).

Collaborators sat in adjacent rooms. During phases of individual work they could neither see nor hear their partner; during collaborative phases they could talk to each other over an audio connection and prepare a joint solution in a shared text document. Collaborators' discussions in the training and transfer phase were videotaped with the help of two sets of cameras and microphones. The observer operating the inference tutoring tool sat in a third room and monitored the ongoing discussion with the help of the audio and video transmission from participants' rooms. The tutor messages were displayed on a separate computer monitor in each participant's room; both participants received the same message simultaneously.

Dependent measures were obtained during unsupported collaboration on the murder-mystery transfer task, which allowed each dyad to draw four collaborative, four individual, and four shared inferences (three text versions corrected for the possibility of confounding inference type with inference content).

Results and Discussion

Figure 1 shows the relative frequencies with which dyads in the four conditions drew collaborative, individual, and shared inferences during their collaboration on the murder-mystery transfer task, and Figure 2 gives the absolute number of dyads who solved the task correctly or incorrectly in each condition. As expected, collaborative inferences were the most difficult inference type to draw across conditions (Figure 1; $F(2;64)$= 9.55; p< .01; $\eta^2_{partial}$= .23). In fact, untrained dyads drew only slightly more then half (56%) of the collaborative inferences they could have drawn. However, training increased the quality of students' knowledge co-construction substantially (*F(3;32)*= 6.03; *p*< .01, $\eta^2_{partial}$ = .36): trained dyads drew more inferences, of all three types, than untrained dyads (*t*= 2.74; *p*= .01). Training with support from the inference tutoring tool proved to be the most effective: Tutored Dyads drew 89% of all possible collaborative inferences, and even more individual and shared inferences (Figure 1). They performed significantly better than even the dyads in the other two trained conditions (*t*= 3.06; *p*< .01), and also showed the highest solution rate to the murder-mystery task (Figure 2, n.s.). On the other hand, Informed Dyads did not outperform Training Task Only Dyads, and also showed a surprisingly low solution rate to the murder-mystery task (Figure 2). Thus, direct strategy instruction, when not accompanied by immediate feedback and adaptive prompts from the inference tutoring tool, did not increase the effectiveness of reflected training, and seems to even have hindered successful problem-solving.

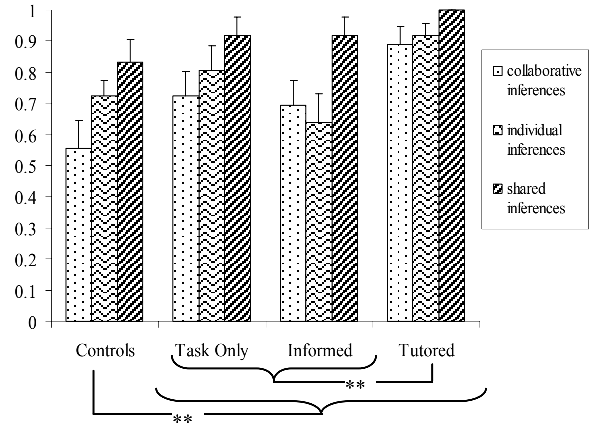

Figure 1: Inference drawing frequencies for the murder-mystery transfer task in the four conditions

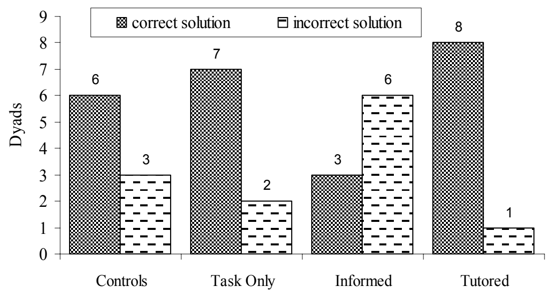

Figure 2: Absolute number of correct and incorrect solutions to the murder-mystery transfer task

These results show that, unless they receive adequate training, collaborators have difficulties with co-constructing new shared knowledge from distributed information resources by drawing collaborative inferences. Fortunately, training by means of reflected collaboration on a carefully designed task seems to be effective in enhancing collaborators' ability to draw collaborative inferences, in particular when supported by immediate feedback (cf. Hattie & Timperley, 2007) and adaptive prompts as realized by the inference tutoring tool. Future attempts towards providing adaptive support for the collaborative drawing of inferences might profit from the development of a natural language tutoring system (cf. Lane & VanLehn, 2005) which is able to recognize when a solution-relevant new piece of information is pooled or an inference is drawn, and can give appropriate feedback. Training interventions employing both reflected practice and adaptive tutoring might be profitable applied to knowledge co-construction in real-life groups (e.g. students engaging in collaborative learning, or interdisciplinary teams solving problems in organizations), in which individuals have to integrate their complementary expertise, viewpoints, or ideas in order to generate the knowledge necessary for solving a joint problem.

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Scaffolding Teacher Adaptation by Making Design Intent Explicit

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Abstract: Fostering adaptations that are congruent with designers' original intentions is a constant challenge. In this paper, we explore a technology-facilitated means of scaffolding teacher adaptation of curriculum materials design. We found that teachers are able to inspect multiple aspects of connections within and between lessons and the consequences of their modifications. This study informs the design of environments that aim to support mutual understanding between teachers and curriculum designers with respect to curriculum coherence.

Introduction

As curriculum researchers and designers aim to create rich learning environments for students, curriculum units have become more complex. Recent standards-based reform movements have encouraged curriculum researchers and developers to address content standards and benchmarks using designs that link scientific ideas together across multiple lessons and activities (Kali, Linn, & Roseman, 2008). Teachers face many challenges in interpreting and enacting these complex materials, and often must make modifications to fit local contexts and constraints. To avoid making adaptations that inadvertently alter the core ideas of these curricula, teachers and curriculum designers must collaborate to construct a common understanding of the innovative ideas behind the units (Stahl, Koschmann, & Suthers, 2006).

To help teachers make sense of innovative curriculum materials, prior studies have employed strategies that demonstrate the relationships between lessons and overall learning goals (Davis & Varma, 2008). However, these efforts focus more on helping teachers improve their understanding of coherence related to a specific lesson and less on becoming aware of deeper curriculum design intent, such as how lessons work together to address learning goals across an entire unit. In this study, we explored how technology-based scaffolds may help teachers consider how their modifications to curriculum materials affects the relationships between individual lessons and broader learning goals as well as connections between and across lessons that are intended to create effective learning experiences.

An idealized modification practice might include the following elements: (1) Compare lessons; (2) Examine the coverage rates of standards and connections in a unit; (3) Examine change in the coverage rates of standards and connections as a result of modifications; and (4) Reflect on understanding and modification strategies (Clark & Yinger, 1987). When making curriculum changes, experienced teachers' plans are explicit and rich in interconnections, because they can better predict what will happen as a result of a particular lesson. In contrast, the planning of novice teachers may consist primarily of daily lesson planning, and tend to provide simple descriptions of isolated events, instead of making inferences about the underlying structure of the teaching and student learning (Borko & Putnam, 1996). In prior design research, we found that science teachers have a reasonable understanding of the relationships between individual lessons and learning goals, but have difficulties identifying connections among lessons, or the deeper structure of the curriculum (Lin & Fishman, 2004, 2006).

We explore some of the elements that constitute curriculum coherence and we call these elements "unit structures." Unit structures refer to four elements: (1) the relationships between individual lessons and learning goals addressed in a unit; (2) the connections that exist between lessons; (3) the number of covered relationships and connections across lessons; and (4) the rate of coverage of these relationships and connections in a modified unit. The first and second elements of unit structures are the focus of previous studies on curriculum coherence. In contrast, the third and forth elements have not received as much attention and may be useful to teachers when they make decisions about whether to keep or remove parts of a curriculum unit.

Based on sociocontructivist theory (Brown, Collins, & Duguid, 1989) and scaffolding design principles (Quintana et al., 2004), we examined how the following three scaffolding strategies help teachers understand curricular coherence: (1) Providing visualizations to help teachers inspect multiple aspects of curricular coherence; (2) Demonstrating changes in the coverage rates of learning goals as a consequence of modification; and (3) Encouraging reflection about the modifications and their impact on coherence. The research questions addressed in this study are: 1) Does teaching experience relate to teachers' understanding of curricular coherence? (2) What are the roles of software scaffolds in helping teachers consider more complex elements of curricular coherence when they modify curriculum units? and (3) When teachers make changes in curriculum units with the assistance of the software scaffolds, how do they reflect on their understanding of curricular coherence and their curriculum modification strategies?

The Planning, Enactment, and Reflection Tool (PERT)

We developed PERT, a software tool designed to help teachers consider higher levels of unit structures by addressing the scaffolding strategies described above. PERT includes three modules. In the *Select Lesson* module, PERT demonstrates the structure of lessons in a unit, the learning goals related to a lesson, and the target and current class periods selected for inclusion in the unit. The *See Coverage of Standards* module demonstrates the relative coverage rates of content and inquiry standards and the details of the coverage in the unit. The *See Coverage of Connections* module demonstrates the relative coverage rates of content and inquiry connections and the details of the connections in the unit.

Methods

We recruited twenty middle school science teachers to participate in this study. Each teacher was teaching project-based science units and had varying levels of experience teaching project-based science units. Teachers were told that they needed to shorten a unit because they had less time to teach the unit than was specified by the curriculum's designers. We observed their decisions about how to shorten the unit *without* the support of scaffolds beyond what is already available in the curriculum materials. At the end of their modification, they were asked to estimate the coverage rates of standards and connections addressed in the modified unit in comparison to the original unit. Next, teachers learned how to use PERT by following step-by-step instructions and conducting a few short practice activities. Then they were asked to modify the curriculum unit again with PERT. Teachers had opportunities to examine the difference between their estimated coverage rates and the actual coverage rates of standards and connections, explore the details of unit structures, and make changes to their lesson selections to better meet their goals for teaching the unit. Finally, we debriefed teachers with questions about their experience in the curriculum modification activities. We conducted a qualitative verbal analysis to transform qualitative data into numerical values, and used *t*-tests to examine the impact of the software scaffolds in helping teachers consider higher levels of unit structures in their modification practice.

Findings

Teachers' amount of experience is not related to their level of understanding of higher levels of curriculum coherence. First, experienced and novice teachers have better understanding of and focused more on lower levels of unit structures in the lesson selection activities in the without-scaffolds situation. For example, they showed better understanding of the coverage rates for standards (intermediate level) than of the coverage rates for connections (advanced level). Second, teachers were able to use more precise methods for coverage of standards (lower level) than for coverage of connections (higher level). In addition, their estimation methods for coverage of connections varied more than those for coverage of standards. Although teachers with more experience and understanding were able to use more precise methods for estimation, the relationship mainly exists for simpler elements of unit structures, such as content and inquiry standards addressed in individual lessons.

The three scaffolding strategies helped teachers consider more types of unit structures, consider unit structures more frequently, and consider higher levels of unit structures when they modify a curriculum unit and when they examine their understanding of unit structures and strategies for modifying curricula. For example, scaffolds for identifying strong and weak coverage rates helped teachers compare relative coverage by considering higher levels of unit structures. A *t*-test showed a statistically reliable difference between the mean number of level of unit structures in the without-scaffolds situation ($M = 0.20$, $SD = 0.62$) and the with-scaffolds situation ($M = 2.30$, $SD = 0.24$) when teachers identified weak coverage rate, $t(19) = 3.009$, $p < .001$.

Discussion and implications

The findings indicate that experience with project-based science units does not contribute to deeper understanding of curricular coherence on its own. One possible reason is that the complexity of curricular coherence is not easily grasped by merely teaching these units, even teaching them multiple times. In addition, the representations and learning support currently used in printed curriculum materials may not be sufficient to express deeper design intent such as the more complex elements of curricular coherence. This study demonstrates that, with appropriate support, both experienced and novice teachers are able to consider deeper design intent and use this information in making changes to the unit. In order to help teachers make changes that are congruent with designers' intent and improve their understanding of curricular coherence, curriculum designers should consider providing support that not only shows the details of curricular coherence, but also information useful for making informed decisions.

The software scaffolds explored in this study can inform the design of future supportive systems that aim to help a larger group of teachers understand curricular coherence and make curriculum modifications congruent with the original design intent. The scaffolds examined in this study can provide teachers with more dynamic representations than existing paper-based educative curriculum materials. In comparison to information provided through face-to-face workshops, the software scaffolds are more capable of providing proximal support to teachers that is situated in their daily practice (Putnam & Borko, 2000). For example, teachers can get access to these software tools in an online professional development system and share their ideas of lesson planning with other teachers. In addition, the supports examined in this study can also be used for demonstrating coherence across a series of interconnected units within and across grade levels (Krajcik, Slotta, McNeill, & Reiser, 2008). With these advantages, scaffolds such as those in PERT can serve a larger population of teachers and be a vehicle for supporting larger scale implementation of coherent curriculum materials (Fishman, Marx, Blumenfeld, Krajcik, & Soloway, 2004).

Finally, the software scaffolds can be used to build a platform in which curriculum designers may share their ideas. Novice curriculum designers can learn from experienced designers by examining cases of curriculum design and seeing how their changes or additions affect the overall goals for coherence as specified by expert curriculum developers. In addition, teachers and curriculum designers could negotiate their understanding of the coherence of curricula and encourage collaboration between them.

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Automating the Analysis of Collaborative Discourse: Identifying Idea Clusters

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Abstract: This poster explores CSCL practices relating to the use of a tool that employs information visualization techniques and large-scale text processing and analysis to complement qualitative analysis of collaborative discourse. Results from latent semantic analysis and qualitative analysis of online discussion transcripts are compared. Findings suggest that such tools that automate analyses of large text-based data sets can offer CSCL researchers a quantitative and unbiased way of identifying a subset of data to study in depth.

Introduction

A growing body of literature emphasizes the use of mixed methods to investigate educational processes (e.g., Johnson & Onwuegbuzie, 2004). In computer-supported collaborative learning (CSCL) research, mixed methods may be needed to understand collaborative discourse that is the primary mechanism for learning in these environments (Hmelo-Silver, 2003). A qualitative approach yields deep insights into what is happening in small segments of discourse, but it is time consuming and not practical for examining a large corpus of data (Sawyer, 2006). Yet relatively little attention has been paid to CSCL practices relating to the use of technological tools that automate analyses of large text-based data sets. Tools that employ information visualization techniques and large- scale text processing and analysis seem to hold considerable potential for advancing learning science practices. In this paper we explore the use of one such tool, the Knowledge Space Visualizer (KSV) that combines latent semantic analysis (LSA) and graph-based information visualization and network analysis (Teplovs, 2008).

The data comprise one of the iterations of a larger design-based research project that investigated how to foster the development of progressive discourse in three online graduate course contexts (Fujita, 2009). Progressive discourse is the process through which participants share, question, and revise their ideas to deepen their understanding and build knowledge (Bereiter, 2002). To answer questions about what kinds of instructional scaffolding are most effective in fostering progressive discourse for knowledge building, it is important to be able to detect when a group of students construct a new understanding in a particular computer-mediated communication (CMC) transcript. Whereas we do not propose LSA as a replacement for qualitative analysis, we suggest it might offer CSCL researchers an alternative approach to analyzing data from one iteration of a design-based research study to inform the design of interventions in a subsequent iteration. To this end, the KSV was used to investigate the following research question: "What are the major themes or ideas clusters found in the student discourse in each course discussion view?"

Methods

This study examines one iteration of a design-based research (Collins, Joseph, & Bielaczyc, 2004) project that investigated how to foster online progressive discourse for knowledge building in three graduate education courses. The participants in this iteration were 17 students in a 13-week online graduate course surveying educational applications of computer-mediated communication. A tenure-stream faculty member taught the course entirely online using web-based Knowledge Forum, a software environment specifically designed to support knowledge building. As Scardamalia (2003) explains, "the basic units in Knowledge Forum are ideas, represented as Notes. The basic workspace for developing, sharing, organizing, and creating multiple representations of ideas is a View" (p. 24). Knowledge Forum differs from typical asynchronous computer conferencing systems by having advanced features such as scaffolds, co-authored notes, annotations, and "rise-above" capabilities to support knowledge building processes.

This paper focuses on analysis of 1010 notes contributed to 11 Knowledge Forum views. Each view represented one week of discussion. The first week and last week views were omitted. The view for week 1 was used to introduce the students to the course, to the database, and to each other; the week 13 view was used for course evaluation. For qualitative coding, the text of notes in Knowledge Forum was exported to rich text files (.rtf) and imported into the NVivo qualitative data analysis software. Each note was read several times in the context of the discussion thread in which the author posted the note, then coded through a process of constant comparison (Merriam, 1998; Strauss & Corbin, 1998). Subcategories were created as more possibilities were found under each emergent theme or idea cluster category. When notes contained more than one theme, they were assigned multiple codes.

LSA is a statistical technique used to extract the deep meaning of patterns of words in specific contexts of use. The technique is performed by applying methods from linear algebra (matrix decomposition and dimension reduction) to matrices that represent usage patterns of terms in documents (Deerwester et al., 1990; Landauer et al, 1998). Documents can be projected into the resulting reduced- but still high-dimensional semantic space and semantic similarity can be determined by calculating the cosine between the vectors for any two documents. Whereas cosine values lack the statistical properties of correlation coefficients they can be interpreted in a similar fashion, with identical documents having inter-vector cosines of 1.0, unrelated documents having inter-vector cosines of 0 and somewhat related documents falling somewhere between 0 and 1.

The resulting similarity matrix for a group of documents – in this case a group of notes from a view – can be used to generate a graph. In the complete projection of such a similarity matrix, all documents are linked to each other if only at minimal cosine values. A more reasonable approach, however, is to select a threshold value for cosine similarity, above which documents are considered linked (and below which they remain unlinked). The selection of the threshold value is empirically determined and detailed in Teplovs (2009). The appropriate value for the analysis reported here was determined to be 0.6.

Results and Discussion

This study used the KSV to investigate the question, “What are the major themes or ideas found in the student discourse?” Of the 1010 notes in week 2 to week 12 views, were members of idea clusters. A grouping of notes was considered to be a valid cluster if it was represented by at least 3 notes within any view. The KSV-based analysis suggests that there are 43 unique idea clusters in the notes.

For example, during week 3 the students discussed various types of CMC environments, their purposes and uses. This week was chosen for closer examination because it was the first week in which pairs of students not the instructor lead the discussion. It provided an opportunity to study how students might engage in progressive discourse as they considered synchronous environments such as chat, moo’s, and mud’s, and compared them to asynchronous environments such as conferencing, listservs, and bulletin boards. The most frequently occurring themes in week 3 identified through semantic analysis were “knowledge building,” “skype,” “moo,” “discussion,” “scaffolds,” “software,” “communication,” and “available.”

A comparison of idea clusters that were identified through LSA and through qualitative content analysis in week 3 is shown in Table 1.

Table 1: Frequencies of notes in idea clusters identified through LSA and qualitative analysis in week 3

LSA			Qualitative Analysis	
Idea Cluster	**Notes**	**Density**	**Idea Cluster**	**Notes**
Knowledge, building	13	0.230769	Chat scheduling	29
Skype, chat, MSN	12	0.212121	Emotions	19
Moos	11	0.490909	Knowledge building	17
Discussion, synchronous	7	0.476190	Moos	17
Software	5	1.00000	Technical issues	15
Scaffolds	5	0.476190	Scaffolds	9
Communication, synchronous	4	0.833333	Synchronous chat	7
Available	4	0.666667	Skype	7

The idea clusters identified through LSA are remarkably similar to categories that emerged through qualitative coding of the student notes. This lends face validity to the findings from LSA, and suggests that LSA might offer CSCL researchers a quantitative and unbiased way of identifying a subset of data to study in depth using mixed methods (Chi, 1997).

Some differences, presented more fully in the poster, are noteworthy and highlight some of the problems associated with fully automating the analytic technique. However, the LSA-based analysis provides some additional metrics that help identify potentially problematic classifications. Table 1 includes values for the network density for each of the clusters. Network density is the quotient of links (edges) and maximum number of links for a given cluster. In practical terms, the network density of a semantic cluster is a measure of the idea diversity within that cluster. Thus, a semantic cluster with a high network density consists of notes that are highly homogeneous in terms of content. Semantic clusters with low network density are characterized by sub-clusters that may be about highly disparate topics but share a higher-level commonality. In the case of clusters from week 3, we see that the two largest clusters (“Knowledge building” and “Skype”) have relatively low density compared to the other clusters. This suggests these clusters may benefit from being described more fully using additional key terms, or that there may be confounding, difficult-to-detect themes that overrode obvious content-based commonalities.

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Determining Curricular Coverage of Student Contributions to an Online Discourse Environment Through the Use of Latent Semantic Analysis and Term Clouds

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Abstract: This paper presents a new approach to mapping student contributions to curriculum guidelines through the use of Latent Semantic Analysis and information visualization techniques. A new information visualization technique – differential term clouds – is introduced as a means to make clear changes in semantic fields over time.

Introduction

As part of their commitment to collective cognitive responsibility (Scardamalia, 2002), students engaged in knowledge building often pursue deep understanding of the topics being studied. A concern expressed by teachers, parents, and other observers is one pertaining to curricular coverage: what evidence is there that students are covering the mandated curriculum? To date, time-consuming manual analysis of student contributions has been the principal method by which answers to that question have been determined.

Methods

Twenty-two nine- and ten-year-olds worked on a unit on optics for ten weeks. They contributed notes to a Knowledge Forum database during that time. Overall, 152 notes were contributed in six shared working views. Each of the views ("Colours of Light & Rainbows", "Grey Fur & White Snow", "Reflection & Absorption", "Mirrors", "Where Light Goes & How", and "Lenses & Sight") corresponded to a topic area within the optics framework.

After completion of work by students and teachers, the Knowledge Forum database was augmented with additional notes. A new note was created for each of the curricular outcome statements contained in the Grade 4 Ontario Curriculum Guidelines (1998). Because the optics area covered in this grade spans two curricular areas, notes were organized into two views, each corresponding to one of the two curriculum units covered by the class's work on light and optics. Latent semantic analysis was use to create the semantic space and the cosines between all notes in the database were calculated. Only those exceeding 0.4 were retained because of the tenuousness of semantic relationships at cosine values below this threshold.

The Knowledge Space Visualizer (KSV) is a visualization tool capable of extracting notes from multiple views to aid the user in finding relationships amongst disparate notes (Teplovs, 2008). Participant contributions are represented as nodes that are linked via edges that correspond to explicit (e.g. "this note build on", "this note annotates", "this note references") or implicit (i.e. the content of these notes is similar) semantic links. Notes were extracted from each of the six shared working views in turn and juxtaposed with notes extracted from the two curriculum views. The KSV was used to arrange the notes into two lines as shown in Figure 1. The upper line of notes are the curriculum outcome statements. The lower line represent the student contributions. Edges indicating semantic similarity join the nodes. This arrangement of notes optimizes visualization of semantic connections between the two sets, while minimizing the distraction of linkages amongst notes within each set.

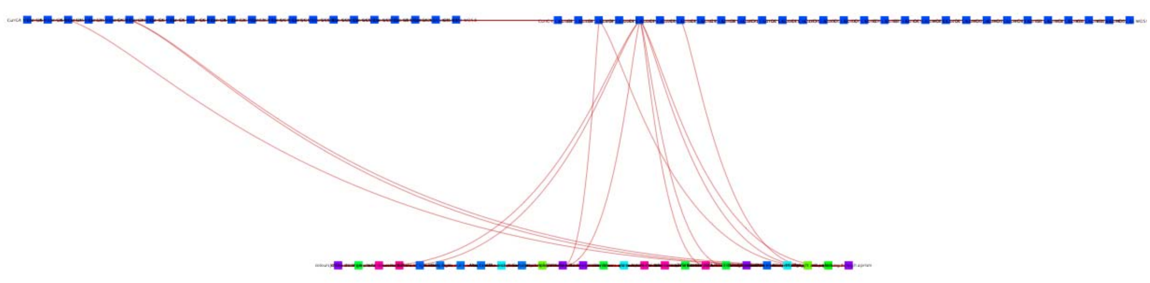

Figure 1: Visualization of curriculum outcome statements (upper horizontal line) and student contributions (lower horizontal line). There are 5 curriculum outcome statements linked to student notes.

Once arranged in this fashion the number of linked curricular items was recorded. To help determine where in the ten-week unit the majority of curricular overlap occurred the date range was adjusted to show only early, middle, and late contributions and the number of linked curricular items was recorded for each setting.

The process of visualizing and counting semantic linkages was repeated for cosine values of 0.9, 0.8, 0.7, 0.6, 0.5, and 0.4. High cosine values referred to highly specific linkages. Lower cosine threshold values represented looser linkages. Linkages below a cosine threshold of 0.4 were deemed too tenuous to merit a claim that the contents were semantically related. Finally, an independent (human) rater assessed whether notes showed evidence of mapping to curriculum guidelines.

To complement the semantic linkage analysis and to provide insight about the content of the participants' contributions a more detailed analysis that focused on the semantic fields produced by the participants was conducted. Term clouds, also known as tag clouds, are a relatively recent innovation. They consist of groups of words, often ordered alphabetically, whose fonts are scaled in size according to frequency of occurrence. The recent emergence of text clouds as a legitimate visualization technique holds promise for investigating the nature of online discourse by allowing the investigator to get a picture of what is happening in the discourse space. In other words, text clouds are useful visualizations for semantic fields. A shortcoming of traditional term clouds is that they do not do a particularly good job of showing semantic field growth. There are at least two reasons for this: there is no chronological aspect, and there is no sense of change vs. the previous term cloud (i.e. a sense of "delta"). The use of font sizing to scale the terms in the cloud is also questionable, as it merely highlights frequently used term rather than highlighting changes over time.

To address these shortcomings, a new graphical form of tag clouds was used. Small multiples (Tufte, 1990) were used to present a chronology of semantic field changes. In this technique, the term clouds reflect the changes between two other term clouds, and the frequencies are indicative of the changes in term frequency rather than the absolute numbers.

Results & Discussion

Overall, none of the student contributions mapped onto curriculum outcome statements at the highest similarity threshold (cosine $\geq$ 0.9). This is likely because of the very different nature of student discourse about a particular topic and the statement about the topic to be covered as gleaned from the government-produced curriculum documents. As the threshold for semantic similarity was lowered more curriculum outcome statements were considered sufficiently similar to the student contributions that a link indicating overlap was included, and that the specific curricular point was considered "covered". At the most inclusive threshold level (cosine $\geq$ 0.4) many, but not all, curriculum outcome statements were identified as having been covered. The highest reliability was achieved at cosine values between 0.4 and 0.5.

More detailed analysis of what, exactly, participants were contributing to the discourse space is provided through the use of differential term clouds. Figure 2 shows a sample differential term cloud.

absorbs (2) black (5) book* (2) colours (2) design* (2) evidence (1) experiment (2) flashlight (3) glass (1) green (3) heavier* (2) hits* (2) information (1) learned (1) lens (1) light (12) purple* (3) rainbow (2) red (3) reflect (1) shine (1) theories (1) theory (2) understand (1) water (3) white (1) yellow (1)

Figure 2: Sample differential term cloud. New terms are marked with an asterisk (*), curricular terms are underlined.

The term clouds can be examined to gain an understanding of what sorts of topics are being covered in the discourse space. The use of differential term clouds, rather than cumulative or sequential term clouds, highlights those terms that have been featured in a particular time period. Simply put, examination of the term cloud helps answer the question: "what's new this week". Of course, any size of time slice can be used; weeks were used as a convenient duration in this study. Large differential term clouds are indicative of significant changes in the focus or content of the discourse from which the term clouds are generated. The differential term clouds can be further summarized by looking at the breakdown on new, unique, and curricular terms as shown by the example in Figure 3.

A challenge for the use of term clouds in general is how to deal with misspellings and alternative word forms. In some cases it is clear that the misspelling should be corrected before the analysis. In others, such as the difference between "glass" and "glasses" the decision to combine them is less clear.

Conclusions

Latent semantic analysis (LSA) can be used to determine semantic similarity of documents. One application of LSA is to determine the semantic similarity of discourse from an online environment and descriptions of curriculum to be covered. Although the nature of the discourse differs in terms of purpose and genre, meaningful comparisons can still be made. Term clouds generated by determining the differential contents of two term clouds that represent different time slices of the discourse can be used to provide additional information about the exact nature of the shifts in the discourse.

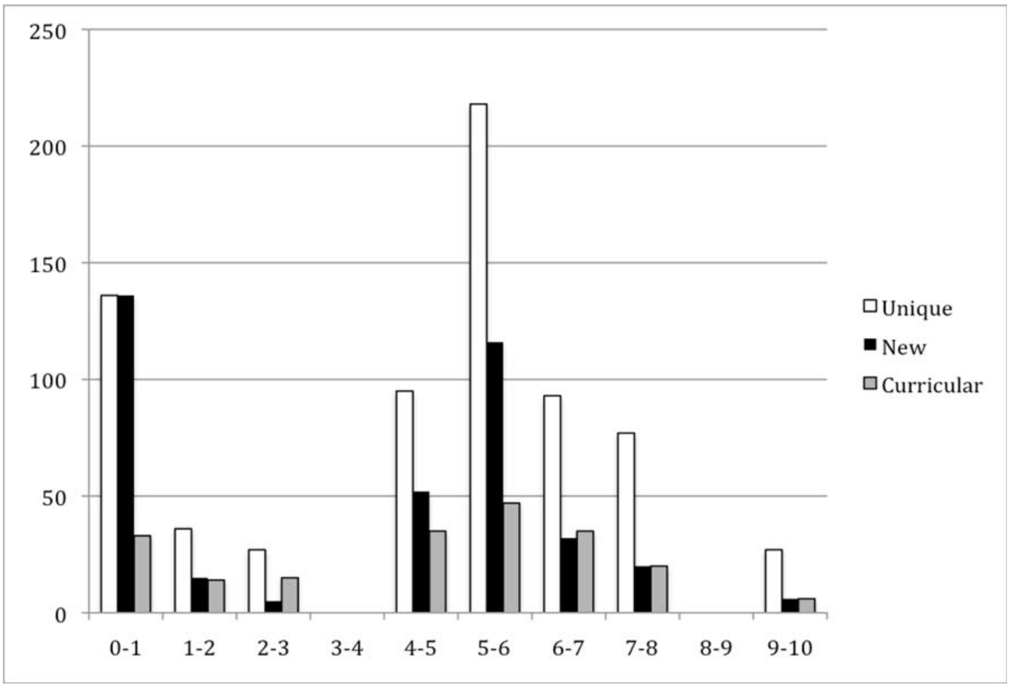

Figure 3: Week-to-week changes in unique, new, and curricular words in differential term clouds.

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Proposing “collaborative filtering” to foster collaboration in ScratchR Community

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Abstract: The present work focuses the interest of study in a naturally emerged and intense online community, this of ScratchR “programmers by choice” community, that actually practice collaborative learning in an authentic way. Our interest is not to support collaborative learning process, but to foster collaboration opportunities. We propose a personalized recommendation system based on a “collaborative filtering” technique aiming at inciting collaboration and increasing the frequency of Scratch projects remixing, in order to foster collaborative learning. In this paper the proposed collaboration fostering mechanism is outlined with the assistance of a test data set. The significance of the proposal is discussed while the future work is described.

Introduction

Computer programming is generally considered an important competence not only because of its economic significance but also of its value as a learning environment. More recently computer programming is referred to as literacy for modern society which enables people to be active contributors to interactive digital content on the web2.0 (Monroy-Hernandez, 2007). Despite its significance, computer programming learning is recognized as a difficult task for students (Wiedenbeck, 2005). In order to lower the barriers in the development of computer programming skills, several approaches have been proposed, such as: educational programming languages (e.g. Logo, Scratch, Alice) to make the programming more attractive (Guzdial, 2004), and the study of contexts for informal learning of computer programming (Maloney et al, 2008). In this paper we focus on the Scratch educational programming environment and especially on the ScratchR online community where several individuals, hobbyists in their majority, are learning computer programming collaboratively for entertainment and in an informal context. The capability of ScratchR community for Scratch projects remixing, constitutes a central mechanism of collaborative learning. In this paper we propose a recommendation system based on a “collaborative filtering technique” aiming at inciting collaboration according to the members' preferences and increasing the frequency of Scratch projects remixing, in order to foster collaborative learning within the ScratchR community. In the followings the Scratch environment and ScratchR community are described first in order to understand the context of the proposed collaboration fostering application then the proposed recommendation mechanism is outlined with the assistance of a test data set. Finally, in the discussion section all of the above is summarized, while its significance and future work are described.

About Scratch and ScratchR community

Scratch (MIT Media Lab, 2008) is an educational programming environment developed by the Scratch project from MIT Media Lab. Scratch encompasses a graphical programming language which makes programming more accessible to children (ages 8 and up), teens and other novices to computer programming for the developed of media rich projects. The ScratchR (Monroy-Hernandez, 2007) is a web site (scratch.mit.edu) where Scratch users can share their projects. ScratchR facilitates collaborative learning of computer programming through (Monroy-Hernández & Resnick, 2008): **(***a) Inspiration***:** browse, download and reuse project elements; **(***b) Feedback from and to the community***:** the other users serve as an audience with varying expertise levels giving opportunities for peer teaching and scaffolding; *(c) Creative appropriation (remixing):* the modification, extension, correction of other’s projects. Projects’ remixing is considered by the authors as a major observable expression of collaboration among the Scratch community members. The current extent of collaborative learning through creative appropriation in ScratchR is clarified in the following quote: *“The Scratch website serves as a repository of code and ideas that can be creatively appropriated to spawn new ideas and new projects. ... Fifteen percent of all of the 23,294 projects shared (as of August 14, 2007) where remixes of other projects. Of those, the types of changes made ranged from simple changes to image and sounds to modification of the actual programming code.”* (Monroy-Hernández & Resnick, 2008). It is reasonable to assume that devising a mechanism to increase remixing in ScratchR community will probably increase collaboration and collaborative learning.

Proposing a collaborative filter for ScratchR remixers recommendations

Goldberg et al, 1992 used the term “collaborative filtering” for the first time in a system called “Tapestry”. “Collaborative filtering” refers to a set of techniques that exploit social annotations and interaction data from the members of a community to facilitate searching in a large set of multimedia objects. One popular example is that of tags that users attach to objects, thus formulating flat categorization systems known as “folksonomies” which are depicted by “tag-clouds”. ScratchR community does not have any personalised recommendations system yet. By using collaborative filtering in ScratchR, it is possible to build a recommendations mechanism that after taking into account projects that have been remixed by other “similar” users, would propose projects for remixing to each member personally.

We are aiming to recommend projects for remix from the more frequently remixed projects. ScratchR offers the list of top remixed projects along with the list of remixers’ psedo-names. We use this list to collect the preferences of the users to projects for remix. Usually the first step of a collaborative filtering algorithm is to estimate the similarity of each user from a large set, to a specific user. In our case we need to estimate which users prefer to remix the same kind of projects and then suggest to a specific member a list of projects that he/she has not yet remixed or even studied and has been remixed by similar users.

As a first step a way to represent remix preferences is needed. Preferences can be represented by an Array: $RP \in \{0,1\}^{nxm}$, where $RPij = \begin{cases} 1 & \text{if project (j) has been remixed by user (i)} \\ 0 & \text{otherwise} \end{cases}$, and n=number of users while m=number of projects. In real applications it is necessary to limit large data sets for example, in our example data set the 10 most remixed projects which involve 1960 members will be used. For example the RP for the top seven remixed projects of ScratchR on 25/10/2008 and for five of the members, is in Table 1. The raw data has been collected manually from ScratchR. Using this small set of data it is possible to see that the project “*3 Trampoline”* could be recommended to users *Fetsch*, *kaotheroogoncreator*, and *mtaylor* etc. Of course these recommendations are not so obvious when using the whole set of data because it is not easy to locate similar members. So we need a way to estimate similarity of members.

Table 1. Remix Preferences array subset for test data.

User	1 PacMan	2 Pong	3 FishChomp	3 Trampoline	4 MarbleRacer	6 Doodle	Doodle
Planetbravo	1	1	1	1	0	1	1
Fetsch	1	1	1	0	1	1	0
kaotheroogoncreator	1	1	1	0	1	1	1
Mtaylor	1	1	1	0	1	1	1
olly144	1	1	1	1	1	1	1

The second stage in the process is to determine the degree of members’ similarity in terms of projects they prefer to remix. In other words we need to compare the set of remixed projects for each member to the remixed projects set of every other member. In order to do this we need to choose a similarity metric (Segaran, 2007). In our case Jaccard coefficient is used in which joint absences are excluded from consideration. Jaccard coefficient gives equal weight to matches and nonmatches. By computing this similarity measure for each possible pair of users we obtain a square Similarity nxn Array: SA, where $SA_{ij} = \frac{\sum_{k=1}^{m} RP_{ik} \otimes RP_{jk}}{\sum_{k=1}^{m} RP_{ik} \oplus RP_{jk}}$, ($\sum_{k=1}^{m} RP_{ik} \oplus RP_{jk} \neq 0$, since we consider member with at least one remix). From the computation formula of Jaccard coefficient it is obvious that $SA_{ij} \in [0,1]$, furthermore $SA_{ij}=0$ means that user(i) and user (j) have not remixed any common projects while $SA_{ij}=1$ means that user(i) and user(j) have remixed exactly the same projects. For the test data set mentioned above we can see a subset of SA in Table 2. To produce recommendations for a specific member we order the list of other users in decreasing order of similarity. Then we propose projects from the remixes of the more (but not absolutely, SAij=1) similar users which has not been remixed by the specific member. For example to user *__sakura__* we can propose projects from the remixes of users *100seconds*, and/or *101eisoJ*, and/or *110ronaldo*.

Table 2. Excerpt from the similarity matrix (SA) for the ScratchR test data set

	__sakura__	02sergi02	06howardr	100seconds	101eisoJ	110ronaldo
__sakura__	1	0,000	0,500	0,500	0,500	0,500
02sergi02	0,000	1	0,000	0,000	0,000	0,000
06howardr	0,500	0,000	1	1,000	0,000	0,000
100seconds	0,500	0,000	1,000	1	0,000	0,000
101eisoJ	0,500	0,000	0,000	0,000	1	1,000
110ronaldo	0,500	0,000	0,000	0,000	1,000	1

An example of the potential

In order to have a practical example of the potential of the proposed technique we are going to apply multidimensional scaling on the Similarity Array. This is going to give us a graphical summary of the complex relations between members. It is interesting to see an example of the recommendations produced by the above technique and to estimate their quality. An excerpt of the two dimensional diagram from the Multidimensional Scaling to the Similarity Array appears in figure 1. From the diagram we can see groups of similar members that remix rather the same group of projects. Members in the center remix the most remixed group of projects.

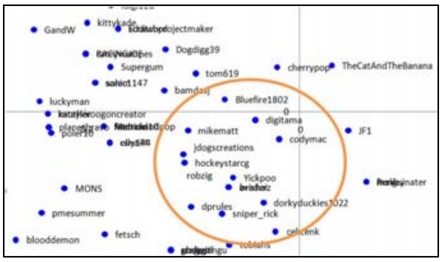

Figure 1. Excerpt from the central part of MDS diagram of SA

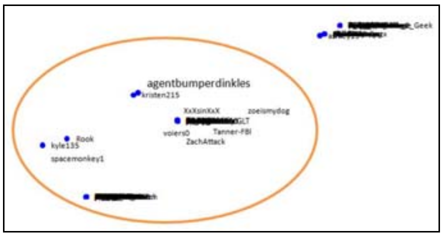

Figure 2. Excerpt from a marginal part of MDS diagram of SA

When we want to make recommendations for one specific member we have to consider the nearest neighbors of him/her. For example let's focus to user *jdogscreations* who (according to the RP) has remixed the following projects: "*1 PacMan*", "*2 Pong*", "*4 MarbleRacer*", "*Doodle*" and *"Marble Racer starter"*. User *hockeystarcg* is a close neighbor of *jfogscrations* and has remixed the projects: *"2 Pong", "4 MarbleRacer", "6 Doodle",* and *"Marble" "Racer starter"*. So the system could suggest to *jdogscreations* to consider projects *"1 PacMan"* and *"6 Doodle"* for remix. Let's take another random sample from the marginal area of the diagram (Figure 2). In the margins users tend to be more exceptional and not so similar. Following the same procedure the system could suggest to user *agentbrumperdinkles* who has remixed the projects: "*1 PacMan"* and "*3 Trampoline"* the project "*Perfect Sidescrolling Engine v1.0"*. This is quite an interesting recommendation because the suggested project is a model project that shows how to implement side scrolling in Scratch; this could empower the user to build more complex programs. Even these small data set shows that it is possible to build one recommendation mechanism for the ScratchR community that could foster the collaborative learning of programming.

Discussion

Computer programming is an educational interesting competence for economical and general learning reasons. Scratch is an educational programming environment which is quite popular and successful. The system provides an easy introduction to computer programming. In addition ScratchR provides user of Scratch with an online community where they can publish, share, comment, and creatively appropriate (remix) projects. In this paper we proposed and described the development of one collaboration fostering mechanism, based on the collaborative filtering technique for the production of personalized suggestions lists with projects recommended for remix. Remix of a project is considered a significant collaboration event in scratch and in every programming environment. The proposed mechanism increases the frequency of projects remixing and constitutes a collaboration fostering mechanism. There are many other possibilities to apply interaction analysis (Fesakis, Petrou, & Dimitracopoulou, 2004; Dimitracopoulou, 2008) techniques in ScratchR. For example, it is possible to make recommendations of members for collaboration, projects for examination, galleries to participate etc. This work is going to be continued after the initial exploration of these possibilities in ScratchR and other communities, with the provision of the personalized recommendation system, its evaluation by the community members and the study of its effects

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Context-aware Activity Notification System: Supporting CSCL

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Abstract: This poster provides an introduction to the Context-Aware Activity Notification System (CANS) and a brief discussion of its design research process. We report the results of three phases of design work. The cumulative results suggest progress toward useful activity visualizations to support forms of social and collaborative learning. The notifications can raise motivation to participate, enhance awareness of group, class, and self-activity, increase participation, and support awareness of instructional and problem-solving opportunities.

Introduction

In traditional face-to-face courses, instructors and students come to a physical place where they mutually act out the course activities. Coordination and cooperation are facilitated by cues and structures in the context: such as, a bell ringing to signify it is time to attend to the teacher, the clock on the wall providing a common marker for knowing how long an activity should last, students passing completed work forward at the end of a class period, or seeing opportunities for dialog. Seeing how others use these cues and structures also shapes interaction. However, in online learning, the Learning Management System (LMS) is a black veil between the instructor and students and among the students. Faculty and students are limited in their knowledge about what is happening in the course to the “words” spoken. Students do not see other students working; nor for the most part do they see each other’s products. Instructors do not see students working and can only influence them with words. Similarly, students do not see instructors working outside of formal presentations and feedback activity. The lack of social information constrains social and collaborative learning.

Context-Aware Activity Notification System (CANS) hopes to improve online learning by making it more social. Instead of simply being a “space” for threaded discussions and information access, we want a “place” that supports the social nature of education. Dourish argues that computation is a medium that communicates between social actors and that represents possibilities for action (Dourish, 2001). Thus, the online learning system must be a medium for the cues of the social nature of online learning which links students to a teacher and students to one another. In 2005 we developed a new architecture to implement CANS with the open source LMS Sakai. In 2007 we were awarded a FIPSE grant from the US Department of Education to advance the research and development of CANS.

CANS – the system

The CANS System includes the LMS, in this case Sakai, and the CANS Server, which provides communication and database services for notification. CANS is licensed under the Educational Community License (1.0) version of the open-source license. CANS supports capturing activity information by establishing a vocabulary of tools and action events, maintaining a history of activity, making notifications available based on the context of use, and allowing users to configure their notification preferences. CANS works by observing activity in the LMS, such as when a member logs in, reads a discussion board item, uploads a document, or enters a chat message. CANS observations are stored and matched with profiles for access to awareness information set by the members. Matches lead CANS to send information to members who want the information in a form they have selected. For example, a student in a group may want to know when the instructor has posted an assignment and have that information immediately emailed or delivered via a desktop widget. The student may want to see who has posted new messages or read existing messages, but only want that information when they enter the course website. An instructor may want the same information but want it organized in a table to see who has contributed and how much to a discussion. Thus the awareness information is a resource for instructors and students in knowing when and how to act, and also a tool for an instructor to quickly make sense of what is going on in the course, how to assess what is going on, and identify appropriate next steps for the class or individual students.

Design of CANS

This section describes phases in the design, development, and testing of CANS from September 2007 to October 2008 and includes a brief summary about the iterative design process, prototype development and evaluation of CANS. The main objective of CANS design is to provide awareness information that is easy to use and supports activity awareness in online environments. There were four phases of design during this period. Each phase reviewed prior design work, developed a prototype and conducted usability testing with representative users including scenarios and think-aloud techniques (van Someren et al., 1994).

Phase-1: Email Digest

An email digest provides a list of activity over a period of time. The daily email digest lists activity in the discussion board, resources (file sharing) and chat room. From usability testing, we found that as the number of activities increased, members opted for visual representations of notification information as the most useful and effective when compared to the textual formats used in the current digests.

Interviews were conducted with 34 students in 6 online courses that were receiving the CANS Email Digest during Fall of 2007. Students primarily spoke of using the digest as a useful reminder of the class itself and a way to track instructor activity, but were often overwhelmed in an active class by the lengthy Email Digest. While some skimmed the contents for actions that were important to them (group member or instructor posts), others simply viewed the unread email as a reminder of the class and deleted it. Because high levels of activity within the class created long lists of activity, many students used the list of text somewhat as a visual bar graph; having a long email indicated a high activity level for the class and encouraged the students to enter the learning environment.

Phase-2: Interactive Webpage

The Email Digests seem to serve a need for a quick snapshot related to certain actions, but respondents described many and varied ways they like to use the social information. We needed a new environment that was both visual and interactive. We used visualizations to provide social comparison information to support self-evaluation and promote participation in online learning. According to Festinger (1954), people are driven to compare themselves with others to evaluate and improve themselves. The Interactive Webpage is a way to see and compare individual student activities in class (see Figure 1). It allows users to customize how they visualize the quantity and relative levels of participation; for example, individual postings and views of discussion boards, chat and resources tools can be viewed in the comparison bar chart and tables for three different time periods – yesterday, last 3 days, last week.

❶ Users can select view options – yesterday, last 3 days, last week.

❷ When users mouseover an item in the chart legend, highlight the corresponding item in the bar chart.

❸ *Member Visualization*: The bar chart shows activities of individual members and average in class.

❹ *Activity Summary*: The table shows who did (posted/viwed) what when.

❺ *Member Summary*: The table is the number version of Member Visualization. By clicking the table header, users can sort the summary table and bar chart.

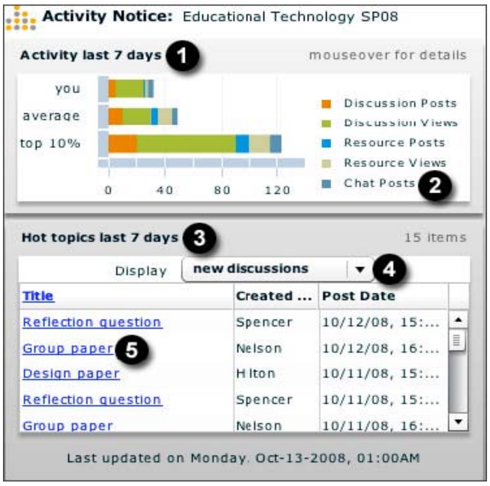
Figure 1. A Screenshot of Interactive Webpage

In the Summer of 2008 was used in 2 online courses. Semi-structured interviews were conducted with 7 students and a focus group was held with the instructors. The reactions of students and instructors to the Interactive Webpage differed from each other greatly. While students found the Activity Summary a "cool-looking" tool, they were confused about the purpose of the Member Visualization. Many were often worried about how it would be interpreted or used by the instructors or peers, and if the quality or thoughtfulness of their postings would be taken into account. Due to the names connected to the graphs, students often felt they were invading other people's privacy by "spying on them." The Member Visualization also had different effects on people depending on their motivations. For some students, the visualization had no effect; to others it made them feel competitive to "get the longest bar graph", while others wanted to seem average and not look like they "didn't have a life" and therefore logged out early without reading everything they wanted. Students often used the Activity Summary as a way of seeing "what the masses were doing" and following suit; in other words, it was an easy way to see which discussions or documents were popular and then find those objects.

Instructors found the Interactive Webpage tool useful for observing patterns of non-participation or seeking history when a student would have problems or questions. Being able to interactively ask questions of the date by selecting, sorting or inspecting visual representations was valued for diagnosing problems or assisting a student with a question or problem. Most felt that this interface was a useful interface for the instructors, but too intrusive for students.

Phase-3: Homepage Widget

In the design of the Homepage Widget, we tried to create a simple and unobtrusive way of delivering class activities for users. The Homepage Widget provides a personalized view of course activities by showing "YOU" in the visualization. Therefore, each user can have a customized view of the bar chart. We currently are in the process of collecting user experience data on the homepage widget.



❶ *Activity last 7 days*: The bar chart shows a personalized view of class activities – you, average and top 10%.
❷ A mouseover of an item in the chart legend highlights the corresponding item in the bar chart.
❸ *Hot topics last 7 days*: The table shows key discussion topics and resources.
❹ Users can select the drop menu options – new resources, new discussions, most viewed discussions most active discussions, most viewed resources.
❺ Users can directly go to discussion pages or open resources by clicking titles.

Figure 2. A Screenshot of Homepage Widget

Implications of CANS for Supporting CSCL

We believe that notifications via activity visualizations are potentially a valuable tool for instructors who want to implement CSCL in LMS. Throughout our usability testing and user experience studies, we have learned that the notifications can raise motivation to participate, enhance awareness of group, class, and self-activity, increase participation, and support awareness of instructional and problem-solving opportunities. However, challenges remain to attune the notifications to the course environment. For example, social comparison visualizations, which identify students by name can have a negative impact on some students' participation, depending on each student's desire to look normal in the eyes of his/her peers or concerns about privacy issues. The use of a social comparison visualization that is customized to the user and eliminates the fear of "participating too much" may better support student self-evaluation and participation. Our next efforts at design for student notification are moving away from student-centered representations and toward object-centered representations. Also enabling customization in report generation and in the way reports are viewed should better support students working in groups as well as whole class activity.

For instructors, the Member Visualization, with each student identified by name, as well as the Activity Summary were useful tools for identifying troublesome patterns or when issues arose. Having an instructor tool which shows specific members yet also allows flexibility in troubleshooting issues and problems is a priority. Activity visualizations such as these show promise for supporting student participation and collaboration and enable instructors work to implement CSCL methods in their online courses.

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Share and explore discussion forum objects on the Calico website

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Abstract: In this article, we present the Calico website, a shared space where researchers and practitioners in education share and explore discussion forum objects coming from different e-learning platforms. The platform is briefly described. The focus is set on the different kinds of representation provided by the Calico toolkit.

Introduction

Asynchronous online discussion forums are used in a wide range of contexts in education. Analysing and building representations for the large amount of data underlying these forums often requires sophisticated methods and tools (Hrastinski & Keller, 2007). Rosé et al. (2008) provide a review on automatic collaborative learning processing.

Bratitsis & Dimitracopoulou (2007) developed the DIAS discussion forum system with several integrated interaction tools that offer a wide range of indicators to all discussion users: students, tutors, teachers and researchers alike. Li et al. (2007) propose a multidimensional analysis framework that supports interaction analysis, text analysis and social network analysis. But in those systems like DIAS or Knowledge Forum for instance, the analysis tools are only available through the platform that supports the discussion forum itself.

Comparing analyses of forums coming from various contexts remains a difficult task. One challenge lies in the fact that applying various tools to the same forums requires a lot of transformations. To facilitate comparisons in content analysis, Law et al. (2007) argue for a unified toolset for analysing CSCL stressing on the fact that “the tools for different analysis are not integrated so that lots of time are wasted in transforming data into different formats for the different analysis”. Offering new open services and tools for the sharing, the exploration and the comparison of fora is at the core of the Calico initiative presented in this paper.

One major issue of the Calico project is to make forums easier to read, explore and analyse. In this perspective, a shared workspace has been developed with novel tools that propose several ways to display the contents of a forum, to compute quantitative and qualitative indicators about authors, interactions, topics and to offer new ways to display global or local information about a forum.

The Calico shared space

The Calico research network associates 4 research laboratories and 6 colleges of education with the goal of developing a better understanding of distant collaborative learning and providing tools for researchers and practitioners for better management study and analysis of discussion fora. The main purpose of this network is to share data, methodology, needs, tools, and analyses between researchers and teachers, allowing different views on content and interaction analysis.

The Calico website offers a shared space dedicated to researchers and practitioners for analyzing “Computer Mediated Communication” (CMC) objects. It was originally created for sharing discussion forum objects from e-learning students’ platforms but it now handles other communication objects such as mailing lists.

The Calico website (http://wims.crashdump.net/calico/) is a CMC object sharing website where users can upload, view, study and share CMC objects. Unregistered users can watch and study public anonymous CMC objects on the site, while registered users are permitted to upload an unlimited number of objects. Some objects are available only for the Calico special interest group, while private CMC objects are strictly available for their owner. The privacy aspects have also to be considered. The Calico website provides light anonymisation features for discussion fora. Full automated anonymisation is not provided since it may transform significant parts of messages.

The technical issues of sharing and exchanging CMC objects stand in three points: the specification of exchange formats, the management of dynamic sources, and the management of large sources.

Sharing and exchanging CMC objects is a new need. Standard exchange format did not exist when we started this work in early 2000’s. Most platforms handle their own data format and few ones include export techniques. The Calico and Mulce (Multimodal Learning Corpus Exchange, http://mulce.univ-fcomte.fr/axescient.htm) initiatives started the design of an exchange format for such data quite simultaneously. While the Calico XML exchange format named XmlForum and designed by B. Huyn Kim Bang and E. Giguet, allows the representation of discussion forum objects, the Mulce XML exchange format allows the representation of general CMC objects and includes detailed meta-information (Reffay et al., 2008).

The design of an exchange format is mandatory but still does not solve the whole exchanging and sharing problem. Exchanging and sharing discussion objects requires the conversion of discussion forum to XmlForum. The conversion is achieved by connectors or spiders that translate e-learning platform proprietary format to XmlForum open format. We already built up two spiders, one for discussion objects coming from BSCW (Basic Support for Cooperative Work) platforms (http://www.bscw.de/) and another one for discussion objects powered by phpBB, a commonly used open solution (http://www.phpbb.com/), and one connector for ASPFRM discussion objects coming from the DIAS system (Bratitsis & Dimitracopoulou, 2007).

Exploring CMC Objects with the Calico toolkit

The Calico toolkit is made of multilingual, user-centered, exploration tools dedicated to CMC Objects. Prior to the exploration, the CMC Objects must have been uploaded on the Calico website. In the following sections, we will focus on five components of this toolkit.

Reading and Filtering CMC Objects: ShowForum

The toolkit includes a basic tool named ShowForum to display and read all available information related to a forum. The messages can be displayed with two layouts: the list layout, and the thread layout. The list layout simply displays the message in chronological order. The thread layout displays the message by threads, in chronological order of the initial message of the thread. Each thread is shown as a "tree", focusing on the relation between posts and replies. A feature allows dynamic anonymization of the author name mentioned in the header of the messages. This feature is shared with the other exploration tools.

Preferences allow the user to filter the messages according to several combined criteria: authors, date range and thread subjects. These preferences will be considered by all the other exploration tools so that analysis can be performed on different views of interest.

Creating chronological thumbnails of CMC Objects: Anagora

Anagora provides a graph representation to visualize overlapping discussion threads over time on a single screen. Its special feature is to calculate the best resolution for a forum to fit on a screen by choosing the most appropriate time scale according to data (Giguet & Lucas, 2009).

Focusing on the CMC Objects content structure: Themagora

Themagora parses discussion forum objects as collective discourse directed either by a specific task achievement goal or by a communication goal. It is a multilingual robust tool, providing "forum tiling" but also "discussion nesting". It uses the differences in the structure of messages along with stylistic statistical data to segment and organize the content of discourse. No external resources are needed. The output of this adaptive parser is a scalable view on collective discussion. Such views are used to browse and navigate in large forums, or to compare discussion progress between small learners groups (Lucas & Giguet, 2008).

Building and Locating topics in CMC Objects: Colagora

Colagora is a tool based on ThemeEditor (Beust, 2002). It allows the user to build up lexical topics, according to his interest. Then it allows to explore the forum through these highlighting filters. Topics of interest are defined with simple word lists. These word lists are either uploaded in the Calico website, or defined interactively from the forum lexicon. Colagora is directed by the user's needs as far as lexicon is concerned: the tool counts word occurrences and displays the whole word list sorted by frequency or by alphabetic order. The user can defined word topics with the words that truly appear in the forum, and with their existing variation due to derivation or misspelling. Colagora then highlights every matching word of the forum with the color linked to the topic (see Figure 1a). Like discussion forum objects, topic objects can be shared with other members. When topic objects are selected, they are used by other tools to colour their own representation (see below Bobinette).

Time, threads and topics: Bobinette

Bobinette was first developed by Huynh Kim Bang and Bruillard (2005) to solve reading problems occurring with classical forum interfaces. Bobinette offers both global and local views of a forum. It uses the chronological axis to display beads (representing posts) on a thread of discussion drawn as an horizontal line. Simultaneous threads are represented as additional lines below the first one. The main topic can be visualised by colour, and special messages, typically starters containing many questions, are highlighted by a question mark. Any post can be clicked open for closer reading. Bobinette has the capability to compute statistics about word topics for a forum and for each post. The content of selected posts can be displayed and the topic words highlighted (see Figure 1b).

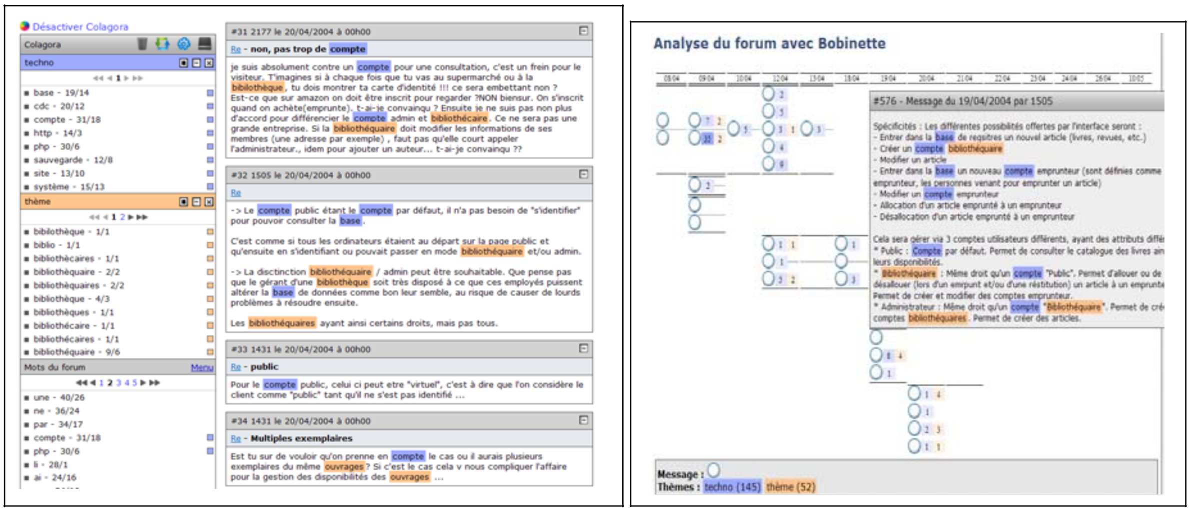

Figure 1. a) Colagora helps defining topics interactively. b) Bobinette offers global and local views.

Discussion and Perspective

One major result of the Calico website is to make forum objects easier to share and explore in education. Thus, the website contributes to the dialogue between researchers and practitioners. The Calico shared workspace includes novel tools that propose several ways to display the contents of a forum, to calculate quantitative and qualitative indicators about authors, interactions, topics and to offer new ways to display global or local information about a forum.

The Calico website hosts about 50 CMC objects, including discussion forum objects and mailing list objects in three languages (French, English and Greek). These objects were uploaded by members of the Calico network and by other researchers, using different e-learning platforms. We now consider the extension to other CMC objects, for instance, chat rooms, instant messaging, blogs. Other languages are also considered: exploring forum objects in Vietnamese and Arabic is under work. The improvement of the existing tools will focus on higher interactivity of the displays, better management of scalability, multilinguism, while allowing comparison between forum objects or forum excerpts.

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Improving CSCL indicators by sharing multimodal teaching and learning Corpora

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Abstract. We point out the need for CSCL community to reach large scale validation for its results by addressing the lack of sharing of interaction indicators and data. The main goal of the Mulce[1] project is a definition for teaching and learning corpora (especially for interaction tracks), a technical format to organize data and a platform for corpus sharing, providing analysis and visualization tools.

Motivation

During the last decade a lot of technical propositions for indicators of social or cognitive process monitoring have been made. The very most part of these indicators (including ours) are designed in a given context, where they show some interesting properties and even promise usefulness for the various actors involved in CSCL real situations. Unfortunately, these indicators often stay in the researchers' hands and are rarely used by real actors of the situation. As far as we know, none of them have been validated or at least evaluated by real/concrete actors. The need for validation of these indicators, at least in a given context, becomes crucial if we want this domain to contribute to the distance learning area of the real world. These indicators are also rarely reused in other situations or contexts. With others (Rourke et al., 2001) we think that replicability, reliability and objectivity need to be improved in our work. A path on this direction would be sharing data so that they can be analyzed and compared. Therefore we propose a formalism to describe contextualized interaction data.

Proposal

Our proposal consists in (1) a formalism to describe a learning and teaching corpus and (2) a platform for corpus sharing (Reffay et al., 2008). The formalism defines the information which can be contained in a corpus and the structure of the data. Through the platform, researchers can share their corpora with the community and access the data shared by other members of the community.

Proposal 1: Learning and teaching corpus formalism

Building and recording interaction in an online training

We define a Learning & Teaching Corpus as a structured entity containing all the elements resulting from an on-line learning situation, whose context is described by an educational scenario and a research protocol. The core data collection includes all the interaction data, the training actors' production, and the tracks, resulting from the actors' actions in the learning environment and stored according to the research protocol. In order to be sharable, and to respect actor privacy, these data should be anonymised and a license for its use be provided in the corpus. A derived analysis can be linked to the set of data actually considered, used or computerized for this analysis. The definition of a Learning & Teaching Corpus as a whole entity comes from the need of explicit links, between interaction data, context and analyses. This explicit context is crucial for an external researcher to interpret the data and to perform its own analyses.

Corpus composition and structure

The main components of a learning corpus are:

- The Instantiation component, the heart of the corpus, which includes all the interaction data, production of the on-line training actors, completed by some system logs as well as information characterizing actors' profile.
- The Context concerns the educational scenario and the research protocol (optional element).
- The License component specifies both corpus publisher's (editor) and users' rights and the ethical elements toward the actors of the training.
- The Analysis component contains global or partial analysis of the corpus as well as possible transcriptions.

The Mulce structure aims at linking the components of the corpus. For example a researcher, while reading a chat session (which belongs to the instantiation component), may have to read the objectives of the activity (which belongs to the pedagogical context).

Instantiation formalism: Actors and environment description

If learning design is a general description of activities involving generic roles and environments, the instantiation phase is concerned by real actors and concrete platforms and tools. It consists in describing (1) the actors (identifier, learning profile, linguistical and cultural aspects, etc.), (2) the technological environments (name, version, URL, etc.), (3) the tools used during the learning activity (technical components actually used) and (4) the groups and their members.

Instantiation formalism: Workspace concept

The hierarchical structure of the learning stage (potentially spread in parallel groups) is captured in the Workspaces element, i.e.: a sequence of "workspace" elements (see figure 1). A workspace is generally linked to a learning activity (of the pedagogical scenario). It encompasses all the events observed during this activity, in the tool spaces provided for this activity, for a given (instantiated) group of actors. A workspace description includes its members (references to the actors registered in the learning activity), starting and ending dates, the provided tools and the traces of interaction that occurred in these tools. In order to fit the hierarchical structure of learning and support activities, a workspace can recursively contain one or more workspace elements. The lists of places, sessions, descriptors, contributors and sources defined in the workspaces element can be referenced by workspace, contribution, or act elements. For example, descriptors may list identified categories so that each act of the acts element list could refer to one or more of these categories. This principle enables to browse the interaction data in many different ways, independent to the concrete storage organization in the XML document.

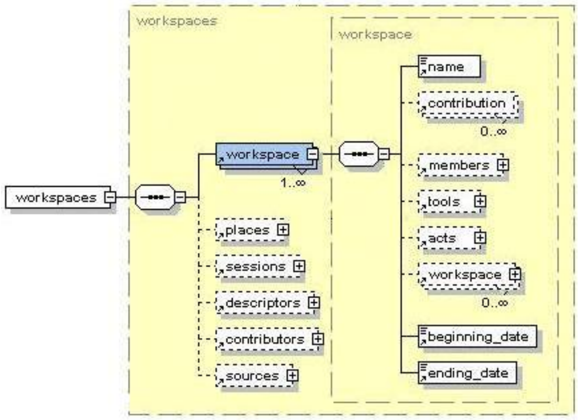

Figure 1. Extract of the XML Schema: workspaces and workspace elements.

Our specification describes communication tools and their features with a great level of precision. The corpus builder can specialize/particularize the schema (i.e., restrict it) to fit the specific tools and features proposed to the learners in a specific learning environment. In the meantime, if a tool cannot be described with the specification, one can augment the schema by adding new elements, in order to take into account the tool's specificities. Both of these mechanisms offer two ways, the specification can be extended to fit the analysis needs. Moreover, recursive workspace description enables the corpus descriptor to choose the grain at which he needs to describe the environment. Thus, a workspace can be used to describe a complete curriculum, a semester, a module, a single activity or a work session (a concept generally related to synchronous learning activities). The workspace concept represents the space and time location where we can find interaction with specific tools.

Interaction traces are stored according to the act's structure. All actions, wherever they come from are described by an act element. Depending on its nature, an act is described by different elements, mandatory or optional like a reference to its author identifier, a beginning and an ending date, an act type and an actual content (or value). For example, a chat act can have the type in/out (actor entering/leaving), it may contain a message, can be addressed to all the workspace members or to a specific one (particularly if it is a private message). This XML Schema defines the storage structure for many act types, e.g.: forum message, chat act, transcribed voice act, and more. The complete Mulce schema[2] for the instantiation component (structured information data) is available online.

Proposal 2: a Platform for corpus sharing

Sharing corpora

The deposit of a corpus consists in declaring it, describing it by means of general metadata, and uploading its components (described previously). Each component has a specific formalism. These can either be standard formalism such as Learning design (IMS-LD 2003) (used for the context components: educational scenario and research protocol), or the specific formalism described here above for structured interaction data. If these recommended formalisms are used to describe the various components of the uploaded corpus, the researchers will fully benefit from all the tools provided one the Mulce platform to navigate and analyse the entire corpus. Otherwise, the corpus will be downloadable as is by other researchers. Each component is described by its specific metadata. On the Mulce platform, these metadata can be used by a researcher to find corpora that fit particular constraints. For example the researcher can select the corpora concerning its own research interests, either in term of used tools, of targeted audience or learning domain.

Browsing and analyzing corpora

The second part of the platform proposes the visualization, the navigation and the analysis of structured interaction data. We distinguish two parts: the navigation (or visualization) aspect, and the analysis aspects of corpora. The interest of the navigation aspect is twofold. Firstly, the corpus becomes independent to the (evolving) software, where originally interaction took place. This is a major benefit for data longevity and reusability. Secondly, because of the main attention paid on the context of interaction in the Mulce project, the interaction navigator makes explicit links between interactions and their surrounded context. Finally, the researcher can select a part of a corpus by means of requests. He can, for example, select all the interactions of an actor using a specific communication tool. For each of the interactions he can access to the prescribed educational activity. The analysis aspect of corpora concerns the use of tools based on the instantiation component formalism. The XML format being defined, we hope that different analysis tools (including indicator synthesis), coming from various teams, will have a version that can operate on the Mulce structure. The tools proposed on the platform will originate from our research team (Betbeder et al., 2007) or from partnership. For example we have two running collaborations: the Calico[3] project, Tatiana (Dyke et al., 2007). The Calico project aims at proposing different visualization and analysis tools, specialized on discussion forums. Tatiana includes a navigator, a replayer and an annotator. The replayer functionality synchronizes the various data sources. We are currently adapting its XML schema to fit ours and extend its visualization functionalities to other communication tools. We are interested in other collaborations aiming at providing other analysis tools.

To conclude, this work suggests a way to access, share, analyze and visualize *learning and teaching corpora*. To make this technically possible, we propose (1) a formalism which defines, describes and organizes data provided by on-line training and (2) a platform to navigate through, visualize and analyze corpora (currently being integrated) through of a variety of tools.

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Alternative ways of monitoring collaboration

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Abstract: Teachers of networked collaborative classrooms, with multiple groups interacting in parallel, need assistance for better understanding and regulating the learning process. They may use tools that collect and process students' activity data, and generate views of students' activities. Classroom management tools may be used to observe and control students' screens, but often fail to exploit interaction data. We present the results of a study where teachers used a classroom management environment to monitor students' collaborative activities, and a discussion of the alternative views provided by a cscl tool, designed for teacher's support.

Monitoring Groups' Collaborative activities: A task for the teacher

In CSCL research community there is an increasing interest in the design of tools that support students' computer mediated collaborative learning. Tool designers build tools for students and teachers; however they seem to pay more attention on students' needs than on teachers' (Dimitracopoulou 2005).

Examples of teacher tools include Prof-CHENE with a communication space for the teacher, that was used to investigate, the nature of knowledge of teachers on students collaborative problem solving (Baker et al 2001). González and Suthers (2002) have proposed a pedagogical agent that helps students collaborate while solving Entity Relationship modeling problems in COLER. The generated advice, during online intervention, was based primarily on comparison between students' individual and group solutions and student participation (e.g. contributions to the group diagram). During Collaborative mediated collaboration (CMC) teachers play multiple roles: providers of information, managers of the students' interaction, and moderators of the students' debate (Baker et al, 2001). Dillenbourg (2005) estimates that the cost for regulation and tutoring multiple groups in a CSCL environment might be very high, so the teacher, like Boeing pilot, is expected to use a "cockpit", for a quick and effective class and group overview. CSCL tools and class management tools have however different objectives. CSCL tools aim at facilitation of collaboration, while classroom management systems, based in network management infrastructure, aim at the management, observation and control of students working in a network either individually or in groups.

In this paper, we report on a study that discusses the effectiveness of these two approaches. First a class monitoring environment has been used to support the teacher. Then a CSCL environment and the support that it provides to the teacher is discussed. At the final part of the paper, a comparison of the affordances of the two approaches is included, along with the future perspectives and implications for next generation monitoring tools.

Context of the study

A network based synchronous collaborative drawing tool, Synergo, has been used for a number of years in an undergraduate course, part of a Computer Engineering degree curriculum. A typical collaborative activity involved dyads of first year students, during a laboratory class and lasted 60-90 minutes approximately. Their joint task was to build a diagrammatic representation of an algorithm that was provided in textual form. Students interacted through Synergo where in a shared window they built their diagrams (i.e. flowchart), and communicated via a chat tool. Teachers observed students' screens and intervened to regulate their activities, without additional support by any tool. Students were asked to seek their partners' help during the problem solving process. Face to face interaction was permitted with restrictions, as students, and teachers were present in the same laboratory. Teacher interventions were permitted in case of major difficulties. Two teacher tools have been used to support teachers in similar settings in subsequent years: NetOp School ™ (www.netop.com), a commercial Class Management Tool (CMT) and Synergo Supervisor, a tool specially designed for supervising and monitoring Synergo collaborative activities. The latter study took place with CMT in two subsequent weeks during last semester, in two laboratory sessions. Five laboratory groups involving 150 students, participated. The observations made are discussed next.

A class management approach for collaborative class monitoring

The class management tool used, NETOP School, include a module for instruction planning, class management and monitoring. The teacher is able to observe students activities at real time, control students actions as permitting or denying access to applications, or locking students workstation. The teacher has the ability to monitor the whole class using thumbnail views of student screens, record students' screens or take snapshots of them. In our study, it was considered most appropriate to use the monitoring facility for observing the activity of 30% of the students of the group which have been selected randomly, i.e. for this study only 10 students' activities were monitored per lab. One teacher and two assistants were present at each lab session. The class monitoring environment was used by the teacher. The teacher observed students screens in thumbnails, or the full size screen of a selected student.

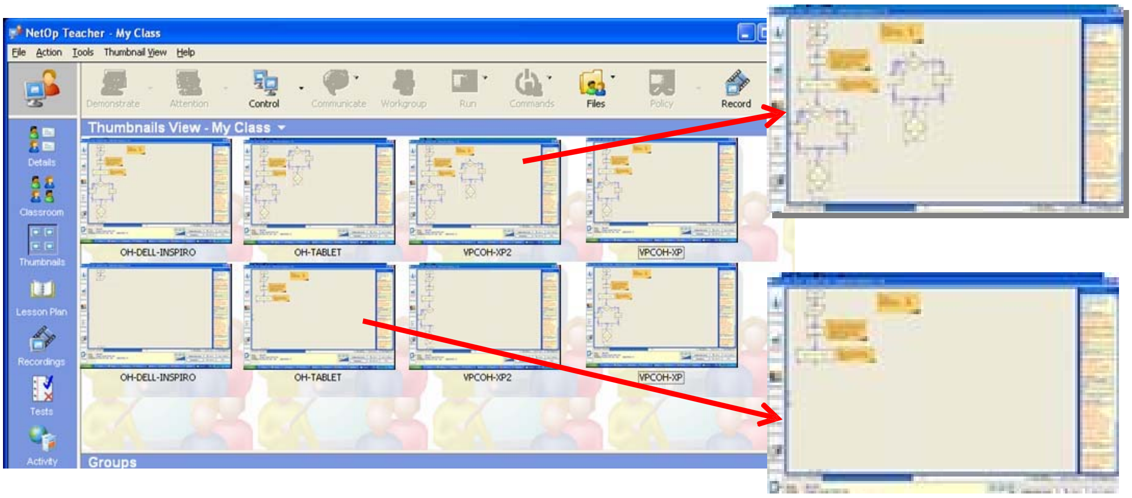

Figure 1. Class management system thumbnails overview.

Based on the teacher's report after each laboratory activity, we discuss the first findings. Students remained on task, so Synergo was the main application in use, therefore, monitoring of each individual screen was easy. However the teacher was able to monitor only the part of the shared working space and the chat dialogue that students were looking at. The persistency of the shared working space and chat, served as a shared working memory (Dillenbourg, 2005) for each group, but not for the teacher. For instance an empty working space (e.g. left bottom of fig. 1) may be a typical situation that requires intervention, as it indicates small progress. However after close observation for some minutes, the teacher discovered that this student had scrolled the already developed part of the solution out of the screen. In order to follow groups' reasoning and reconstruct their activity (Baker et al, 2001) the teacher had to look at the whole process. This was not possible since only the current status of the solution and chat that students worked on, was available. Keeping track of each students' solution and collaboration process by shifting attention among groups, even if only 30% of the students' activities were monitored, was found particularly demanding.

During this study a requirement of visualization of more abstract views of group interaction data was raised. In addition, asynchronous navigation of the history of the working space or chat of each group was discussed. The teacher was interested in solution process (Voyiatzaki et al , 2006). Thumbnails provided a comparative view of the progress of students' work. E.g. in fig. 1 the teacher can see that the upper screen the group had proceeded with the implementation of the loop, while this is not the case in the lower screen. Concerning collaboration, this could be monitored only through inspecting the chat, however this was also hard, as students in these activities used elliptical language in chat messages, and they actually used two related means of communication: chat and flowchart symbols. Thus it was easier to monitor the status of problem solution at the level of the class and group and not at the individual level. Alarms for unexpected situations were not produced, as activity data could not be processed.

Monitoring a collaborative class through Synergo Supervisor

Synergo Supervisor is a tool designed to support the monitoring and supervising role of the teacher in these activities, and has been used in similar setting in previous courses (Voyiatzaki et al , 2008). In the spirit of Cockpit (Dillenbourg, 2005), the teacher has a quick overview of group's activities and identification of the groups that do not function as expected, like the pilot who identifies faults in the plane. The teacher monitors each group's process in various levels of detail, through graphs, video like representations, and sequences of snapshots of the drawing space, based on calculation and integration of logged data. The teacher is able to have an overview of the current status of the class activity. He can navigate asynchronously more detailed views of each group's interaction. Changing focus, he may inspect the history of the process at student, group or class level. It offers an overview of the groups' processes with comparative view of snapshots taken during solution process, and with graphical representation of students' interaction.

The teacher had an overview of groups' activities in a class overview level (Fig 2 (1),(2)). Unexpected interactions could be identified: A warning symbol of a "lamp" and "chat" have been associated to groups 1 and 3 respectively, as their state was not as expected. Comparison of class and current group behaviour, activated triggers that generated these indicators. In the graphical overview representation (2) the teacher could see that one group was more active than the others or exchanged fewer chat messages. He focused, on groups' dialogues

(3), in order to detect difficulties or misunderstandings that might require intervention. He was always aware of groups' interaction overview (2) and able to navigate asynchronously to current and previous snapshots of their solution . Selected group's current solution instance was compared with other groups' solutions (5), even in a less detailed view, to detect differences, for teacher's intervention. The teacher monitored individual's contribution, either by content of messages (3) or by comparing group members' interactions (4). The teacher was able neither to observe the monitor of each student, nor to take the control from the student (e.g. to deny access to other applications).

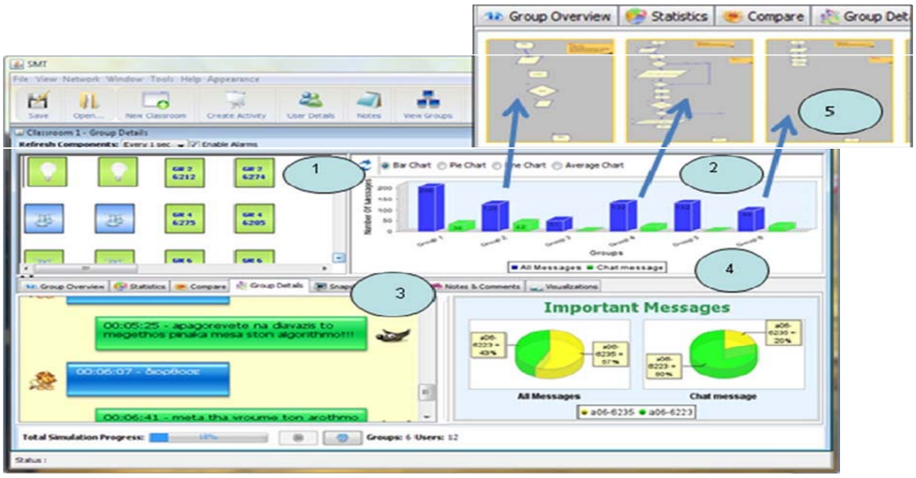

Figure 2. SYNERGO Supervisor .

Perspectives on tools for supporting teacher understanding

From the discussion of the first outcomes of our study, it seems that very rich representation as students screens, are not always enough to support teacher's understanding during collaborative activities. A combination of the two tools presents advantages: Synergo Supervisor may be used as teacher cockpit while class management system as teacher navigator, control and communication channel. We want to analyse the use of the two approaches by the teacher, to gain better and in depth understanding of teacher needs in real time class collaborative setting. So a new study is planned, in which we plan to use both these environments.

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Computer-Assisted Evaluation of CSCL Chat Conversations

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Abstract: Although instant messaging is a very popular tool for collaboration and it has been used for a wide variety of CSCL tasks, there are only a few applications for assisting the tutors in evaluating the conversations of the students. Due to the difficulty of this task, chat is seldom used in a formal education context. In order to tackle this problem, several applications were developed which assist the tutors when evaluating chat conversations. This paper presents a comparison of the evaluation results when using these applications on a set of three multi-user chat sessions.

Introduction

Instant messaging has been proven to be an effective way of undertaking Computer Supported Collaborative Learning (Stahl, 2006) because it is a simple and efficient synchronous communication tool which facilitates the construction of complex ideas as a result of group discourse. It is also suited for larger groups because, unlike verbal conversations – either face-to-face or videoconferences, it permits the development of different discussion threads at a particular moment in time. Therefore, many environments and tools which have been developed for CSCL during the last 15 years have included instant messaging facilities (Baker & Lund, 1996). Various enhancements to standard instant messenger technology have been proposed and CSCL chats tools have introduced facilities such as explicit referencing of previous utterances or concepts (Mühlpfordt & Wessner, 2005), whiteboards and concept map drawing board. Nevertheless, with a few exceptions, the usage of chat was not adopted in a formal educational context, mostly due to the difficulty of assessing the participants' participation to conversations. In order to solve this issue, there is a need for tools that analyze chat discussions and provide feedback to the tutor.

This paper presents a comparison regarding the evaluation of chat conversations by two groups of tutors: those analyzing the chats using specialized tools and those who are not using any analysis software. The next section describes the chat experiment and the main features of the tools used for analysis. Then, we shall present the results of evaluating the participants in the chat by four different tutors, as well as the automatic grading offered by the software. The paper ends with conclusions and references.

The Chat Experiment and the Analysis Tools

Several chat experiments were undertaken in order to assess the students' knowledge and understanding of certain topics and concepts covered during the course. In one of these experiments, undergraduate students participating in the Human-Computer Interaction course were grouped in teams of 3-4 members and asked to chat about collaborative web technologies. The conversation was composed of two distinct stages: during the first stage, there was a debate to decide which web technology among instant messaging, discussion forum, blog and wiki is the most powerful and well suited, while the second one consisted of a cooperating effort in order to find the best way to integrate all of these technologies under the same platform. Thus, the participants were engaged in both a competitive and a cooperative discourse in the same chat, without any moderator. The students used the ConcertChat (1) system which offers an explicit referencing mechanism that is very useful in chats with more than two participants, as it provides linking to previous utterances or phrases.

Two distinct tools were used to analyze the chat logs in order to facilitate the evaluation of the participants: Polyphony Analyser (Trausan et al., 2007) and ASAP (Dascalu et al., 2008). Both tools combine natural language processing and social network analysis (SNA) techniques in order to provide feedback about a chat conversation, While the Polyphony Analyser mostly uses NLP techniques combined with the lexical ontology WordNet (2), ASAP is oriented more towards SNA. The former combines ideas specific to the socio-cultural paradigm (Vygotsky, 1978) and to the dialogistic ideas of Bakhtin (1973), as well as to the classical cognitive paradigm that uses ontologies and knowledge-based processing. This application can be used to facilitate the discovery of important semantic and social data from the chat: the extent to which the topics were covered by the participants, the main subjects of the discussion, an evaluation of the competence of each participant, a graphical view of the chat that can be useful in evaluating the implication of each participant and the degree of debate. Moreover, the tools can be used to discover new implicit references between utterances and it offers a better visualization of the discussion threads.

ASAP (An Advanced System for Assessing Chat Participants) uses the social network of the participants and the utterances graph which result from the succession of turns in the chat and the explicit references between them. Thus, the social network can be modeled as a graph taking the participants as vertices and the references between utterances as edges. In order to evaluate the competency of each participant, several qualitative and quantitative factors are being considered such as the characteristics of the social network (e.g. closeness, rank), the speech acts that are present in each utterance and the importance of the words in each utterance.

The evaluation of a collaborative chat conversation and the provision feedback (including grading) to the students is a difficult and time-consuming task for the tutor, especially because information regarding both the collaboration process and the content has to be taken into account. Moreover, when distinct tutors evaluate a certain number of chats, it is mandatory to establish a common set of rules, in order to ensure a homogenous grading process. To this extent, it is important to notice that qualitative and prompt feedback is crucial for the students in order to be aware of their mistakes and try to correct them. The following section will present a comparative study that shows that using the tools described greatly reduces the time needed to evaluate a chat conversation and improves the feedback generated.

Comparison of the Evaluation Results

Three collaborative chat conversations, involving four students each, from the experiment described in the previous section have been chosen to be analyzed by four distinct evaluators who are tutors for the HCI course. The three tables below offer the grading of the participants in each chat offered by the evaluators and by the two analysis tools. Furthermore, evaluator 3 and 4 used the feedback provided by these applications, while evaluators 1 and 2 did not. Chat conversations 4 and 36 are considered positive examples both regarding the content and the degree of collaboration, while chat 34 is a negative one.

Table 1: Evaluation results for chat conversation 4.

Chat No.4	Student 1	Student 2	Student 3	Student 4
Evaluator 1	9	8	7	8
Evaluator 2	10	9	7	6.5
Evaluator 3	8	8.5	8	9
Evaluator 4	9.5	10	6.5	8
Evaluator - average	**9.125**	**8.875**	**7.125**	**7.875**
Polyphony	**10**	**8.23**	**6.50**	**8.17**
ASAP	**10**	**5**	**6**	**6**

Table 2: Evaluation results for chat conversation 34 (students 2 and 3 were penalized by evaluators 2 and 4 for plagiarism – marked with *).

Chat No.34	Student 1	Student 2	Student 3	Student 4
Evaluator 1	8	5	7	6
Evaluator 2	7	7*	4*	6
Evaluator 3	8	7	7	7
Evaluator 4	7	6*	5.5*	6
Evaluator - average	**7.5**	**6.25***	**5.875***	**6.25**
Polyphony	**6.81**	**7.97**	**10**	**6.47**
ASAP	**10**	**10**	**10**	**8**

Table 3: Evaluation results for chat conversation 36 (evaluator 2 has not assessed this chat).

Chat No.36	Student 1	Student 2	Student 3	Student 4
Evaluator 1	9	9	10	9
Evaluator 2	-	-	-	-
Evaluator 3	9.5	8	8	8
Evaluator 4	8	9	10	8.5
Evaluator - average	**8.83**	**8.66**	**9.33**	**8.5**
Polyphony	**7.80**	**9.51**	**10**	**8.14**
ASAP	**7**	**7**	**10**	**6**

From the tables above, one can observe that the grading offered by the Polyphony Analyser is very similar to that of the evaluators and to their average grade as well. Below, in table 4, the average absolute error rate for each evaluator as well as for the analysis tools are presented. The grading error for Polyphony is 10.1%, twice better than ASAP, and close to the worst error rate of the tutors. It is worth mentioning that the ASAP error rate is consistent with the figure presented in Dascalu et al. (2008). Nevertheless, the correlation listed in the table indicates significantly poorer results for both applications compared to those of the tutors. The low correlation of the applications can be explained by the fact that for each chat the most important participant is assigned the maximum grade. Plus, students 2 and 3 from chat 34 have been penalized for plagiarism which was not detected by the analysis tools. Correlation2 in table 4 indicated the correlation of the grades of all the students minus these two – in this case Polyphony shows a correlation that is comparable to those of the tutors.

Table 4: Average absolute error rate and Pearson's correlation.

	Evaluator 1	Evaluator 2	Evaluator 3	Evaluator 4	Polyphony	ASAP
Average error rate (%)	5.0	7.3	8.3	4.5	10.1	22.1
Correlation	.89	.87	.69	.95	.38	.26
Correlation2	.92	.80	.51	.93	.85	.19

The time required for analysis was reduced by more than 30% for the tutors employing the analysis tools. Thus, tutor 1 required an 80 minutes average per chat and, tutor 2 - 45 minutes, tutor 3 – 30 minutes, tutor 4 – 20 minutes. This may be explained by the utility of the information offered by the tools: the conversation topics are useful for evaluating if the discussion was on-/off-topic, the visualization is useful for evaluating participation of each user and their collaboration level, the chat thread outline for analyzing if threads are consistent, the implicit references improve outline for collaboration and the grading and utterance evaluation are useful for assessing the contribution of each participant.

The most useful comparison is between tutors 1 and 4 which have quite similar error rates and correlations: tutor 4, who benefited from automatic analysis, needed more than twice less time for the evaluation of a conversation.

Conclusions

In addition to having chat tools with powerful features that are useful for collaboration, it is very important to build analysis software to guide the tutors when assessing the performances of the students that participate in a chat, especially in a formal context. This paper has introduced a chat experiment for undergraduate students and presented a comparison between the results of the evaluation of three chat conversations by tutors who are using the analysis tools and those who are not. To this extent, the most salient advantage is the reduction of the time needed for evaluation by more than half for achieving the same evaluation performance.

Endnotes

(1) ConcertChat can be accessed online at http://www.ipsi.fraunhofer.de/concert/. The project is available online on SourceForge at http://sourceforge.net/projects/concertchat/.
(2) WordNet can be accessed online at http://wordnet.princeton.edu/.

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GRASP: The Group Learning Assessment Platform

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Abstract: We demonstrate a prototype assessment technology designed to enable unobtrusive, real time assessment of group dynamics from speech. As part of that work, we describe a test bed for experimentation with alternative approaches for automatic processing of speech for this purpose. Furthermore, we present a specific successful technique for predicting activity levels and amount of overlapping speech in recordings of actual student group meetings recorded over a semester of a graduate engineering design project course.

Introduction

Multi-disciplinary design project classes present challenges both for supporting and for assessing learning because the learning is self-directed and knowledge is acquired as needed throughout the design process. What makes it especially tricky from an instructor perspective is that the bulk of student learning takes place without the instructor present. While this provides students with opportunities to develop skills related to "learning to learn", it can also mean that instructors are left not knowing when and how they can intervene to support the students most effectively. It is well known from the social psychology literature on group work that groups frequently do not function in an ideal way (e.g., Faidley et al., 2000).

Recently, in order to address this problem, there have been a number of efforts to support instructors in managing group work by offering them forms of automatic assessment and reporting (e.g., Soller & Lesgold, 2003; Kay et al., 2006; Pianesi et al., 2008). In prior work, researchers have looked at automatically detecting various aspects of student activities during group work (e.g., Kay et al., 2006; Pianesi et al., 2008). Various forms of data have been used including message board postings (Kim et al., 2007), chat data (Soller & Lesgold, 2003), video (Chen, 2003), and audio (DiMicco et al., 2004). Because our goal is to support students in project based courses, speech recorded using mini digital recorders that are small enough for students to carry with them is the most natural medium for our work since student group working meetings are typically conducted face-to-face, sometimes planned and sometimes spontaneously, in any of a number of locations.

We present the Group Learning Assessment Platform (GRASP)[1], a technology designed to enable unobtrusive, real time assessment of group dynamics from digital recordings of student speech. We will begin by describing GRASP at a conceptual level. We then present techniques for predicting activity levels and amount of overlapping speech in recordings of actual student group meetings recorded over a semester of a graduate engineering design project course. We conclude with findings related to our automatic assessment technology as well as our current directions.

Overview of GRASP

The problem of automatic assessment of group learning processes is large and multifaceted. First, different instructors may have a plethora of alternative assessment goals ranging from goals for learning, to goals for social development, to goals for productivity and project success (Gweon, 2008). Assessment criteria must then be operationalized in a way that is reliable and valid. Within the recorded conversational data are a succession of different types of events, which may be catalogued in a variety of ways. As part of the process of doing the automatic assessment from the speech signal, these events must be detected and used to compute indicators related to the selected assessment categories. Finally, the recorded speech itself is multifaceted, encoding both content features related to what was said as well as style and intonation features that indicate how the speech was uttered. All of these types of speech features may be informative, and none of them are trivial to detect. Because of the wide space of possible assessment frameworks that fit this paradigm of detecting events in speech in order to compute indicators that correlate with desired assessment categories, we developed GRASP to be both as a prototype assessment technology and a test bed for exploring alternative assessment approaches.

Figure 1 illustrates the GRASP framework. In stage 1, students carry headphones and mini digital recorders with them so that whenever their project teams meet in any location, they can record their meetings, with the speech from each student recorded in a separate file. In the next stage, we preprocess the speech to create a representation consisting of feature-value pairs we can extract from the speech files. Next we compute indicators from the speech recordings, both related to an individual's participation in a meeting and a group's well functioning, based on comparisons of the speech for the individuals present in the meetings. Using regression models trained over speech data paired with human assessment ratings, we are able to make automatic predictions about how humans would rate group meetings along selected assessment dimensions.

[1] This research was supported in part by NSF Grant EEC-064848.

Finally, these automatic predictions can be displayed for an instructor to observe. This process model was designed to be general, allowing us to explore all four important dimensions in our ongoing work.

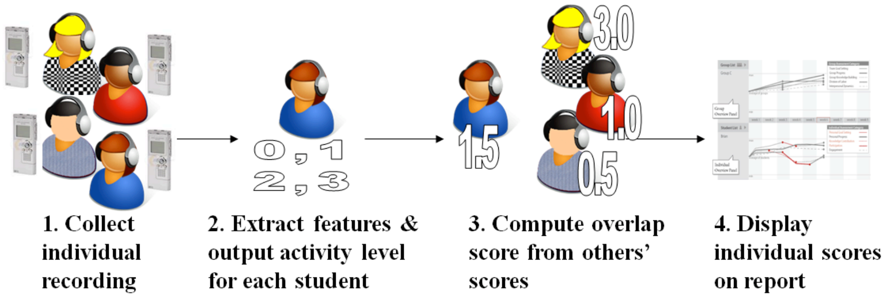

Figure 1 Overview of the four stage automatic assessment process.

Processing the Speech

Using current speech processing technology, one can make use of features that can be extracted from speech, such as pitch and energy level, that say something about the nature of the interaction. In prior work, Dabbs and Ruback shows the usefulness of style of speech in gaining insight into group processes that occur among individuals who participated in group work (Dabbs & Ruback, 1987). In our work, using recordings collected from students during project group meetings, we computed amount of activity level for each student using machine learning technology. From the predicted activity level, two types of measurements were computed: namely, average of the percentage of time when that student was talking during group meetings (average activity level) and average percentage of group mates who were talking during the time when that student was talking (amount of overlap). Average activity level is an approximate measure of the amount of talk that the student contributed during in group meetings. Amount of overlap says something about how seriously a student's group mates take his/her contributions. If overlap is high, then it may be the case that the student's group mates don't find it valuable to stop and listen when he/she speaks.

Before amount of talk and amount of overlap can be computed from speech, it must be segmented, and each segmented must be coded for the amount of speech by the associated student that was detected in it. We chose to segment the speech into 10 second intervals so that it would be reasonable to assume that for most segments, there would be at most a single dominant speaker. We adopted the following 4-point scale for activity level: 0 - no speech from primary speaker; 1 - primary speaker only does back-channeling, where back-channeling is a way of showing a speaker that you follow and understand their contributions, often through interjections such as , "I see", "yes", "OK", "uh-huh"; 2 - primary speaker speaks holds the floor for less than half of the 10 seconds; 3 - primary speaker speaks holds the floor for more than half of the 10 seconds

We first verified that human annotators could make this judgment reliably from the audio recordings of individual segments. Using this coding scheme, the inter rater reliability evaluated for two coders over 144 segments was 0.78 Kappa. With the reliable coding scheme, a single coder then coded 1132 segments (distributed evenly across students from a project course). The largest proportion of segments was coded as 0, which amounted to 47.5% of the segments. 8.5% were coded as 1, 30.5% as 2, and 13.5% as 3.

In order to apply machine learning to speech, each segment of speech must first be transformed into a set of feature-value pairs. A total of 39 features were extracted for each of the 10 second segments using wavesurfer (Beskow & Sjlander, 2000). These features are comprised of structural aspects of speech, features related to F0 and power. With the coded speech data after it had been transformed into a vector representation, we then evaluated whether it was possible to use machine learning to automatically assign segments of speech to one of these four categories with high enough accuracy. We used Weka's SMO learning algorithm (Witten & Frank, 2005). In order to avoid the evaluation results being inflated due to overlap in speakers between train and test sets, we adopted a cross-validation evaluation methodology where a model was first trained on all but one student, and then performance was evaluated over the segments of the remaining student. We did this for each student and then averaged across students to compute the performance of 74.26% accuracy. We then validated the model by using the human coded numbers for each student to compute an average activity level, and then made a similar computation using predicted values from the cross-validation experiment. When we correlated the average activity levels for each student based on human codes with those based on the automatic codes, we achieved a correlation coefficient of 0.97, indicating that we can achieve a reliable estimate of activity level using a machine learning model. We then trained a model using all of the coded data, which we used in the subsequent analysis we discuss in this poster. We applied the trained model to a separate set of speech data from that used to build the models for predicting student activity. Altogether 18 students' recordings were segmented into 10 second segments. The length of each recording differed due to differences in meeting lengths. The number of segments ranged between 7 minutes 30 seconds to 2 hours 19 minutes 50 seconds in length (45 to 839 ten second segments), with an average of 47 minutes in length (282 segments). Using the speech model just described, student recordings were assigned amount of talk values. Example predictions are shown in table 1, where we see that Student 1 is the dominant speaker for all three segments shown. Students 2 and 3 start to contribute more substantially during the third segment, and student 4 only does back-channeling.

Table 1: Example predictions of speech activity. Numbers in parenthesis indicate the smoothed values.

(sec)	Student1	Student2	Student3	Student4
0~9	3 (3)	0 (0)	0 (0.5)	1 (0.5)
10~19	3 (3)	0 (2/3)	1 (1)	0 (2/3)
20~29	3 (3)	2 (1)	2 (1)	1 (1/3)
30~39	3 (3)	1 (1.5)	0 (1)	0 (0.5)

Using the same predictions of activity level per segment, an amount of overlap index was calculated for each student. Overlap is defined as the amount of activity level by group mates when the student is actively talking. In order to compensate for some error in coding activity level, we first smoothed the predictions of activity level by averaging the activity level prediction of a segment with those of the segment before and the segment after. The resulting smoothed scores were then real values between 0 and 3. We then applied a threshold to determine which segments we would treat as segments during which a student was speaking. The threshold for each meeting was computed as the average of all the activity level over all the smoothed segments in that meeting. For each of the 10 second segment, we compared the student's smoothed activity level to the threshold. Therefore, if a student's smoothed activity level in the given segment was above the threshold, that student was considered as speaking during that segment. Next, for the segments where activity level was larger than the threshold, which are considered as segments where the student was talking, we computed the average smoothed activity level of the other meeting participants during that segment. We consider this the overlap score for that student, which indicates the prevalence of other group members talking at the same time when this student is talking. Finally, after computing amount of overlap for all the 10 second segments, an average of the amount of overlap is computed over all the segments in a given meeting to yield one overlap score per student.

Current Work

We have described a technique for predicting amount of overlapping speech in recordings of group meetings. Results from regression models trained to predict assessment categories from our prior work (Gweon, 2008) with activity level and overlap indicators suggest that these indicators are useful for identifying the students that instructors are more likely to make faulty assessments of based on in class observations. Our hope is that this insight might overcome "blind spots" that instructors might have in order to improve the support they can offer students. One important next will be to test how providing such information influences instructors' behavior, well functioning of student groups, and ultimately student learning and project success. Further work can also be done to identify other quantities that can be extracted from the speech that might be useful for project course instructors. Our research group is planning additional data collection efforts in another types of project courses in order to enable the development of a more generally useful framework for assessment of student groups.

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An Architecture for Intelligent CSCL Argumentation Systems

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Abstract: Argumentation is a key research area within CSCL. Yet, while many empirical studies investigating the educational benefits of various forms of collaborative argumentation have been conducted, there has not been much work done towards developing generic and reusable software architectures for collaborative argumentation that have the potential to reduce the development time for argumentation learning systems. This paper proposes a general architecture for intelligently supported collaborative argumentation systems.

Introduction

Argumentation skills are critical for humans in many aspects of life. Some researchers have characterized argumentation skills as central to thinking itself, supporting people in coming to rational conclusions about various issues in life (Kuhn, 1991). Consequently, teaching argumentation skills is a central goal of education, both on a general level – for instance, classroom dialog is a form of group argumentation – and also in specific application areas such as the physical sciences or the law. In addition, argumentation and learning are intertwined: argumentation involves elaboration, critical reasoning, and reflection, all of which support deeper learning. Often, human teachers provide instruction on argumentation through face-to-face dialog and direct interaction with students.

However, while classroom learning is an excellent way for students to learn to argue, it is difficult to "scale up" this approach, teaching large numbers of students effectively, due to limitations in teacher time and availability. Educational technology and especially CSCL systems can help realize instruction on argumentation at a large scale. Indeed, there has been considerable effort in developing and assessing educational technology to support argumentation (e.g., Andriessen, 2006; Weinberger et al. 2005). Many of these efforts have been shown to be effective for various argumentation domains. At the same time, there has not been the same amount of research towards generic, flexible and reusable software architectures for building educational collaborative argumentation systems. Being able to build upon a well-designed software architecture has the potential effectively to reduce the development time required for constructing collaborative argumentation learning systems as compared to a typical "from scratch" development approach. Since many non-trivial development, design, testing and deployment aspects can be dealt with at an abstract architecture level, such a general architecture holds the promise that we, as a research community, won't have to keep reinventing the wheel and building throw-away prototypes. But what are the essential design features and requirements for a flexible software architecture that facilitates the implementation of a rich variety of potentially differently targeted educational argumentation systems for research purposes and practical classroom usage? Based on an extensive literature review of approximately 50 argumentation systems (covering both general-purpose and educationally targeted tools, e.g., Suthers et al., 2001; Reed and Rowe 2006; McLaren et al, 2007), this paper summarizes the key requirements and – based on these – proposes an architecture for a CSCL argumentation system with intelligent support functions.

Architecture Requirements

The architecture requirements for a CSCL argumentation system can be classified into several categories. On the *overall* level, the architecture must be flexible (enabling different variants of argumentation tools to be built on top of it) and at the same time platform independent at least with respect to the clients. The latter requirement is especially important for classroom usage, where multiple machine types have to be supported. It should also be programming language independent and provide a loose coupling between system parts: these two characteristics facilitate the addition of new components (such as specific add-ons for research purposes) to the system. Next, there should be support for both *synchronous* and *asynchronous* collaboration. Here, it is important that the system works well for small groups (≤5) in synchronous usage and scales up well in asynchronous usage for larger, at least classroom size, groups. Furthermore, there should be a detailed role and rights management for controlling the access of users to system functions (important for comparative studies and for classroom usage) based on roles such as moderator, administrator, teacher, or "student group member." These roles are also important for using pre-defined learning processes (collaborative learning scripts) that have shown to be educationally effective (e.g., Weinberger et al. 2005) and should thus be foreseen in the architecture.

Awareness mechanisms are a further key feature required for CSCL argumentation systems. For synchronous usage, this means highlighting parts of the argument space to provide users with information about the current contributions of other users. For asynchronous usage, notification messages (e.g., what has changed since the last login?) are an important means for creating awareness. *Communication* is another important factor for productive collaboration: The architecture has to allow for different forms of user communication such as text-chat as well as audio or even video chat (it should be easy to turn these options on and off for research purposes), and there must be support for special communicative roles like a moderator or an intelligent feedback agent with special rights such as interrupting a user group to give hints or to ask questions. The group mode of communication has to be highly flexible, enabling different groups (small vs. large) to communicate about different aspects of an argument and to jointly edit/create arguments. The communication protocol should be easy to understand, so that future developments and additions are supported. Concerning the *application data*, an important requirement is *persistent storage*: neither in research contexts nor in classrooms is a data loss acceptable. Also, there should be support for logging single user operations to replay the argumentation process or to restore an argumentation state at any time. These functions are important for automated or manual data analysis. Especially for mobile usage contexts, the possibility of working with local data without accessing a network can be helpful.

A next class of requirements comes from the fact that different areas of argumentation (such as scientific argumentation, argumentation in law or argumentation in philosophy) involve different types of arguments and different styles and rules of argumentation. This has implications both related to system *interaction* and *visualization* (e.g. threaded discussions, graphical style, text, matrix-views, etc. – here it should be possible to use different views for the same data) and to the underlying argument ontology. Thus, the architecture must support different *argument ontologies* and provide the option of extending or manipulating these (which is especially interesting in research contexts) as it is, for instance, possible in Digalo (Kochan, 2006). Another important aspect for some argumentation domains is the ability to create links from argument elements to *external resources* (or parts of these) such as texts, web pages or videos. LARGO (Pinkwart et al., 2006), Belvedere (Suthers et al., 2001) and Araucaria (Reed and Rowe 2006) are examples of argument systems that employ such links to external resources. Finally, the ability to automatically analyze student group argumentation and to provide the learners with feedback on their progress is a key requirement that has been shown to be educationally beneficial in a variety of studies. As such, *analysis and feedback components* should be included in the system architecture. Here, flexibility is a key requirement: especially for research purposes, it should be straightforward to develop and include custom analysis and feedback agents in the architecture.

System Design Approach

Currently, there are no argumentation systems (CSCL or other) that satisfy all of the above requirements. In the following, we propose a system architecture that addresses all the listed challenges. Overall, this architecture (shown in Figure 1) is structured as a three-tier system with the following building blocks:

1. The data layer, which manages all of the data of the application. This layer stores the registered users with their models, including roles and rights. It logs all actions (for use in replay and analysis) and contains the argument ontologies as well as the collaborative learning scripts.
2. The server layer, which provides functionalities to control the user actions (who is allowed to do what?), bring the concurrent user actions into a consistent state, and manage the different scripted collaborative argument sessions with their multiple participants.
3. The client layer, which contains the user applications as well as the intelligent agents. Components in this layer can manipulate the current state of an argument and can communicate with others.

These three tiers are loosely coupled: they communicate only via platform independent XML messages. This design facilitates system extensions, since new components – such as new feedback agents or new client user interfaces – do only have to “understand” the XML data format and can then be included in the system regardless of the programming language they are built with. XML as a data exchange format also has the advantage that it is – at least partially – human readable, and some relevant XML based standards (e.g., IMS-LD for learning scripts and AML (Reed & Rowe, 2006) for argument models) already exist.

The architecture diagram also shows that there is a separate argument model in each layer (called “SessionObject”). These models all are kept consistent with the “central” argument model stored in the data layer. This approach, which is similar to the “hybrid CSCL architecture” proposed by Suthers (2001), means that all client applications have the argument data stored on the local machine. This design makes it possible to work locally without losing work even when the network connection to the server is temporarily unavailable. The server ensures that all the data models are synchronized (e.g., when one machine that was temporarily disconnected rejoins the network). Most of the communication and application logic is stored in the server. This is important for two reasons: first, to achieve a loose coupling of components (required to allow for an exchange of components: not too much should depend on a specific client) and, on the other hand, to allow the distribution of client applications via the web, where large downloads are usually not appreciated.

To make system extensions as easy as possible, the technical interfaces between server/client and server/AI engine are identical. This means that generally, intelligent agents have the same action options that human users have. Possible differences between human users and artificial intelligence (AI) agents concerning access or action rights can be defined in the data layer: e.g., a feedback agent might be allowed to interrupt any group discussion, while a student will not. An AI client might take the role of a moderator, an ordinary participant, a (domain- specific) advisor or even an “awareness agent” which provides other users with awareness information. The flexible architecture even allows using several AI clients at the same time, for instance, a team of advisors / coaches each of which having one specific expertise (e.g., a collaboration coach and a domain-knowledge coach).

The client layer contains a “portal” component (which allows users to choose the argument they want to join) and supports multiple views on argument data. This is useful to allow for devices with special interface requirements (such as mobile devices), and to visualize the same argument in different forms (which may be desired in research contexts). Finally, to get easily maintainable code and exchangeable components, general software design patterns like observer (see client layer) or proxy (see server layer) (Gamma et al, 1995) are employed.

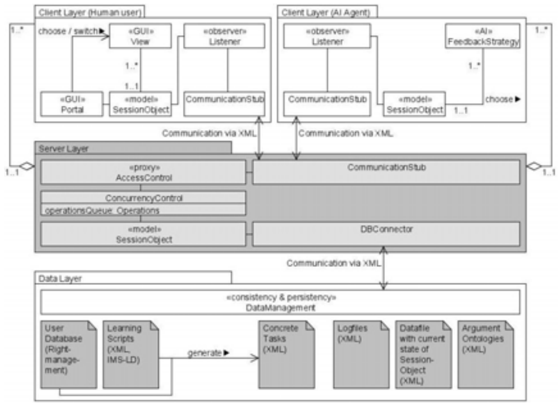

Figure 1. UML diagram of proposed system architecture

Outlook

In our current work we are implementing an argumentation system based on the described architecture. The aim is to create a generalized framework and methodology for the construction of argumentation support systems to help students learn argumentation in different domains.

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VMT-Basilica: An Environment for Rapid Prototyping of Collaborative Learning Environments with Dynamic Support

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Abstract: In this interactive poster we demonstrate the VMT-Basilica environment that provides facilities for rapid prototyping of computer supported collaborative learning environments that support collaboration in a way that is responsive to what is happening in the collaboration rather than behaving in a "one size fits all fashion".

Introduction

The goal of the instructional approach underlying the design of the VMT-Basilica framework[1] is to maximize the benefit students receive from the interactions they have with one another by providing support for learning and effective collaboration in a way that is responsive to what is happening in the interaction in real time. Previous discourse analyses of collaborative conversations reveal that the majority of those interactions between students do not display the "higher order thinking" that collaborative learning is meant to elicit (Webb & Mastergoerge, 2003), and we have found this as well in our own observations in lab and classroom studies, both at the college level (Gweon et al., 2006) and at the middle school level (Gweon et al., 2007). The literature on support for collaborative learning and learning more generally tells us that scaffolding should be faded over time (Collins et al., 1991), that over-scripting is detrimental to collaboration (Stegmann et al., 2004), and unnecessary support is demotivating (Dillenbourg, 2002). Thus, a major goal of our research is to address these issues with a framework that allows us to track what is happening in the interaction so that the automatically triggered support interventions can respond to it appropriately, offering interactive support that addresses both students simultaneously. To that end, we demonstrate the VMT-Basilica environment that provides facilities supporting collaboration that way.

VMT-Basilica

Based on our experiences with designing and engineering collaborative learning systems that involve integrating the state of the art in text classification and conversational agent technology, we recognized the need for a framework that facilitates such integration. Here we present such a framework.

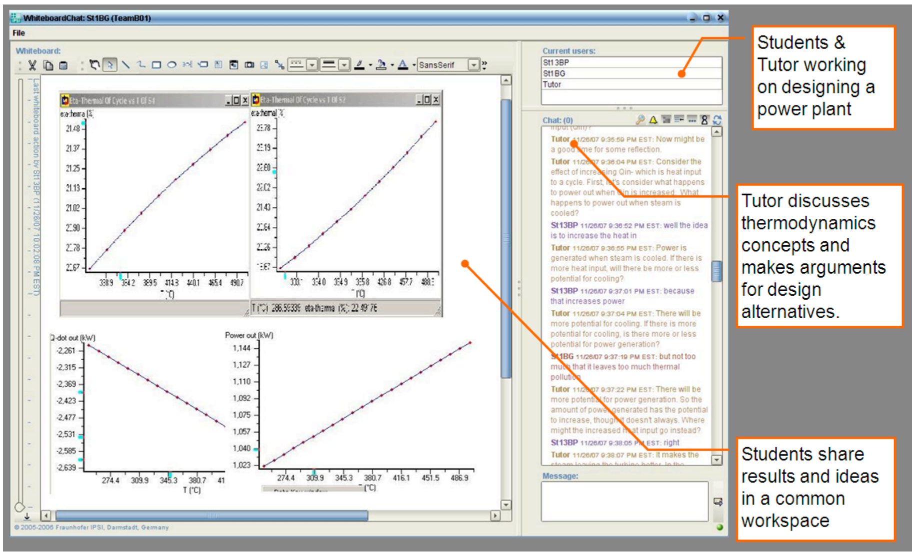

Figure 1 VMT-Basilica integrates Basilica with the Virtual Math Teams (VMT) environment (Stahl, 2006).

VMT-Basilica is an integration of the Virtual Math Teams (VMT) environment for computer supported collaborative learning (Stahl, 2006) with an architecture for rapid prototyping of dynamic support for

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collaborative learning (Kumar et al., 2007). The VMT-Basilica architecture has been designed to allow a great deal of variation in how this coordination between the human participants and the agent(s) plays out. Desiderata of the framework includes reusability of component technologies, compatibility with other platforms, and the ability to provide flexibility to system designers to select from a wide range of existing components and then to synchronize, prioritize and coordinate them as desired in a convenient way. While we continue to make further improvements to the framework to better achieve these specifications, in its current form, the Basilica framework is an event-driven framework that enables development of conversational agents by using two basic components, referred to as Actors and Filters. These components communicate using Events. The Basilica framework implements a set of abstract software classes, which correspond to components, events and other supporting elements of the framework like channel independent communication, logging and process management. Along with these abstract classes, the Basilica framework now has a growing set of reusable Actors, Filters and Events that can be used to rapidly build custom conversational agents. This integration has already been used in successful classroom studies of collaborative learning (e.g., Chaudhuri et al., 2008).

Example Interaction

Table 1 displays an interaction between two students and a tutor agent who interacts with both students simultaneously in a study involving VMT-Basilica where the task was for students to design a power plant.

Table 1 Example Interaction from Classroom Study

B6	so i think the best thing to go with first is to increase the pressure entering the connector
Tutor	You might want to review what you saw earlier in the sensitivity analysis investigating the effect of changing P-max on steam quality and efficiency, from the top half of page 13 in your book.
Tutor	type: HELP WITH CHANGEPMAX if you want to discuss it with me.
B1	help with changepmax
Tutor	Remember the sensitivity analysis you have completed where you manipulated P-Max and observed it's effect on the efficiency of the cycle. You can refer to the figure that I have pasted onto your whiteboard for your convenience. Having seen how changing P-Max, the Maximum Pressure at the Heater Inlet, effects efficiency and Steam, do you think as a general principle the Maximum pressure should be increased ?
B6	Yes
Tutor	So the Efficiency of a Cycle increases by increasing the maximum pressure of the cycle. In addition to the effect on efficiency, what happens to the steam quality at the turbine exit if you increase the maximum pressure of the cycle ?
B6	Decreases
Tutor	So let's think for a minute about these competing effects: Increasing P-Max makes the efficiency better but the steam quality degrades. Is the steam quality at the turbine exit acceptable at the maximum allowable pressure within safety limits?
B6	No
Tutor	How does having poor steam quality at the turbine exit effect the turbine blades ?
B6	makes up wear down
Tutor	The steam condenses on the turbine blades and leads to wear and tear. What is the minimal quality of steam that we want to maintain so that the damage to the turbine is not significant ?
B6	0.85
Tutor	Steam quality should be maintained above 0.85 to avoid any damage to turbines blades during operation. So we need to balance these concerns by increasing the maximum pressure, but not enough that the quality of the steam drops below the minimum value (0.85). Are there other limitations on increasing the maximum pressure at the heater inlet ?
B6	no?
Tutor	Can the devices and pipes in the cycle stand if we keep on increasing the pressure ?
B6	20000kPa
Tutor	Beyond a particular pressure, the pipes and devices in a cycle become unsafe at risk for accident. The maximum pressure at heater inlet should be within safety constraints of the material used.
B1	so to what value do you want to change the pressure at s1?
B1	do we want to keep X of s3 above or below .85?
B6	Above
B1	so, if we want to increase p1 while keeping X3 above 0.85, what about 8500kpa as p1?

The primary technology that has been used to date to develop Actors within the Basilica framework is a tool set called TuTalk designed to support quick authoring of dialogue agents (Cui & Rosé, 2008). This work includes 1) tools for non-technical users to author dialogue specifications for particular student exercises and 2) a backend system for supporting full spoken or text-based dialogue behavior that follows the authored specifications. The TuTalk authoring environment was used to create a set of 12 tutor agents, like the one that participates in the interaction displayed in Table 1. Notice that the tutor's contributions are responsive to those of the students. For example, we see that when Student 6 answers incorrectly to the tutor's question of "Are there other limitations on increasing the maximum pressure at the heater inlet?", the tutor responds with a more specific question designed to lead the student to the correct answer without giving that answer away.

Filters are meant to identify meaningful patterns within the stream of activity produced by students as they interact with and through a client collaborative learning environment. An important component technology used in our investigations with Basilica to date has been the TagHelper tools workbench (Rosé et al. 2008). In the interaction displayed in Table 1, the initial prompt where the tutor invites the students to ask for help on the topic of changing the maximum pressure of the cycle was triggered by taking note that the students were discussing the topic of increasing that parameter of the cycle. In our experience, students are much more receptive to instruction from a tutor agent in the midst of their collaboration when it is well times with respect to their goals, and when they are given the option to choose to have that interaction or not. In this case, notice that the tutor agent first suggests that the student reflect on a topic and then provides instructions for how the students can ask for that help. The students are able to continue what they were talking about until they are ready to ask for the tutor's help. In this case, they ask right away. This approach to tutor involvement was implemented using two separate filters and two separate actors. First, a filter detects that the students are discussing a topic related to help the agent can offer. Then an associated agent offers the help. A second, independent filter waits for the student request. Finally, an actor in the form of a TuTalk agent delivers the interactive instruction. Notice how the students build on the ideas discussed with the tutor after the interaction with the tutor agent ends.

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eXtremely Simple Scripting (XSS): A Framework to speed up the development of computer-supported collaboration scripts

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Abstract: External computer-supported collaboration scripts may support learners in collaboratively using new technologies. This contribution introduces a framework that offers an object-oriented package of classes and methods that supports eXtremely Simple Scripting (XSS), i.e., the rapid implementation of CSCL scripts for the use with new technologies. We report two examples on how this framework has been used to implement computer-supported collaboration scripts in mobile learning with tablet-PCs and with an interactive table.

Introduction

Increasingly, new technologies like interactive tables, ambient displays, handheld devices, smart boards, or tablet PCs can be found in classrooms. However, neither teachers nor students seem to have the adequate knowledge (i.e., internal scripts; cf. Schank & Abelson, 1977) to cope with these new possibilities in an effective way. Interaction and learning processes in scenarios using new technologies may differ significantly from their collaboration experiences. Learners may thus lack effective internal scripts to use such new technologies for collaborative learning. In these situations, learners need additional instruction (i.e., an external script). External computer-supported collaboration scripts may support learners using innovative collaboration technologies productively.

However, the development (e.g., the programming of the software) of new computer-supported collaboration scripts has been requiring considerable effort so far, because the design of the script requires expertise in both cognitive psychology of learning and in computer science. Collaboration scripts can be seen as consisting of a number of components and mechanisms that are highly interrelated. Usually, “the first year” of collaboration between educational scientists and computer scientist is spent to find a common language with respect to these components and mechanisms.

However, recently a group of Finnish, French, German, Greek, and Swiss researchers in the European Research Team CoSSICLE developed such a common specification of computer-supported collaboration scripts (Kobbe et al., 2007). This contribution introduces a framework that transferred this specification into an object-oriented package of classes and methods that support rapid implementation of scripts for the use with innovative technologies: the eXtremely Simple Scripting (XSS). Furthermore, we report two examples to show how this framework can be used to implement computer-supported collaboration scripts on different devices.

Specification of Collaboration Scripts

Kobbe and colleagues (2007) distinguished components and mechanisms of computer-supported collaboration scripts. Components can be seen as the objects that can be manipulated by specific mechanisms. The components are participants, activities, roles, resources, and groups. Important attribute of *participants* is their number, due to the fact that some scripts require a fixed number of participants per group. These requirements often result from a specific number of other components like roles or resources. *Activities* are the main component with respect learning, because the actual learning processes are triggered. In case of a peer review script, learners may be asked to explain or to provide constructive critique. *Roles*, e.g. the role of an analyst or a constructive critic, are often used to define clusters of a set of activities. Within the script, learners use, manipulate, and/or create *resources*. Learners may get a problem case and theory to solve a problem as initial resource. Their task is to create a new case analysis and/or to discuss their analysis until they agreed on a joint solution. The problem case, the theory, and all contribution of learners in the discourse are regarded as resources. While roles specify a set of activities, *groups* are used to specify learners who directly interact.

The mechanisms of computer-supported collaboration scripts to manipulate the components are task distribution, group formation, and sequencing (Kobbe et al., 2007). The *task distribution* within a group of learners is a central feature of collaboration scripts. The activities, roles, resources described in a script may be distributed within a group. Some scripts use specific *group formation* mechanisms to facilitate learning processes, i.e., instead of self-organized groups, an algorithm is used to compose groups. Through *sequencing*, scripts often provide a temporal structure of components and mechanisms, e.g., scripts may specify the sequence of activities, roles, resources, and/or group formations.

The eXtremely Simple Scripting (XSS) framework

The XSS framework is based on the specification developed by Kobbe and colleagues (2007). The aim is to provide a functional framework that allows for the rapid development of computer-supported collaboration scripts for innovative technologies. Therefore, the XSS framework provides a number of classes and methods to realize scripts. However, all classes can be extended or overwritten if needed to implement a specific script. The framework consists of three main components: (1) *The CsclApplication class*, which specify the overall structure of any collaborative learning application that is based on CSCL scripts. Frequent operations, such as the group formation and sequencing, are pre-implemented to support the developers. (2) *The GroupBuilder class* provides group composition features. (3) *The Sequence class* organise and manage the activities of all participants. In the following, we describe the procedure how the framework can be utilized to implement computer-supported collaboration scripts.

Initialising the script. To realise a script, the *Script class* has to be filled with information on the script first. A list of possible activities as well as a list of possible roles has to be provided. The roles comprise the information about the sequence of activities with regard to this role. Furthermore, phases are defined, which serve to coordinate the participants within one group. To synchronise the phases, the framework offers different options: (a) the phases of each participant can be independent, (b) the phases can be synchronised, i.e. the phase does not start before the last member of a group reached the beginning of that phase, or (3) when the first member reaches the phase the system will move all other members of a group to the same phase.

Participants. After initialising the script, participants can enroll (can be enrolled). For each participant an instance of the *class Participant* is created. Furthermore, the participants are assigned to a group. The assignment of participants to groups can, with regard to the script, be done right after enrolment or until all participants are enrolled. Algorithms that can be defined in the *GroupBuilder class* perform the group composition and the assignment of roles. To trace changes with respect to the assigned activities, each *Participant class* is observed by the view of the participant.

Sequence. A *Sequence class* is assigned to each group. This class has access to all participants and the list of phases provided in the *Script class*. Using this list, the current phase is handed over to the *Participant class*. Knowing it's own role, the *Participant class* use this information to start the next activity. At the same time, the *Participant class* informs the respective view about the change of the activity. With regard to the activity, the view can provide the required user interface including all necessary functions. If the *Participant class* finished the current activity, the *Sequence class* is informed. If the activity has an output (e.g., a short essay), this output is saved and made available as resource for all other activities. The *Sequence class* further checks the status of the phases of all group members. If a participant reaches a phase that has to be reached by all participants, the participant has to hold out for the other participants. If a participant gets to a phase that is defined to force all participants into this phase, the phases of all participants of one group are set to this phase. If the phase has no specific flag with respect to synchronisation, the *Participant class* moves forward to the next regular class. This will cause that the procedure described above is restarted with the phase. This procedure is performed until the last phase in the list of phases is finished.

Two Examples Using the XSS Framework

In this section, we describe two examples of computer-supported collaboration scripts that were adapted for innovative devices. The first example is the MURDER script (cf. O'Donnell & Dansereau, 1992) that is implemented for the use on TabletPCs or handheld devices. The second example is an argumentative collaboration script (cf. Stegmann, Weinberger, & Fischer, 2007) that was implemented for an interactive tabletop display. For both examples, specific features of the XSS framework will be focused. The evaluations of both scripts are currently running. The outcomes of these evaluations will be presented at the conference.

The MURDER Script in mobile learning

The MURDER script was developed to support dyads in face-to-face settings with respect to text comprehension. First of all, a text of several pages will be segmented into smaller sections. For each section, the MURDER script specifies several activities for two learners (cf. O'Donnell & Dansereau, 1992): (1) *Mood* – the learners relax and concentrate on the task, (2) *Understand* – both partners read the first section of the text, (3) *Recall* – learner A reiterates the text section without looking at the text, (4) *Detect* – partner B provides feedback without looking at the text, (5) *Elaborate* – both learners elaborate on the information, and (5) *Review* – both partners look through the learning material once again. The learning partners are supposed to engage in these activities for each text segment, switching roles regarding recall and detection for each segment, until they have completed the text. The implementation of the MURDER script for the use on a TabletPC should especially enhance the fourth and fifth phase by providing special features to trigger deep elaboration and transactive discussions.

The MURDER script heavily relies on two main features of the XSS framework: (1) the synchronisation of phases and (2) the feature to use the output of one phase as resource for another phase. The synchronisation of phases is especially important with respect to the switch from phase “Understand” to phase “Recall”. The computer-supported implementation of the MURDER script has to ensure that both learners finished the phase “Understand” before learner A starts to describe the text section in the phase “Recall”. The possibility to use the output of one phase as resource of another phase is crucial in the computer-supported version of the MURDER script to support phase “Elaborate” and phase “Review”. The learners are supported with specific visualisations regarding the similarity of their keywords made in phase “Understand”.

The Argument Construction Script

The argument construction script aims to facilitate the quality of argumentation during discussions. So far, the script was only implemented to support online discussions. The script focuses on the quality of single arguments (according to a simplified model of Toulmin, 1958) as well as the quality of argumentation sequences (according to Leitão, 2000). There, the script consists of input text boxes for a claim, grounds and qualifications. Each text box of the interface is to be filled out by the learners to construct a completely explicit argument. Furthermore, the script aims to facilitate specific argumentation sequences of argument-counterargument-integration (following Leitão, 2000). Hence, the script triggers learners to answer argumentations with counter argumentations and tries to integrate the argumentations in the end in an integration.

The implementation presented here transfers the argument construction script to face-to-face scenarios at an interactive table. Learners are asked to apply a specific theory to a problem. While they argue, they should put their arguments on the table and relate them with the arguments that are already posted. In this scenario, the XSS framework provides the methods to trigger the construction of single arguments (i.e., writing the claim is the first phase, adding the grounds is the second phase, and so on) as well as the construction of argumentation sequences (trigger to reply to an argumentation with an counter argumentation).

Further potential, limitations and open issues

The XSS framework has the potential to ease the development of computer-supported collaboration scripts for innovative technologies significantly. By providing an easy to use implementation of the script specification of Kobbe and colleagues (2007), the complexity of interacting components and mechanisms can be handled more easily. However, so far the XSS framework does not include an interface to author scripts. A possible solution would be to integrate the framework with other available tools like the script modelling tool (that produces an IMS-LD file; Harrer & Mahlzahn, 2006) that already produce script description on the base of the specification of Kobbe and colleagues (2007). Another open issue is, whether the XSS framework can cope with the large variety of scripts. So far, we developed and evaluated only the scripts described above. Many more scripts need to be tested to find an answer to this issue.

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Design and Enactment of Collaboration Scripts – an integrative approach with graphical notations and learning platforms

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Abstract: This paper presents an approach to integrate methods to define collaborations scripts graphically with existing learning platforms enabling the enactment of the scripts automatically in the learning platform. The practical usage of the approach with the MoCoLADe script design tool and the platform CeLS has shown the potential of the approach and provides insights for a generic solution connecting design tools and learning tools.

Background – Computer-enacted collaboration scripts

One of the declared unique advantages of technology for teaching and learning is its potential to support collaborative learning (CL). E-learning Technologies evolved through a number of generations including the following phases: Large scale facilitation and implementation of individual learning process, Learning Management Systems (LMS), facilitation of peers and teacher communications through communications tools. New specifications for Instructional Management Systems based on the concept of Leaning Design (IMS -LD) have emerged only recently (Hummel et al., 2004). The IMS-LD engine (CooperCore) and editor (RELOAD) specifies a template that enables creation of synchronized and personalized workflow through a course. An advanced approach for creation, customization and reuse of collaborative sequences of a learning activity flow is addressed by LAMS (Dalziel, 2003). Collaborative sequences may represent strategies that comprise of well - defined structures (scripts), consisting of distinct stages that are interconnected and based on each other in various ways. Scripts structure the collaborative learning process by constraining interactions, defining the sequence of activities and specifying individual roles (Dillenbourg, 2007). The use of scripts in the framework of computer-based learning support environments (LSE) is a major topic of recent research in the CSCL community. The cognitive, computational and educational perspectives of scripting computer supported collaborative learning (CSCL) are elaborated in a recently published book (Fischer et. al., 2007). This poster will describe a model that represents an integrative approach for graphical notations and learning platforms that enable Design and Enactment of complex Collaboration Scripts. The presented integrative approach is based on the existing MoCoLADe - Model for Collaborative Learning Activity Design (Harrer, Malzahn & Hoppe, 2007) and on the Cels Collaborative e-Learning Structures (Ronen et. al, 2006) environments.

Existing work and different perspectives to collaboration scripts

The graphical notation MoCoLADe has been designed for the formal modeling of collaboration scripts based on the conceptual framework of Kobbe et al (2008). The notation provides means to model group formation, assignment of roles and documents to groups or individuals and the definition of temporal dependencies between activities. The dynamic features of the script can be simulated interactively, so that a teacher can check if the script works with her/his class given a specific setup of students, documents etc. The first prototype of the graphical editing tool was tested with several CSCL scripts from the literature to show the soundness of our modeling approach (Harrer, Kobbe & Malzahn, 2007). To allow the execution in existing e-learning platforms, the output of simulation runs and models in the IMS/LD format is possible; a mapping to other learning platforms has been prepared and was goal of the work in this poster.

CeLS is a web-based system designed to create, execute, share and reuse activity structures reflecting various collaborative instructional strategies e.g.: reaching an agreement, peer-product evaluation, contest, jigsaw and any of their combinations. The unique feature in CeLS's design is its ability to use learners' inputs and products from previous stages and to conduct complex, multi-stage, structured activities based different 'social settings'. CeLS is used in conjunction with LMS systems or independently, as a powerful and flexible tool for creating and conducting online collaborative structured activities, and for sharing and reusing these pedagogical resources. CeLS was piloted in Israel by 25 teachers in 50 courses (3000 students) conducted in 6 Universities, 7 Colleges in a variety of subjects including: science, technology, education, medical professions, philosophy, IT and art and in teacher training programs (Kali & Ronen, 2008; Abrahmov & Ronen, 2008).

An integration approach using design tools and learning platforms

Currently, research on and the practice of collaboration scripting is spread over many areas. Besides the empirical research on specific scripts and their effectiveness, there have been initiatives to support a larger population of educators in the creation of scripts. Some concentrated on dedicated learning platforms, such as LAMS as a self-contained learning platform, some approaches focused in conceptual modeling decoupled of specific platforms. The current lack of integration of different approaches for educational modeling and execution platforms reduces the re-usability of scripts for different settings and platforms.

In this work we aimed at the combination of the two approaches and systems into one interoperable framework to create synergy between these research strands and to reach a wider audience for applying and exploring scripted online learning scenarios. Table 1 describes the different functionalities that can be achieved with each system regards the Modeling and Usage of a pedagogical scripts. Our work aims at integrating these existing approaches for collaborative online learning into a unified frame for designing and enacting online educational scenarios, for practical use in universities and schools in all subject domains.

Table 1: Main aspects of the partners' work on collaboration scripts

Approach	MoCoLADe	CeLS
Potential & Affordances	Design of complex collaboration scripts & simulation and testing of the scenarios before the use with students	Design and enactment of complex online collaboration scripts.
Limitations	Does not support enactment of the scripts that have been designed and simulated	Does not provide graphical representation nor simulation and testing of the process before enactment.
Goal	Integrate and combine the potential and affordances to offer: √ Graphical and intuitive modeling of collaboration scripts √ Simulation and testing by the teachers √ Enactment with students of all subject domains and levels	

Using the approach – first results with an example script

The unified approach was preliminary tested by performing a notation planning and enacting of a limited number of pedagogical scenarios. A first exemplary integration was achieved between the graphical models produced by the MoCoLADe editor and the CeLS learning platform. A collaborative activity was designed in the MoCoLADe editor, exported to CeLS and the asynchronous part of the learning scenario was conducted using CeLS (Figure 1).

The scenario in computer science teaching consisted of several activities: a classroom phase introduced a method for object-oriented design with UML (a widespread method for modelling software systems in computer science) using a “group puzzle / jigsaw” approach to learn how to apply the design method. In a second phase the students had to hand in their solutions, exchange them with their peers, and comment on each other's solutions in the CeLS platform. This circulation of results and the commenting are one of the specific features of CeLS that only few learning platforms support, hence the automated enactment of the peer reviewing phase was possible based on the specification in the script model.

The first small scale design and experiment showed the feasibility of the approach we propose: The initial feedback collected from the teacher as well as the participating pupils indicates that the integration of design tools with learning platforms supports to create meaningful learning activities; we were also able to get confirmation that the prototypical systems are usable by the specific target groups, e.g. the editor for teachers, the platform for pupils and the teacher.

Conclusions and further work

The work presented here proposed an approach for interoperability between design tools for pedagogical scenarios and collaboration scripts and their enactment in various learning platforms. To allow the teachers intuitive access to the educational modeling, graphical notations are well suited (Botturi & Stubbs, 2008). The MoCoLADe language is one representative of these graphical notations and has been used for the definition of a blended learning scenario for a computer science class. The resulting model was exported to the CeLS platform and practically used with a class for the peer commenting / reviewing phase of the script. While this scenario showed the feasibility of our approach, we currently work on a more generic solution that connects modeling tools with learning platforms using a conceptual meta-model that can be mapped from and to arbitrary educational models and learning platforms. With the help of profiles for each platform the tools specified with general properties in the model (e.g. some asynchronous communication tool) can be mapped to concrete tools in the respective platform (e.g. a CeLS comment or a LAMS forum).

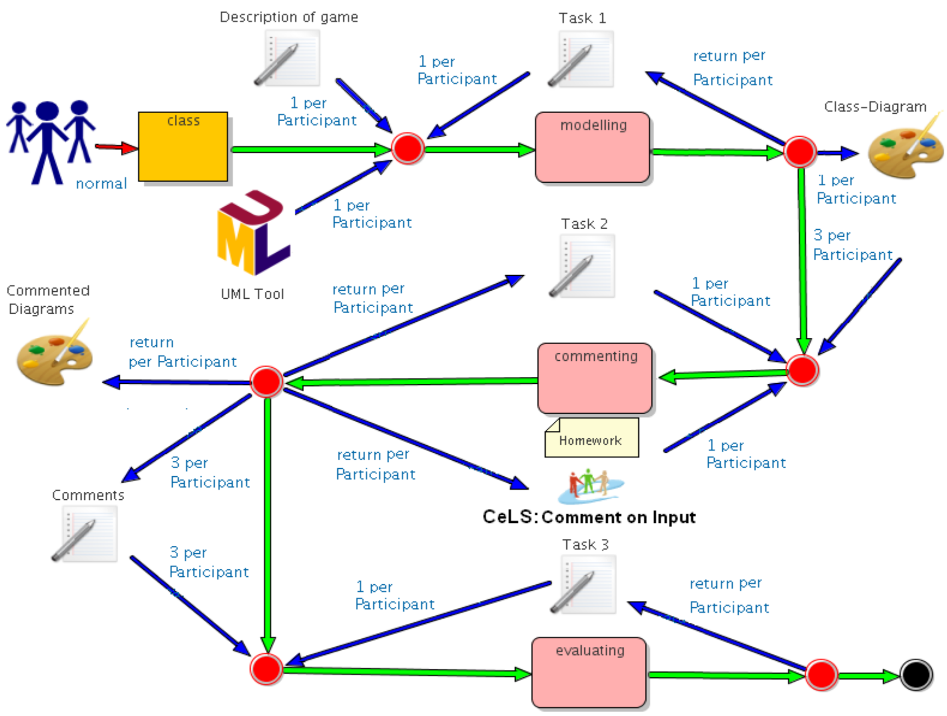

Figure 1. Graphical MoCoLADe model of the script enacted with

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A Design Rational of an Editor for Pedagogical Procedures

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Abstract: The scenarisation of learning activities seems to be a promising way to answer CSCL challenges. The success of the corresponding Learning Design field depends largely on its ability to offer eLearning professionals well-adapted tools. Whereas a number of languages are coming to maturity in this field, the associated authoring tools are still too difficult for instructional designers to manipulate. This paper presents the specification of an authoring tool based on particular scenarios which are here called Pedagogical Procedures.

Introduction

Learning design (Koper, Tattersall, 2005) seems to be a promising way to support the overall process of elaboration and delivery of learning activities. On the one hand, it provides models to describe pedagogical activities, and languages to formalize the descriptions produced (the scenarios). On the other hand, it also provides means to interpret the languages and transform the models of activities into actual activities running in virtual learning environments.

Although the results obtained in this field are significant, there remains progress to be made in order for the instructional designers to be able to get hold of them, to appropriate them and to put them into practice naturally. One of the reasons for this difficulty is that the modeling languages proposed are very abstract and the associated authoring tools, though offering graphical interfaces, are based on the manipulation of those concepts (modelEditorNew for LDL (Martel, Vignollet, 2008), Recourse (http://www.tencompetence.org/ldauthor/) for IMS-LD, MoColade (Harrer & al., 2007), etc.). The current instrumentation of the design phase thus seems to be inadequate for instructional designers (too far from their “world”) (Griffiths & al., 2005).

In order to actually support instructional designers more effectively during the design phase, we have identified particular scenarios, called Pedagogical Procedures (PP), and the concepts used by instructional designers to express them. Then, we have defined the corresponding model and educational modeling language intended to model them. As this language proposes concepts that are meaningful and eloquent for instructional designers, it can be considered as a Domain Specific Language (DSL). A PP graphical editor has been developped. This paper presents the work done on PPs.

What are Pedagogical Procedures?

The scenarisation of learning activities is a design activity which relies on an intuition shared by a lot of teachers: some learning activities are better than others in leading to effective learning and promoting the construction of knowledge by the learners. These learning activities considered more efficient than others are passed on by teachers from generation to generation. They take on the status of “recipes”. When they are correctly applied, these “recipes” favor learning. For example, in the French primary education system, all the teachers know and frequently use the La Martinière procedure (Rossignol, 1951). It is intended to develop pupils’ mental calculation abilities and to facilitate the acquisition of basic notions in calculation. Because of its efficiency, it has been raised to the rank of official procedure for carrying out mental calculation by the French Ministry of Education. The point here is not to discuss the supposed efficiency of these “recipes”, but to emphasize their existence and the fact that teachers acknowledge and endorse this existence.

The term "Pedagogical Procedure" can be bracketed with several other terms that have long been used in the field of educational technologies but we propose to define a more precise and more "formal” codification than the usual ones.

Definition of a pedagogical procedure

Pedagogical Procedures are specific scenarios that are distinguishable from others by their relatively codified character and the degree to which they are shared in the teacher community. So, for instance, by its systematic repetition, its implementation rhythm and the way it mobilizes the learners’ attention, the La Martinière procedure mentioned previously allows teachers to obtain indisputable results in the field of mental calculation. For this reason, these particular scenarios inspire confidence in teachers. They willingly use them for two main reasons: first, their implementation is facilitated by the codification; second, these scenarios are little disputed by the academic authorities insofar as they have gained popular recognition in the teaching community.

A pedagogical procedure is made up of a sequence of instructions given to the participants of a learning activity, that describe what they will have to do in the activity to reach the objectives set by the teacher. The pedagogical procedure defined as a sequence of instructions given to learners is codified as well as the instructions of a recipe.

A Pedagogical Procedure is defined as follow:

A Pedagogical Procedure is a particular scenario which contributes to the organisation of the learning activity. It is not linked to one particular subject or domain. It includes a set of instructions given to the future participants of the activity which describes what they have to do. Considering learning objectives, the application of these instructions leads to a quasi-certain result as only scenarios validated by teachers' experience can be considered as Pedagogical Procedure.

Examples of Pedagogical Procedures

When observing actual learning situations, several pedagogical procedures can be easily identified as they are frequently used within these situations (Villiot-Leclercq 2007). It is impossible to establish an exhaustive list of PPs, in particular because they are regularly revised and modernized.

For convenient and methodological reasons, we have selected eight PPs to be part of a reference list of PPs: "Case Study", "Guided Case Study", "Debate", "Treasure Hunt", "Controversy", "Conduct a Survey", "Give a Talk", "Role-Playing Game". Of course, they are in accordance with the definition given in the previous section. Among the selected PPs, some are simpler and more intuitive than others. For instance, *Controversy* is a complex one. It has been elaborated and codified by Bruno Latour at the *Ecole des Mines de Paris* (http://www.macospol.eu/streaming2/) and it is now disseminated at MIT (http://www.demoscience.org/) and in several engineering schools.

Of course, making an inventory of these PPs together with their description in terms of participants, phases, instructions and artefacts is not enough. They have to be described formally if we want them to be usable within a LD approach in which they are supposed to become computational objects.

The building of Pedagogical Procedures

In order to transform these descriptions into formal models via an editor, we have to consider the way in which an instructional designer could build a PP by manipulating the ingredients it is made of: participants, phases, instructions and artefacts. An important part of the effort put into the development of this editor is dedicated to the analysis and the understanding of what an instructional designer is ready to do to formalize a scenario. We also have to identify the entities and the relations that s/he can easily use to express the scenario, whilst keeping it as intelligible as its textual description.

Thus, the conception process of this tool has integrated a participatory design phase involving instructional designers and computer scientists about the way to build a PP using a small number of entities. This phase is very important. Indeed, a study on teachers' design practices (Henri & al., 2007) has shown the gap that exists between on the one hand the formalized and sometimes normalized methods instrumented by tools, and on the other hand, actual practices. These authors call for a design phase that is better adapted, less linear and more compatible with various design approaches as for them, the linear and sequential progress suggested by the "traditional" learning design approach incites the designer to determine the pedagogical orientations at the very beginning. For their part, these authors defend the idea that a new approach could attempt to respect the central importance granted to the contents while establishing a direct link between contents and pedagogy.

The construction of a Pedagogical Procedure (PP) begins with the selection of the participants who will receive the particular instructions in this procedure. Based on the metaphor of the orchestra, every participant will have a different *partition (score)*. Interpreted in concert, these scores will allow the participants to play "the (musical) piece". In the mind of the designer, a PP is formed of all the *instructions* given to all the participants. A PP does not need to be completely specified to be valid.

As shown in Figure 1, the investigations about the construction of the PP are made through spaces which can already prefigure the interface of the editor. An instruction is represented by the *initial artefact,* the action to be realized, and the *final artefact*, the result of the application of the instruction to the initial one. The instructional designer has also to clarify the nature of the *artefacts* involved in the *instructions*. For that purpose, s/he selects them from a palette of artefacts. In the case of the "Give a Talk" PP, the artefact *Subject* is the result of the instruction *Chose a subject.* It is also the initial artefact of the instruction that follows, *Search for information*. It highlights the need to clarify the links between the instructions. To allow it, operators are given to the designers.

The stages detailed above are only a fragment of the instrumented method proposed by the creators of this editor. This method results from the instructional designers making explicit their building rules for a pedagogical scenario.

If we refer to the expectation of the designers, it must be possible to build a PP starting from objects, or from instructions. These conclusions only serve to strengthen the necessity of offering multiple entries to the designers: by the contents, by the interactions, by the phases, etc. Thus, the construction of a PP should be done invarious manners. However, one of the results of this work is that it is definitely necessary first to identify the participants and then to define their respective partition (score).

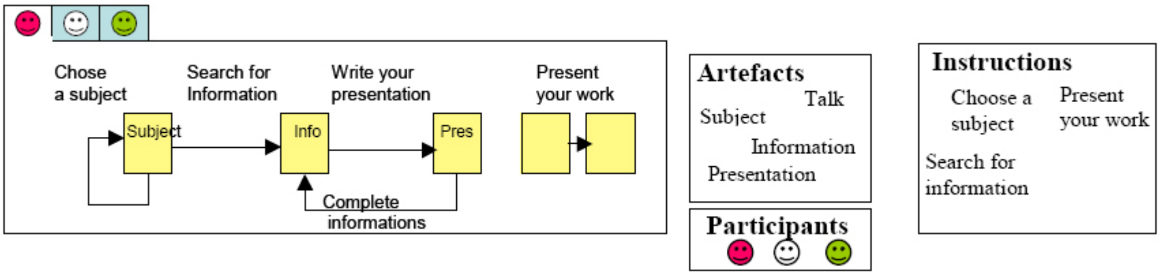

Figure 1. The PP under construction.

Conclusion

The design aspect is more than ever at the center of the process of production of eLearning trainings. This orientation, followed now by instructional designers, is promising in that it improves the reusability and the sharing of the corresponding scenarios produced. This helps to increase the supply of existing scenarios and thus the dissemination of the eLearning approach.

In this paper, we have presented an initiative for a participatory design of a design tool of these training modules. We have insisted on the necessity of clarifying the means by which the instructional designer tries to build a scenario since s/he relies on a precise definition of this scenario and on some simple objectives.

Via the example of Pedagogical Procedures, which are very codified scenarios and recognized as such by teachers, we have shown how such an initiative has allowed us to obtain the main objects that are useful for the conception of the editor. In this case, they have been able to obtain the definition of the central concept, that of the Pedagogical Procedure, and of the various associated models on which the conception of the editor is based: the model of the Pedagogical Procedures (the main concepts which allow to define them), the model of the tasks, the model of the interface and the associated one of the interactors.

This editor is now developed and experimentations have to be conducted with teachers. The following step is to instrument the transformations of the PP to LDL scenarios to allow their execution.

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PART II

PRE-CONFERENCE EVENTS

Introduction to CSCL 2009 Workshops, Tutorials and Seminars

Co-Chairs
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The pre-conference of CSCL 2009 is a time for a variety of collaborative-learning and community-building events in groups of one or two dozen participants, where people spend about a day together engaged in a discourse that is in some way tailored to their personal and professional position in the research community.

While the main conference consists primarily of formal presentations of academic papers, posters, panels and invited speeches, the pre-conference is a more informal experience where people can get to know each other and interact in a more personal atmosphere. Just as the doctoral consortium and the early career events bring together people at a certain stage of professional development, the workshops, tutorial and seminars bring together people with common topical interests within the spectrum of CSCL research. These events are designed to not only facilitate the exchange of knowledge, but also to foster dialogical collaborative learning. Furthermore, by introducing people from around the world to others with shared interests at the beginning of the week-long conference, these events lead to personal friendships, develop legitimate peripheral participation and form social networks that can provide interpersonal support throughout the conference and even lead to long-term collaborations and personal ties.

Workshops, tutorials and seminars address a broad spectrum of major or timely topics in computer-supported collaborative learning. This includes tools (e.g., tools for more effective, efficient and enjoyable CSCL interactions; for researchers), practices (e.g., teacher best practices; the analysis of student practice), theories (e.g., learning, cognition, teaching, practice) and methods (e.g., research approaches, techniques, methodologies). These events fit within the conference theme and the ways in which technology supports individual, group or community cognition within their societal contexts. They include sessions devoted to learning about specific concepts, methods or techniques, or to furthering our knowledge and understanding through group discussion and problem solving. In keeping with the constructivist spirit of CSCL, pre-conference events are generally highly interactive. The "mini-conference" workshop style of PowerPoint slide presentations of multiple papers is discouraged.

Workshops are "working meetings" for a group of people to take advantage of being co-located to work together collaboratively on a theme of shared interest. Seven workshops are offered at CSCL 2009. There are two on methodological issues of interaction analysis, three on scripting and other forms of support for collaboration, and two on specific kinds of CSCL environments: Group Scribbles and argumentation systems.

Tutorials are hands-on opportunities for newcomers to experience some topic under the guidance of more experienced researchers. This year we offer two tutorials on leading-edge techniques within CSCL: "Collecting and Analyzing Gaze Data from Collaborative Interaction" and "Handling Multi-level Data." As is traditional at CSCL conferences, we have a tutorial "Introduction to CSCL," this year configured as a dialog between members of the ijCSCL journal board of editors and the audience.

In addition, in the spirit of this year's conference theme, *Seminars* are offered for practitioners interested in incorporating computer support into their collaborative-learning pedagogies. These could be educators of teachers (faculty for pre-service teachers, trainers for in-service teacher professional development), university teachers, workplace trainers, e-learning practitioners, and even managers and decision makers from across all educational sectors. There are seminars on the topics of "Constructing Graphical and Hypertext Knowledge Representations for Learning" and "Modeling, Creating and Enacting Online Collaborative Scripts." There are also seminars on two software systems for classroom use: "Scratch: Creating and Sharing Interactive Media" and "E-discussion Moderation with Argunaut."

TUTORIALS

Introduction to CSCL

Organizer
Gerry Stahl, Executive Editor of *International Journal of CSCL,* gerry@ijCSCL.org

Abstract: The ijCSCL Board of Editors presents a day-long introduction to CSCL. This tutorial will be a dialog among oldtimers and newcomers to the CSCL community. The day will be divided into four sessions, focusing on CSCL visions, CSCL practices, CSCL technologies and CSCL theories. During each session, several members of the ijCSCL Board will discuss with each other and with the audience the broad topic for that period. This will be an opportunity to participate in a unique discourse about central issues and controversies in our field. The dialog will be computer supported by the ijCSCL wiki.

Tutorial Overview

Discussants: Many members of the ijCSCL Board of Editors. The people listed below have expressed interest in being discussants, but the session presentations will be open to all Board members.

Participants: Doctoral students, teachers, faculty and researchers interested in learning about CSCL.

Presentation method: Discussants will make brief statements and start discussion, dialog and debate among each other and with the audience.

Online discussion: The wiki at http://ijCSCL.org/wiki will contain the opening statements of the discussants. The wiki will be open for discussion before, during and after the tutorial and the rest of the conference. This could initiate a permanent wiki on the central topics and issues in CSCL, open for the whole community of researchers and practitioners.

Session I: CSCL: Why bother? — Vision, benefits and potential

Time: 9:30-11:00

Topic: The 20-year history of CSCL, its accomplishments, its failures and the challenges still facing it.

Discussants: Paul Kirschner, Naomi Miyake, Claire O'Malley, Roy Pea, Jeremy Roschelle

Session II: Practices and practicalities — Using CSCL in classroom

Time: 11:30-13:00

Topic: How classrooms and other learning venues—whether distributed or co-located—can be organized to promote, structure, guide and support collaborative knowledge building.

Discussants: Tak-Wai Chan, Elizabeth Charles, Pierre Dillenbourg, Lone Dirckinck-Holmfeld, Therese Laferriere

Session III: Technologies for supporting collaborative learning

Time: 15:00-16:30

Topic: A sampling of specific tools, techniques and technologies from the CSCL toolkit, and the general approaches they are based on.

Discussants: Hugo Fuks, Ricki Goldman, Ulrich Hoppe, Chee-Kit Looi, Masanori Sugimoto, Barbara Wasson

Session IV: Theoretical frameworks relevant to CSCL

Time: 17:00-18:30

Topic: Broad theories from other disciplines that inform analysis of CSCL interactions at the individual, small-group and social levels of description.

Discussants: Sanna Jarvela, Nancy Law, Peter Reimann, Hans Spada, Dan Suthers, Rupert Wegerif

Methodologies for analyzing interaction and learning

Time: The rest of the CSCL 2009 conference

Collecting and Analyzing Gaze Data from Collaborative Interaction

Organizers
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Tutorial content

Eye tracking provides valuable information to better understand how learners use CSCL systems. The simplest application of eye-tracking consists of recording when and how often learners focus their gaze on a particular area of interest. For example, do they look at a knowledge awareness tool while composing or when receiving a message? Which sentence openers do they look at most in a semi-structured discussion tool? A technically more challenging approach consists of capturing gaze when learners construct an artifact (e.g. a concept map), or when the scene is dynamic (e.g. Tetris). In this case the areas of interest are mobile and need to be recorded in parallel to gaze. Several popular CSCL applications correspond to this case, e.g. chat tools, forum threads, and graphical discussion tools. Finally and most complex, dual eye-tracking consists of simultaneously recording gaze from two collaborators working on a shared task.

This new methodology offers promising insights into the interaction processes during collaboration. In this tutorial, we propose to address the methodological challenges inherent to the three types of gaze data collection and analysis. Standard analysis and replay software which usually come with eye-trackers are intended to visualize individual activity only. We propose to introduce participants to the challenges of recording and analyzing through hands-on activities with a replay tool that we developed to visualize and explore quantitative indicators related to collaborative gaze (Figure 1).

Tutorial format

The tutorial mixes presentations and hands-on activities. 1) Introduction to the experimental setup required to record data. 2) Exploration of diverse gaze records with the replay tool 3) Presentation and discovery of different quantitative indicators computed by the replay tool (divergence, co-occurence, dispersion, etc), 4) Advanced use of the replay tool based on gaze features. Researchers already active or planning to start in this field will get an opportunity to discuss how they could use and extend the replay tool developed by the organizers. This could be the starting point for the development of an active community of researchers on gaze in collaborative situations.

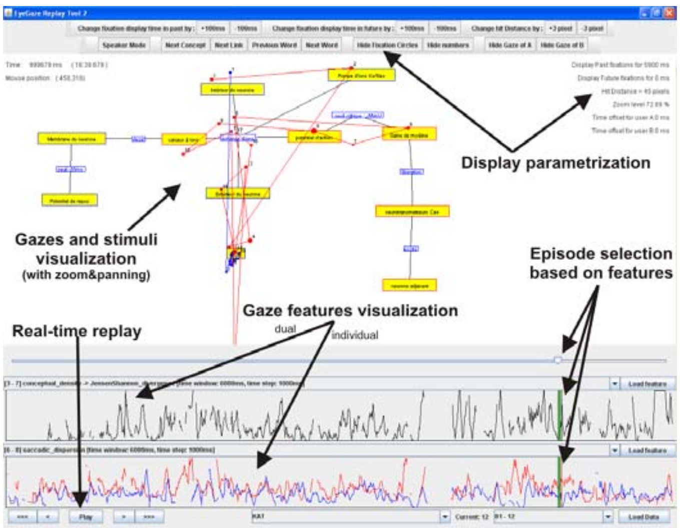

Figure 1. Illustration of the Replay-Tool integrated in the framework

Special procedures

Participants who already have gaze recordings in a collaborative situation are invited to contact the organizers by April 3rd to assess whether their data can be used during the tutorial. Participants who do not have their own data will be able to use the organizers' data sets (Collaborative Concept Mapping, Collaborative Tetris, Collaborative Raven Matrices).

Multi-level Analysis

Organizer
Ulrike Cress
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Description of the Event

In CSCL we often have to handle data with a multi-level structure (Cress, 2008). These quantitative data describe individuals, but these measures are statistically not independent, because the individuals interacted in groups and influence each other. The workshop shows why standard statistical procedures like ANOVAS and correlations will not work with these data. The workshop will present some basic ideas of multi-level modeling (Bryk & Raudenbush, 1992; Burstein, Kim & Delandshere 1989) and explain the logic behind it.

Multi-level models would be an adequate method for dealing with many CSCL data, but the problem is that their application only makes sense with a large number of cases (Hox, 2002). In CSCL research we do not normally have such large samples. The aim of the workshop is to discuss how we can deal with the multi-level structure of the data, on the one hand, and the relatively small samples on the other. From the statistical point of view, there appears to be no "best" solution in this situation. But the workshop aims to make researchers aware of multi-level problems, and motivate them to think about designs which can be adequately analyzed.

The event addresses both people with and without experience in multi-level analysis.

Description of the Event Format

The event will start with a presentation about the problems of nested data. It will show which problems occur when these data are analyzed inadequately. It will then show how multi-level modeling deals with such data.
The second part will be highly interactive. Here participants are asked to present their data and to describe their designs. The workshop gives participants an opportunity to discuss their solutions with the group and to find strategies to handle the data adequately.

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Hox, J. J. (2002). *Multilevel analysis: techniques and applications.* Mahwah, NJ: Lawrence Erlbaum Associates.

SEMINARS

Scratch: Creating and Sharing Interactive Media

Organisers
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Abstract: Scratch (http://scratch.mit.edu) is a new programming language that makes it easy to create interactive stories, music, games, art, and animations – and share those creations on the web. In a little over a year, more than 47,000 members have contributed over 300,000 projects online. Scratch presents powerful opportunities for learning – as people program and share with Scratch, they learn to think creatively, plan systematically, and work collaboratively, while also learning important computational ideas. In this seminar, participants will have a unique opportunity to work with the creative team that developed Scratch. Join members of the Scratch Team from MIT Media Lab for hands-on experiences with Scratch, explorations of how collaboration is supported by Scratch, and design-oriented activities for further supporting collaboration. Bring your laptop – no prior experience with Scratch is necessary!

Seminar description

Scratch (http://scratch.mit.edu) is a new programming language – developed by the Lifelong Kindergarten group at the MIT Media Lab – that makes it easy to create interactive stories, music, games, art, and animations. Creating with Scratch is much easier than traditional programming languages: you simply snap together graphical blocks, much like LEGO bricks or puzzle pieces. Once you've created a Scratch project, you can then share it with the world on the Scratch website, like you share videos on YouTube or photos on Flickr. A wide range of projects have been shared on the Scratch website, from community narratives to role-playing games to scientific simulations. In the first year and a half since the website was made public, Scratch has been downloaded more than half a million times – more than 47,000 members have contributed over 300,000 projects, and many of the more than 200,000 registered members have participated by commenting, tagging, bookmarking, joining galleries and taking part in discussion forums.

Designing, programming, collaborating, and sharing are tightly interwoven in the practice of Scratch. Both the application interface and the website are designed to support and encourage collaboration and sharing. In this seminar, we will introduce Scratch and the online community, explore the ways in which collaboration is supported in Scratch, and brainstorm ways of enabling more opportunities for collaboration in Scratch. This seminar presents a unique case study of collaborative learning as mediated through an online environment designed to support young people in creative design activities. We will investigate the technical aspects that support collaboration (e.g. mechanisms for code collaboration, galleries for sharing projects, forums for providing support) – and then illustrate how these technical affordances are contextually appropriated by the community (e.g. community members using galleries as critique groups).

The overall objective of this half-day seminar is to engage participants in explorations of how Scratch supports (and might support) collaboration. The workshop will provide participants with opportunities to: gain hands-on experiences with Scratch programming and the Scratch website, analyze stories from the first year and a half of the Scratch community (as presented by the MIT Scratch Team), imagine possibilities for future modes of Scratch interactions and collaborations through design activities, and discuss how Scratch experiences could inform the design of other collaborative environments.

Seminar participation

We invite individuals with a wide variety of experience to participate. From those who are completely new to Scratch to those who have used Scratch extensively, those who have years of programming experiences to those with little or no experience, all are welcome, as a mixed audience will provide new insights and appreciations for working with Scratch. Participants are encouraged to bring their own laptops to the workshop. We will provide participants with copies of Scratch on portable discs, as well as Scratch support materials, including Scratch quick-start cards, the Getting Started guide, and the *Reference guide*.

Modeling, Creating and Enacting Online Collaborative Scripts

Organizers
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Andreas Harrer, Catholic University Eichstätt-Ingolstadt, Germany, andreas.harrer@ku-eichstaett.de
Yael Kali, Technion, Israel

Theme

The seminar focuses on pedagogical and technological aspects of modeling and applying *structured instructional strategies* (scripts) for all levels and subject domains. Two dedicated environments will be introduced:

CeLS (Collaborative e-Learning Structures), is an innovative approach and system for creating, implementing, sharing and reusing collaboration scripts. The unique feature in CeLS's design is its ability to selectively reuse learners' inputs and products from previous stages and to create and conduct complex and rich, multi-stage activities based on different 'social settings' (groups and roles).

The graphical language MoCoLADe (Model for Collaborative Learning Activity Design), based on an intuitive drag-and-drop approach for educational modeling, will be used as a tool to design and model scripts.

Participants will first experience the environments by participating in sample scripts, explore a variety of examples in various subject domains, and then challenged to design, create and share their own activities.

The seminar addresses:

- Practitioners of all levels (University – Elementary school) and subject domains that are interested in getting acquainted with innovative technology for creating, implementing, sharing and reusing online scripts.
- Researchers who are interested to use these tools for conducting studies on CSCL.

Expected outcomes and contribution

Participants will benefit from experiencing a large variety of scripts, from active engagement in creating their own scripts, from sharing activities with other participants, and from the expertise of organizers.

Participants will design and build artifacts that they will be able to use in their own settings. Continuation activities will be proposed to the group for sharing future experiences of enactment and revisions of CSCL scripts.

We expect stimulating discussions about potential affordances and challenges of the innovative approaches and tools introduced in the seminar.

Program

Morning:
Welcome & Introduction
Let's play scripts - experiencing sample scripts
Creating scripts and script examples:

- CeLS approach & architecture: activity stages, the building blocks, social structures, social settings and groups formation
- The graphical notation MoCoLADe and how it corresponds to the CeLS concepts
- Examples of scripts that were enacted with students in actual instructional settings for various levels and subject domains, including large courses in: education, IT, science, arts, medical professions, social sciences. The activities include: peer-product evaluation, contest, reaching group agreement, role-play, jigsaw and other strategies.
- Sharing and reusing scripts

Afternoon:
Designing our scripts (in small groups): Participants will explore existing examples and design their own scripts for various subject domains and instructional purposes.
Sharing our scripts: Presentation and discussion of participants' scripts.
Summary: Challenges of sharing and reusing collaborative online pedagogy.

Constructing Graphical and Hypertextual Knowledge Representations for Learning

Organizer
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Seminar content

This seminar will investigate ThinkSpace, a technology-based tool for collaborative learning and reflection. ThinkSpace is a simple idea combining computer-based concept mapping and a wiki in a tool that can be used for structuring and clarifying thoughts about complex material. The tool is used by groups of learners for creating an interlinked online knowledge repository – a mini encyclopaedia - in a wiki and constructing a corresponding graphical representation in the form of a concept map. Being hyperlinked to the wiki, the concept map provides both a navigational aid and overview of the wiki content, as well as being a tool for representing meaning. The wiki repository, as well as its graphical counterpart, are dynamic means for analysing, manipulating and interlinking content knowledge. The workshop will explore the potential of the process of creating multi-layered knowledge representations with ThinkSpace for encouraging active thinking about complex ideas.

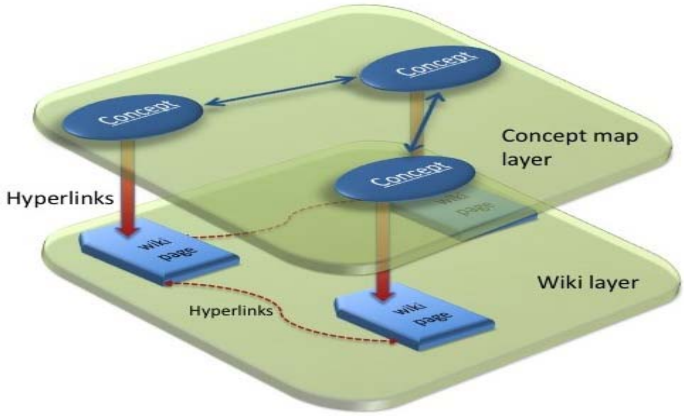

Figure 1. Double layered knowledge representation with ThinkSpace

Seminar format

- Introduction to ThinkSpace – presentation by the organizer
  - Conceptual structure and learning theory underpinning the tool (introduction to concept mapping and wikis)
  - Technological implementation
- Brief technological hands-on training
  - Short concept mapping task to familiarise the participants with Gliffy
  - Short wiki writing task in the Sandbox on Twiki to familiarise participants with Twiki's functionality
- Main reflective small group task: participants will receive an overview starter-pack of information and links to online sources on a topic, which does not require any specific expertise, such as a historical period or a current affairs issue. The task will consist of mapping the main conceptual structure of the topic around a central question and creating an underlying interlinked information base. Through this task the participants will experience the ways in which the tool affords and constrains particular types of thinking and discussion, which will give them an insight into how ThinkSpace can be used to encourage certain types of learning.
- If more than one group are involved in the workshop, the groups will be allowed time to compile short reflective presentations about their experience of working with ThinkSpace and their thoughts about how the tool can facilitate learning.
- The workshop will end with a conclusive discussion about possible ways to explore the ThinkSpace tool and similar technologies in different learning settings.

E-discussions Moderation Made Easier with the Argunaut Tool

Organizer
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Theme and goals

Facilitating the moderation of synchronous e-discussions is one of the challenges undertaken by today's CSCL community. The need to provide means for such facilitation in this context is twofold: on the one hand, these e-discussions (considered also as a classroom dialogue) are essential for learning and therefore their proper moderation is important; on the other hand, teachers are not used to facilitate e-discussions and, therefore, it is crucial to provide them with the proper means to do it.

The aim of the Argunaut project (IST-2005-027728, http://www.argunaut.org) was to provide teachers and other moderators of e-discussions with a computerized tool and its associated pedagogical methodology to support and increase the effectiveness and thereby the quality of the monitored e-discussions (De Groot et al., 2007). The Argunaut system can facilitate the simultaneous moderation of multiple e-discussion environments by helping the moderator understand what is going on in the discussions and, furthermore, allowing the moderator to intervene in a way that can enable better discussions without disrupting the peer interaction of the discussants.

During the six-month period April-September, 2008, we had the opportunity to use the tool with teachers in real classroom settings. This experience allowed us to understand the teachers' need for such tools in their daily work. Giving a first-hand account of this experience, and jointly reflecting on it, are the main purposes of the planned seminar.

Intended audience: Researchers, teachers and practitioners interested in having hands-on experience with the tool and in discussing its possible implementation in school settings and in work places.

Description of format of activities planned

During the seminar, participants will be able to use the Argunaut system to moderate e-discussions conducted through the Digalo tool (developed in the DUNES project - IST-2001-34153, http://www.dunes.gr/) in real time, as well as to review already concluded moderated discussions in replay mode.

The organisers will present some good examples of moderation of past discussions and teachers' feedback on the use of the tool in their classrooms.

After the hands-on experience we will have a guided discussion regarding the advantages and disadvantages of the use of such tools for teachers in classroom and in online lessons.

Directions for further research and implementation of these approaches and tools will be dealt with as well, if the participants so wish and time allows.

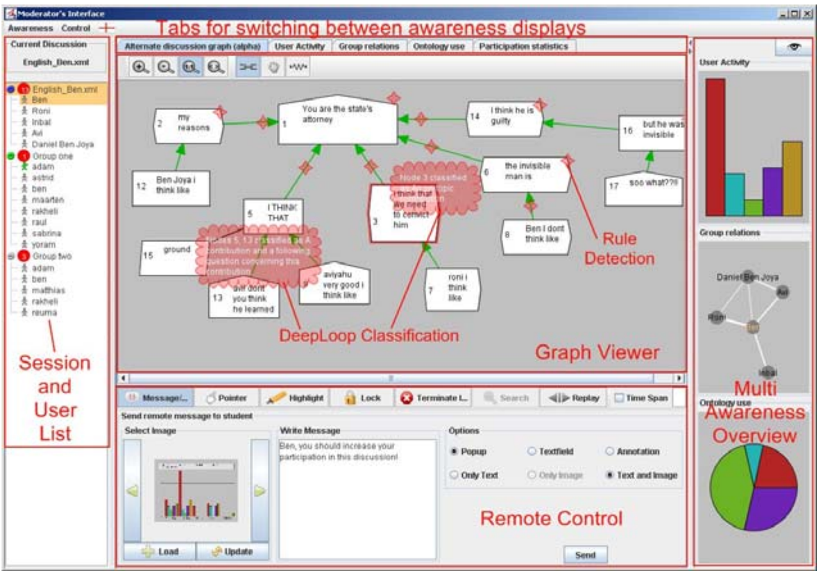

Figure 1. Screenshot of the Moderator Interface (MI) of the Argunaut tool

Expected outcomes

Enlarging the community of teachers and practitioners using the Argunaut tool as well as the research community studying moderation of e-discussions.

Expanding and enriching our understanding regarding the potential use of this tool for learning and teaching in real classroom situations.

Prior relevant experiences of organizers

Participation in and management of R&D projects, and implementation of its outcomes. Working with Digalo, Argunaut and other CSCL tools with teachers in real classroom setting. Conduction of several teacher training cycles addressing these tools and supporting pedagogical methodologies.

References

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WORKSHOPS

Common Objects for Productive Multivocality in Analysis

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Workshop Objectives

This full day workshop is intended for anyone who is actively engaged in analysis of interaction relevant to CSCL concerns. The objective of the workshop is to work towards the interdisciplinary study of interaction analysis in CSCL. Presently CSCL encompasses diverse approaches to the study of how technology-mediated interaction leads to learning: it is multi-vocal. Multivocality is a strength, but only if the "voices" share sufficient objects to reach some degree of coherence in the discourse of the field. This workshop will continue the work of the ICLS 2008 workshop, "A Common Framework for CSCL Interaction Analysis." At that workshop we explored the diversity and commonality of the field on four dimensions: the *purpose* of analysis, the *units* of interaction that are taken as basic in the analysis, *representations* of data and analytic interpretations, and analytic *manipulations* taken on those representations. The present workshop will add one more dimension: *theoretical assumptions* underlying the analysis. It will focus on identifying potential common objects for productive multivocality at these five levels. It will also identify differences, and whether these differences are complementary (potential sources of richer understanding) or incompatible (potential barriers to a common discipline). The workshop will take a data-driven approach, focusing the discussion on several corpora and sample analyses to ground discussion.

Workshop Format

In advance of the workshop, sample corpora and analyses will be identified (details are provided below). The workshop itself will be divided into four portions demarcated by coffee breaks and lunch.

- Introductions of workshop participants, an introduction to workshop objectives and format, and (time permitting) a preview of the data to be considered.
- First case study (after coffee). (a) The Data Presenter will present the data corpus. (b) Each Analyst (two or more, possibly including the Data Presenter) will present an analysis of the data, including explicit summaries of their theoretical assumptions, purpose of analysis, unit of interaction, analytic representations, and analytic moves. (c) The Discussant will compare and contrast the presented analyses in terms of the five dimensions just listed, open the case up for discussion and draw conclusions concerning what common objects in each of these levels may enable productive multivocal dialogue in CSCL.
- Second case study (after lunch), as above.
- Discussion and conclusions: Identify potential "common objects" of interaction analysis in CSCL and how they may be leveraged to make the multivocality of the field productive. Identify also any irreconcilable differences we should be aware of. Make recommendations concerning post-workshop activities and practices that will improve the development of a discipline of interaction analysis (including possibly report writing by workshop participants, recommendations to ijCSCL and other journals, possible collaborations, future events etc.).

Submission Procedures

All workshop participants must have prior experience analyzing interaction as a means of learning, and all will be expected to participate in the discussion. (We will admit participants who are new to interaction analysis only if space is available. Payment of a workshop fee is not sufficient to guarantee admission.) In advance of the workshop, we will (1) identify workshop participants, (2) solicit data corpora and select *Data Presenters* for two data corpora for analysis; (3) assign some participants to be *Analysts* and *Discussants*; and (4) require that the Data Presenters and Analysts analyze their assigned corpus in advance of the workshop. Two sets of data corpora will be selected to reflect different pedagogical contexts inspired by different theoretical underpinnings, and data presenters, analysts and discussants for each corpus will also be selected from multiple research traditions. Participation requirements differ for each category of participation:

Basic Participation: All researchers who wish to participate should submit up to two pages summarizing their relevant prior experience, their objectives in participating in this workshop, and a bibliography of relevant publications.

Analyst/Discussant: Researchers who wish to be selected as analyst or discussant should meet the requirements for basic participation, and append one to two pages characterizing the analytic work they typically undertake in terms of: (1) theoretical assumptions; (2) purpose of analysis; (3) units of interaction (4) notations for data and interpretations; and (5) analytic manipulations.

Data Presenter: Researchers who wish to offer a data corpus should meet the requirements for Analyst/Discussant, and submit an additional document summarizing the nature of the corpus and making the case that this data will serve the objectives of the workshop. Data presenters may also serve as analysts or discussants.

Workshop URL: http://engaged.hnlc.org/

Interaction Analysis and Visualization for Asynchronous Communication: Analysis Methods, Tools and Research Questions

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Description of the workshop content

Topic: Automatic and semi-automatic methods and tools providing indicators and multiple visualizations and views, that could support self-regulation and/or moderation purposes. Focus on Interaction Analysis (IA) tools that analyse asynchronous and content oriented communication and collaboration tools, such as forums, discussion lists, wikis, and blogs.

Currently, there are IA tools that provide a variety of IA indicators such as participation and interaction oriented indicators, content analysis indicators, and mixed approaches. There are also IA tools that provide interface alternatives in CMC tools (e.g. alternative reading views in forums). Moreover, there are IA tools that are directly linked to a specific learning environment (e.g. a specific forum) or others that are independent of them; recently some methods are designed so as to be open to every kind of interaction data.

Goal: To achieve a consensus on IA tools' basic functionalities and to identify categories of IA indicators for different purposes; to discuss more intensively the research design methods applied so as to study the use of these IA tools (by students and/or teachers), as well as their effects in learning activity processes.

The present workshop aims to:

- (I) Achieve a consensus on minimum standard features and functionalities of IA tools
- (II) Identify complementarities in methods and indicators, so as to start to improve or enrich them
- (III) Identify common IA indicatorsor even common sets of indicators needed for the analysis of asynchronous interactions taking place in different environments (forums, lists, blogs, etc): for instance, a consensus on lists of indicators and visualizations that can be attached to any discussion list and forum to be considered as the signature of such discussion list or forum. It can include for example: total duration, number of participants, senders, posts, threads; list of authors, graph including daily/monthly posts, etc)
- (IV) Identify range of questions that we reach to answer with the existing IA indicators sets, as well as open questions that correspond to unsatisfying needs of IA tools users.
- (V) Achieve a consensus on minimum steps of research design studies, when intending to design and develop IA tools for teachers, moderators and students

Description of the workshop format

(I) Pre workshop phase:
(i) Position papers submitted, reviewed and then synthesized; (ii) A social environment is set up by organizers. IA tools, data corpus, as well as previous discussion reports on workshop issues are exchanged between registered participants.

(II) Workshop phase:
(i) Introductory Panel; (ii) Hands on activities with/around computers; (iii) Round tables managed by a moderator; (iv) Synthesizing Panel; (v) Concluding Panel

III) Post-Workshop phase:
(i) Final conclusions uploaded in the workshop website; (ii) Continuation of community of interest (exchanging tools, data corpus, and related papers).

Intended audience and call for papers

(1) Researchers involved in the design and production of IA tools for asynchronous communication and collaboration tools or educators-researchers that have some previous experience by the use of existing IA tools.
(2) Senior or junior Researchers that are in process to produce work related to the research direction of IA for regulation and self regulation or they are strongly interested to.

Workshop URL: www.ltee.gr/IA_WS_CSCL2009

Intelligent and Innovative Support of Collaborative Learning Activities (WIISCOLA)

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Description of the event content

CSCL is an interdisciplinary field that integrates researchers with one common goal: support new learning experiences where students can interact mediated by technology and learn through exploration, discussion and self-regulation. To support collaboration is a complex issue due to the context of group learning where the synergy among learners' interactions affect the learning processes and outcomes. This problem has become more evident with the emergence of Web technologies that allow people to work and learn collaboratively. In this context, Artificial Intelligence (AI) techniques, ontologies and semantic technologies can be instrumental to handle the development of intelligent support systems that help teachers and students. For teachers, intelligent support offers better ways to create and run CL activities and analyze students' interactions. Students can receive intelligent guidance that stimulates the emergence and occurrence of productive interactions. However, to accomplish the development of intelligent systems for CSCL, we need to re-think about the state-of-the-art in AI and semantic technologies and push the research trends in CSCL towards the new generation of technologically sophisticated systems/methods to enhance/improve collaborative learning. This workshop aims at bringing together researchers from AI, semantic web and CSCL communities to think and share the vision of the next generation of systems that can support collaboration in educational settings. The main theme of this workshop is to discuss about the next generation of intelligent systems and semantic technologies that will be useful to support collaborative learning. We are especially interested in topics that enhance current CSCL support systems in architectural, technological and philosophical levels, such as:

- Architectures, frameworks and systems to design CSCL environments
- Tools and languages to support CSCL scripts
- Intelligent systems for CSCL (data mining, distributed systems, user interface, etc)
- AI in CSCL: ontologies, agent technology
- Semantic Web technologies to support CL
- Leveraging Social Semantic Web in CL
- Innovative ways to analyze students' interactions
- New approaches for group/individual assessment
- User modeling for CSCL.

We hope to give participants the opportunity to:

- Investigate and discuss new architectures, systems and techniques that explore the full potential of CSCL environments
- Gain an understanding about the current research in AI and Semantic Web technologies within CSCL contexts
- Investigate the development of intelligent and innovative support systems for CSCL and draw the research directions and agenda to create the next generation of intelligent systems for CSCL.

Description of the event format

All papers will first be reviewed by the program committee, and then opened to the public together with the comments of the reviewers. Everyone interested in the topic will be invited to comment on the review of the papers and make their own review or comments on the Web site, http://www.chocolato.org/wiiscola. Finally, authors of the papers with the best evaluation from the committee and from the community will be invited to present their papers. During the event, papers will be presented (15 min each); after each presentation, groups will be formed for discussion (10 min), followed by a round of feedback and Q&A (10 min). The results of this collaboration will be published on the website.

Workshop URL: http://www.chocolato.org/wiiscola

Competitive Challenge on Adapting Activities Modeled by CSCL Scripts

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Theme and Goals of the workshop

Both the Learning Design community and the CSCL scripting community are working on the problem of modeling learning activities. The idea is to build a formal description of such activities (called a script, or a scenario, or a sequence, or a learning design) that a computer will be able to read and interpret in order to automatically generate the CSCL environment that will support the execution of the corresponding activity. Researchers of these communities have thus proposed and developed models, languages, methodologies and tools to support this approach.

A script is written in a given language (for example IMS-LD, LDL, the collaborative scripting language, etc.) and transformed in an activity running on an existing virtual learning environment. Thus the activity is strictly running according to what is described in the script: it cannot deviate as it is scaffolded by a computer process. The problem then is the following: how can it be adapted to events that may occur in the activity. Indeed, learning activities are continuously evolving whilst they are running. Teachers always have to adapt the situation to the learners' reactions and to external events. Some may have been planned and the teacher knows how to react; some may be unpredictable and the teacher has to imagine a way to adapt.

The theme of this workshop is the adaptation of activities modeled by CSCL scripts according to what is happening in the activity. The issues to deal with include the following:

- Can adaptation be taken into account in the scripting approach?
- What are the models and languages required to do that adaptation ?
- Do the currently existing models, languages and supporting tools handle this problem?
- Which concepts do these currently existing models, languages and supporting tools propose for that?
- How can adaptation be handled?

These issues may be considered in both the case of foreseen events (adaptation is specified within the script) and the case of unforeseen events (there is nothing in the script to define how to react).

The *adaptation* problem raises another problem: the *observation* one. The workshop will also deal with this problem issue: how can an activity be observed while it is going on? Are concepts dedicated to observation needed in the script models? What is currently existing to support observation within scripting approaches? Which models? Which tools?

Format of the workshop: a challenge with one benchmark scenario

The workshop is defined as a kind of competition gathering teams that will have to work on the design of a common case study (a given learning activity which will serve as a benchmark) dealing with the issues mentioned above. Two kinds of participants are expected:

- "competitors", who will be engaged in the challenge,
- "attendees", who will be able to look at the concrete competitors' solutions, to get hands-on experience with these solutions and to discuss further requirements with the competitors.

It is open to any academic or industrial e-learning researcher, e-learning designer or e-learning practitioner in CSCL. It will allow confronting the various solutions and models, approaches and tools through modeling experiences of collaborative learning activities, considering the adaptation and observation problems, starting from a real situation to be modeled and ending at the corresponding implemented activity.

Submission procedure and planned activities

Pre-workshop – submission procedure

Before the workshop takes place, a "challenge", i.e. a scenario that should be modeled by the different competitors, will be defined and put at disposal in the workshop website. It will be issued by March the 1st, 2009 to allow preparation for the conference. A "call for modeling solutions" will be issued at the same time. Potential contributors (future competitors) are expected to submit an initial text describing briefly their solution approach (planned modeling technique to be used, intended CSCL tools, adaptation approach) and the issues tackled in the solution (of course, contributors are not expected to consider all the issues) for a short reviewing process to select competitors. As we want competitors to have time in preparing the solution and not to be overbooked with writing tasks, the required description will be short (one or 2 pages long). The final decision to be engaged as a competitor in the workshop will be taken on the basis of the description submitted. The selected competitors are expected to prepare a solution to the challenge for the workshop event. More information about the submission process will be available soon in the workshop website, together with the case study (see http://www.lama.univ-savoie.fr/wiki/index.php/CSCL_Workshop_Challenge_on_Adaptation).

During the workshop

- Presentation of the competitors' solution and discussion during the morning session;
- Open space in the afternoon for the participants to test the solutions and play with them. This will be followed by a concluding session, summarizing and comparing the approaches, and identifying further ToDos for the field.

Post-workshop

The competitors' solutions will be collected into a technical report on "adaptation for CSCL scripts" and published at least in the web. We are currently considering a publication for a special issue of a journal.

Workshop URL:

http://www.lama.univ-savoie.fr/wiki/index.php/CSCL_Workshop_Challenge_on_Adaptation

Scripted vs. Free CS Collaboration: Alternatives and Paths for Adaptable and Flexible CS Scripted Collaboration

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Theme and Scope

Research has consistently emphasized that free collaboration conditions may fail to engage all team members in productive learning interactions. Scripted collaboration has been proposed as a method for triggering peer interaction and creating a meaningful learning situation for all learners.

The CSCL community is currently exploring systematically the issue of collaboration scripting. However, there are also voices calling for attention on the issue of sacrificing the "fun and creativity of free collaboration" to attain effectiveness. Computer-supported scripting has been criticized for its loss of flexibility and also the danger of "over-scripting" the collaborative activity. The need has also been emphasized to differentiate between flexibility loss that is due to pedagogical design and undesired constraints of computer-based scripting techniques. At the same time, suggestions for more adaptive and intelligent forms of CSCL scripting are already on the table. Against this background, we argue that a significant issue for the CSCL community is to productively reflect on existing research regarding the pros and cons of scripted vs. free collaboration.

The goal of the workshop is to be an informal meeting which facilitates the dissemination and advancement of knowledge and expertise in this field. It is intended for researchers and educators who have a strong interest on the issue of how to improve CSCL practice and outcomes through the flexible implementation of methods for structured support and guidance of collaborating students. The research question is crucial for people who approach the issue from different but complementary perspectives (learning scientists, educators, engineers/computer scientists, instructional designers, the LD community).

The workshop will focus on (but is certainly not limited to) the following topics:

- Adaptable and flexible forms of guidance and support in CS collaboration activities.
- Theoretical issues on analyzing and advancing CS scripted collaboration.
- Methods and tools for the design and operationalization of CSCL scripts.
- CSCL scripts in everyday teaching; reflection on experiences from practice.
- Interaction analysis techniques to inform the adaptable and flexible behavior of CSCL systems.
- Intelligent forms of tutoring/scaffolding/scripting in CSCL systems.
- User and group models to promote flexible adaptation of CSCL script implementation.

We welcome papers that describe speculative ideas, work in progress, and discussions of important issues.

Format

The workshop will be a full day workshop with three sessions: two morning sessions and one afternoon session. Papers will be made available before the workshop to all participants so that they will have time to review the material. During the morning sessions all authors will be given time to present their work and answer other participants' questions (it is possible to dedicate one morning session to hands-on activities). In the afternoon session participants will be assigned to working groups and will be asked to reflect on key issues and ideas raised by the presented papers.

Workshop URL: http://mlab.csd.auth.gr/cscl2009/sfc-workshop.htm

CSCL Argumentation Systems: How Do Empirical Results and Emerging Technologies Inform System Development?

Organizers
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Workshop Content

Many CSCL systems at least implicitly relate to argumentation since they allow students to learn and construct knowledge collaboratively. There has been considerable effort in developing and assessing educational technology to support argumentation within the CSCL community. Many of these efforts have been shown to be effective for specific argumentation domains. At the same time, the general design problem of how to support a learner's acquisition of argumentation skills via computer support has not been solved and is still an important item on today's CSCL research agenda. Also, the affordances of new technologies (e.g., Web 2.0, Social Software, collaborative virtual environments, mobile devices, etc.) for argumentative CSCL systems have not been thoroughly investigated yet. The central goal of this workshop is to bring together two types of researchers, (a) those with an educational/psychological background who are interested in approaches to support the acquisition of argumentation skills and empirical studies, and (b) those with a more technology-oriented perspective who are interested in groupware systems for argumentation and the novel opportunities that come with "Social Software", emerging web technologies, and other modern programming principles and technologies. These two groups will have the opportunity to meet and discuss the technological implications of recent empirical findings on argumentation and to discuss which aspects of novel technologies are worth further empirical investigation from the viewpoint of argumentation.

Workshop Format

The format of this full-day workshop is characterized through a short series of statements by the participants (what is their background and what do they hope to learn from the workshop?), followed by two rounds of discussion in small sub-groups and plenum collections of the sub-group results. The workshop ends with a planning for a joint eBook on "Educational Technologies for Teaching Argumentation Skills" that has been accepted by Bentham Science. The chapters of this eBook are not fixed yet, and we expect the workshop attendees (or a subset thereof) to volunteer to write chapters based on the workshop. In that sense, the publication is both a planned outcome of the workshop and a means to extend the workshop beyond the scope of the conference.

Intended schedule – morning session:

- Welcome and brief statements of interest by participants
- Small-group (5-6 persons) discussions on "empirical implications for argumentation technology design" – what are the important design aspects of successful argumentation technology? Each small group will contain participants with a more technology-oriented research focus as well as participants with a more educational perspective.

Intended schedule – afternoon session:

- Presentation and discussion of group results (part 1)
- Participants may demonstrate their argumentation systems (running on their computers) to the larger group. This is planned as a "poster session" style session, with 5-6 systems being shown and the audience walking around
- Small-group (5-6 persons) discussions on "technological affordances worth investigation" – what are the research avenues opened by new technological trends and design options?
- Presentation and discussion of group results (part 2)
- Discussion of chapters for the planned eBook

Special Procedures

Participants are asked to send informal position papers (1-2 pages) to the workshop organizers before the workshop, briefly stating their own experience with CSCL systems for argumentation and their motivation for attending the workshop.

Agile Learning and Collaboration—Improvisational Uses of Group Scribbles and Other CSCL Tools

Organizers
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Yannis Dimitriadis, University of Valladolid, School of Telecommunications Engineering, Valladolid, Spain,
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Abstract: Teachers in many countries now have access to wirelessly connected devices, but need ways to use that infrastructure to enable rich collaborative learning. Group Scribbles provides a dynamic and flexible medium that is easy to learn and enables transformative participatory learning experiences. A familiar Post-It note metaphor allows most teachers and students to learn Group Scribbles quickly and to use it to enable simple brainstorming activities without much preparation. This workshop brings together users and researchers from around the world to demonstrate Group Scribbles and other collaborative learning tools, discuss challenges of assessment and improvisational instruction, and develop design principles for producing activities that enable agile learning and collaboration in real classrooms. Through engaging brainstorming and design sessions, the workshop itself will operate as an agile classroom as participants use Group Scribbles to receive, generate, edit and transmit their own script to determine the flow and aims of the workshop.

Workshop Format and Activities

This full-day workshop will bring together users and researchers from around the world to demonstrate Group Scribbles and other collaborative learning tools brought by participants, discuss challenges of assessment and improvisational instruction, and develop design principles for producing activities that enable agile learning and collaboration in real classrooms. The workshop will begin with a background talk on the agile classroom, followed by a demonstration of Group Scribbles. Group Scribbles will be the medium via which participants receive, generate, and edit information throughout the day in their brainstorming and design sessions. We will use Group Scribbles to present a candidate agenda for the remainder of the session. Participants will be invited to use the tool to edit this agenda— renaming topics, changing their order, suggesting new topics, voting on topics, etc. Thus, the workshop itself will operate as an agile classroom wherein the participants get to edit their own script.

The candidate agenda will include:

1. Brief reports (5-10 minutes) from existing experienced users on how they are using Group Scribbles
2. Discussion of other tools and techniques used by participants
3. Investigation of the challenges of real-time diagnostic assessment
4. Real-time assessment design challenge (small groups)
5. Discussion of improvisational instruction in a CSCL environment
6. Improvisational instruction challenge (one brave volunteer leads the "class" in a learning activity)
7. Refinement of design principles for Group Scribbles-based learning activities

Invited Participants

This workshop is intended for designers of collaborative tools and pedagogies as well as the instructors who use them. Roughly 10-20 participants would be ideal. We invite research partners who have direct experience using Group Scribbles in classroom settings, and also hope to attract new researchers to the Group Scribbles user community and share experiences with developers and users of comparable tools.

Invited participants will include, but are not limited to, the following:

- Chee-Kit Looi, Foo-Keong Ng, and Wenli Chen, National Institute of Education, Singapore
- S. Raj Chaudhury and students, Auburn University, United States
- Deborah Tatar and students, Virginia Tech University, United States
- Mike Sharples, Sarah Sharples and students, University of Nottingham, United Kingdom
- Chiu-Pin Lin and students, National Hsinchu University of Education, Taiwan
- Bill Penuel and Angela Debarger, SRI International, United States

POST-DOC & EARLY CAREER WORKSHOP

Post-Doc & Early–Career Workshop

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Summary

The *Post-Doc & Early-Career Workshop* is intended to provide an opportunity for researchers early in their careers working in the Learning Sciences to discuss their own research, to discuss post-doc and early-career challenges with peers and senior mentors and to initiate international networks related to their research topics. Topics addressed include funding opportunities, including the kinds of funding Post-Docs and Early Career Researchers can apply for; how to develop a research agenda and/or career path, including publishing, where and how much; how to mentor and supervise graduate students; new research methods; possibilities for building international research networks; international mobility/going abroad including how, how long, where. The Workshop will also have a specific focus on the specificities of the CSCL community and on the dilemma with which this community is confronted (interdisciplinarity, gaps between different methodological approaches). Participants are post-doc and early career researchers (starting with those just finalizing their doctoral thesis to those having 5 years of experience after receiving the doctorate). In addition to researchers interested in experimental research, researchers interested in scientific issues linked to implementation and practice (scalability, sustainability, etc.) will participate. The following 27 applicants have been accepted to participate in the workshop.

Table 1: Post-Doc & Early-Career Workshop participants, affiliations, research topics, and brief abstracts.

Participant and Affiliation	Research Topic and Abstract
Carmela Aprea University of Mannheim Lehrstuhl für Wirtschaftspädagogik 68131 Mannheim Germany caprea@bwl.uni-mannheim.de	**Reasoning Processes in Economics: Basic Ideas and Possibilities for Integrating CSCL** In a world full of changes and complexities, economic reasoning (ER) plays a crucial role not only in vocational and professional training but also in citizenship and social science education in general. In my presentation, I would like to pick up this issue by exploring (1) what the component processes of ER might be, (2) what factors might influence their quality, and (3) how CSCL might be used to foster the development of ER skills.
Kira Baker-Doyle Pennsylvania State University, Berks 718 Carpenter Lane Philadelphia, PA 19119 USA kjb33@psu.edu	**Teachers' Social Networks and Networking Practices** Dr. Baker-Doyle's research centers on the social networks of teachers in professional development contexts, both online and in-person. She employs a mixed-method approach to her research, integrating quantitative social network analysis with qualitative case study data.
Murat Cakir Drexel University 3141 Chestnut Street Philadelphia, PA 19104	**How Online Small Groups Co-Construct Mathematical Artifacts to do Collaborative Problem Solving** My research focuses on the organization of *interactional practices* through which small groups of students *coordinate* their actions

Participant and Affiliation	Research Topic and Abstract
USA murat.perit.cakir@drexel.edu	across *multiple interaction spaces* of an online environment called Virtual Math Teams as they collaboratively investigate open-ended math problems. Based on ethnomethodological analyses of online interactions I argue that small groups develop joint mathematical understanding in this virtual environment by *co-constructing* a shared *indexical ground*, which is constituted by the sequential production of mathematical artifacts in graphical, narrative and symbolic forms that *reflexively* specify each other.
Britte Haugan Cheng SRI International 333 Ravenswood Avenue Menlo Park, CA 94025 USA britte.cheng@sri.com	**Documenting How Technical, Social and Material Resources are Leveraged by Learners Within and Across Events** My current research addresses the challenge of documenting the complex of learning processes, products, and settings in the context of global, distributed, technology-enabled activities in which learners engage. The theme of my work is to understand how technical, social and material resources are leveraged by learners within and across events and settings.
Bram De Wever Ghent University Department of Educational Studies H. Dunantlaan 2 9000 Ghent Belgium Bram.DeWever@UGent.be	**Instructional Approaches to Optimise CSCL** My research focuses on the educational and didactical challenges when implementing technology in learning situations, more in particular on the impact of structuring approaches on social knowledge construction in asynchronous discussion groups in higher education. I want to broaden both the instructional approaches (i.e. other forms of structuring, scripting, or regulating in CSCL) as the technologies used (e.g. wiki environments).
Ning Ding Groningen Institute for Educational Research Groningen University The Netherlands n.ding@rug.nl	**Exploring the Gender Difference in Students' Knowledge Elaboration Process in Synchronous CSCL** Previous research has indicated that synchronous CSCL runs the risk of enlarging the gender gap in physics learning. Due to the gendered communication style and representation ways, the synchronicity of online collaboration may impede females' knowledge elaboration, especially in mixed-gender collaboration. My current research concerns whether the asynchronous CSCL can offset the gender problem in CSCL.
Ulises Xolocotzin Eligio University of Nottingham Jubilee Campus B3 Exchange Building NG8 1BB United Kingdom lpxux@nottingham.ac.uk	**Emotions and Context Perception in Computer Supported Collaborative Learning** I am investigating emotion experience and emotion understanding during co-located collaboration around computers. My research combines self reports and statistic with detailed video analysis. The broad aim is to explore collaborators' understandings of their own and others' emotions in relation to contextual factors like interface and task design and to social factors like collaboration quality.
Bernhard Ertl Universität der Bundeswehr München Werner-Heisenberg-Weg 39 85577 Neubiberg Germany mail@ertl.org	**Facilitating Knowledge Work in Media Contexts** Dr. Bernhard Ertl's research focuses on the facilitation of knowledge work in media contexts and relates to individual and organizational measures for the acquisition, the construction, the representation, the communication and the application of knowledge. It includes perspectives on the learning individual, (e-) collaborative knowledge construction, knowledge management and on gender issues.
Nobuko Fujita OISE/University of Toronto 420-105 Isabella Street Toronto, ON, M4Y 1N9 Canada nfujita@oise.utoronto.ca	**Group Processes Supporting the Development of Progressive Discourse in Online Graduate Courses** My research explores the development of progressive discourse for knowledge building in online course contexts. Future research plans to extend the suggestive findings with more quantitative analyses that

Participant and Affiliation	Research Topic and Abstract
	(1) draw a more complete picture of the complex social and semantic relationships that occur between individuals online and (2) make the in-depth analysis of the group discourse more applicable to practice.
Christine Greenhow University of Minnesota 1503Goodrich Avenue St. Paul, MN USA Visiting Fellow (2009-2010) Internet & Society Project Yale University greenhow@umn.edu	**How Emerging Networked Technologies Shape Complex Social Relationships** In my paper, I introduce the social and technical features that characterize social networking systems and outline results from emerging research that explains the social and intellectual practices in which youth naturally engage within such systems and how these relate to the competencies increasingly valued in formal education.
Frode Guribye Department of information Science and Media Studies University of Bergen Norway frode.guribye@uib.no	**Interaction Analysis of the Use of Digital Presentation Tools in Higher Education** My research plan involves participating in a project that will study the use of digital presentation tools (such as PowerPoint and Keynote) in higher education. The project has recently received funding, and the first phase will be carried out the next two years. A key aspect of this project will be to use Interaction Analysis to analyze university lectures that we will record on video.
Robert Jorczak University of Minnesota 4031 Zenith Avenue S Minneapolis, MN 55410 USA jorc0001@umn.edu	**Task Guidance and Online Learning** Robert Jorczak is investigating ways to design asynchronous online text discussion to improve student critical thinking. Of particular interest are instructional techniques that promote the processes of information divergence and convergence in discussion.
Manu Kapur National Institute of Education Learning Sciences Lab Singapore manu.kapur@nie.edu.sg	**Productive Failure** My research leverages the notion of productive failure in CSCL groups to demonstrate a hidden efficacy in engaging students in solving complex, ill-structured problems without the provision of external support structures or scaffolds even though such collaborative problem solving seemingly leads to failure initially. Empirical evidence for productive failure was established in a series of classroom-based, experimental studies (Kapur, 2008; Kapur & Kinzer, 2009). I am now working on expanding the evidence base for as well as unpacking the interactional mechanisms and processes that explain productive failure.
Swapna Kumar Boston University School of Education Two Silber Way Boston, MA 02215 USA swapnac@bu.edu	**Teaching and Collaborative Learning with Web 2.0** Research interests: The potential of asynchronous online communication (discussion forums, blogs, wikis) to foster reflection and collaborative learning and build learning communities; Student learning with emerging technologies (e.g. podcasting, SecondLife); Online course design; Web 2.0 use by students and faculty in higher education, and ethical issues that arise from the use of new technologies in learning environments.
Oskar Lindwall University of Gothenburg Department of Education Box 300, SE-405 30 Göteborg Sweden oskar.lindwall@ped.gu.se	**Building an Infrastructure for Video Documentation and Analysis in the Learning Sciences** In the learning sciences, the use of video recorded interaction has recently been established as a "standard way" of doing research. However, the ethical, theoretical and methodological discussions are often lagging behind the technological development. There is therefore a need to develop infrastructures that are able to guide scholars at all stages of the research process. A project at the University of Gothenburg aims at building such an infrastructure.

Participant and Affiliation	Research Topic and Abstract
Lei Liu University of Pennsylvania Graduate School of Education 3400 Market Street Philadelphia, PA, 19104 USA leil@gse.upenn.edu	**Learning about Complex Systems in CSCL Environments** My work involves examining how students learn about complex systems in CSCL environments and constructing professional development for science teachers to develop and implement technology-rich curriculum units that embed cognitively-rich pedagogy (e.g., problem-based learning) and cutting-edge science applications (e.g., Nanotechnology).
Foo Keong Ng National Institute of Education Singapore 679040 lefouque@gmail.com	**Development of Mathematical Identities of Teacher Trainees** Viewing education as 'learning to be', this multiple case-study looks at the development of mathematical identities ("how mathematical a person is") of a few trainee teachers. By an analysis of life stories of participants, I try to understand the life-experiences a person has that can have an impact on mathematical identity and how this identity can evolve. What can help or impede trainee teachers in their mathematical identity development?
Vanessa Peters Ontario Institute for Studies in Education University of Toronto Ontario Canada vpeters@oise.utoronto.ca	**Co-Designing Technology Scripts to Promote Collaborative Knowledge Construction and Inquiry in Secondary School Science** This research investigated the Knowledge Community and Inquiry (KCI) model that blends collaborative knowledge construction with scripted inquiry activities. The study used a co-design approach to create an engaging curriculum for 114 grade-ten biology students. Findings suggest the new curriculum model fostered collaborative knowledge construction as well as individual student learning.
Vanessa Svihla The University of Texas at Austin 937 East 50th Austin, TX 78751 USA vsvihla@hotmail.com	**Learning to Design/Designing to Learn** I focus on two strands of research: Designs for 21st century synchronous learning and assessment in the context of high school biology, and how students learn to design in the context of university biomedical engineering. In both, innovation and deep disciplinary content are key aspects, and I investigate learning through rich and robust methods, triangulating multilevel modeling, social network analysis and qualitative research.
Christopher Teplovs OISE/UT 420-105 IsabellaSt. Toronto, Ontario M4Y 1N9 Canada christopher.teplovs@gmail.com	**New Visualization Tools for Knowledge Creation** My current work investigates the use of techniques from information visualization and automated content analysis to make sense of large collections of CSCL data. Plans for future work include: (1) the refinement of the visualization and analytical tools for the study of socio-semantic networks and (2) the infusion of these tools into the classroom (be it physical or virtual) through adoption by teachers and students.
Keisha Varma University of Minnesota College of Education and Human Development Minneapolis, MN USA Keisha@umn.edu	**Investigating K-8 Students' Mental Models of Complex Systems in Classroom Contexts** I am interested in students' understanding of complex science concepts and how technology can facilitate science learning. My research focuses on using multiple methodologies to measure students' representations of complex scientific systems as I analyze the relationship between students' interactions with scientific visualizations and their learning outcomes.
Sashank Varma University of Minnesota Educational Psychology 165 EdSciB 56 East River Road	**How Symbol Systems Support the Acquisition of Abstract Mathematical Concepts** I study the complex forms of cognition of greatest interest to education. Earlier in my career, I worked on sentence comprehension, discourse comprehension, and problem solving. My current research

Participant and Affiliation	Research Topic and Abstract
Minneapolis, MN 55455 USA sashank@umn.edu	focuses on how children and adults master the symbols systems that define abstract mathematical concepts, such as the negative integers. I pursue this through behavioral experiments and computational modeling.
Ravi Vatrapu Center for Applied ICT (CAICT) Copenhagen Business School Howitzvej 60, 2.floor Frederiksberg, DK-2000 Denmark vatrapu@hawaii.edu	**A Comparative Informatics Research Approach to CSCL** Ravi Vatrapu's research interests are in comparative informatics of learning technologies. Vatrapu's research focuses on how people (1) *interact with the technology* (apperceive, perceive, and appropriate socio-technical affordances) and (2) *interact with each other* (technological intersubjectivity). Findings document systemic cultural variation in both aspects of interaction listed above with several implications for theory and practice.
Alyssa Wise Simon Fraser University Faculty of Education - 15th Floor 250-13450 102 Avenue, Surrey, BC V3T OA3 Canada alyssa_wise@sfu.ca	**Reference Points, Roles & Representations: Three Perspectives on Supporting Collaborative Learning through Technology** Dr. Wise's research focuses on the design and use of online conversational environments for learning. She is particularly interested in the interactions between individual actions and a groups' collective development of ideas. Her work investigates different ways to support productive interactions including providing reference points objects, allocating students different conversational roles and promoting productive "listening" behaviors.
Jennifer Yeo National Institute of Education Nanyang Technological University Singapore Jennifer.yeo@nie.edu.sg	**Orchestrating Talk for Science Meaning Making in a Problem-based Learning Classroom Mediated by Computer-supported Collaborative Learning** My research area focuses on the design of learning environments to support science meaning making mediated by computer-supported collaborative learning. The aim is to understand students' science meaning making process and the mediating factors that support knowledge advancement. Learning environments studied include Problem-based Learning for high school science and Knowledge Building for environmental science at the elementary levels.
Timothy Zimmerman Rutgers University Graduate School of Education – Learning and Teaching 10 Seminary Place New Brunswick, NJ 08901 USA timothy.zimmerman@gse.rutgers.edu	**Mobile Technology for Ocean Science Learning in Schools and on Field Trips** My research falls within three broad domains of the learning sciences: 1) effective design and use of classroom and mobile computer-mediated tools and learning environments, 2) the nature of, and pedagogical strategies for, learning across formal and informal (museums, out-of-school, etc.) learning contexts, and 3) students' abilities to apply science concepts to environmental decision-making; all situated around the learning of ocean science concepts.
Katerina Zourou University of Luxembourg Campus Walferdange Route de Diekirch, L-7201 Luxembourg katerina.zourou@uni.lu	**Computer Mediation in Foreign Language Education & Tele-Collaborative Practices Online** Katerina Zourou is a post-doctoral researcher in the field of computer supported collaborative language learning at the University of Luxembourg, DICA-lab research. Her research topics involve effects of computer mediation in foreign language education as well as telecollaborative practices online.

DOCTORAL CONSORTIUM WORKSHOP

CSCL 2009 Doctoral Consortium Workshop

Co-Chairs
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Introduction

The CSCL Doctoral Consortium Workshop aims to foster a community of CSCL students by providing a forum for students to meet and network with peers and leading members of the CSCL community. The invited students are sharing their current dissertation work-in-progress with peers and faculty members to discuss methodological and theoretical issues of central importance to the CSCL field; collect feedback on their research directions; and develop a supportive, collaborative research community of CSCL scholars.

Student Participants

This year, ten students have been selected to present their dissertation ideas at the Doctoral Consortium Workshop. Their research topics span a range of issues in the CSCL field. The ten students participating in this year's workshop include:

Holger Dick (University of Colorado, Boulder, USA) is researching on online communities using Wikis. The dissertation aims to study the development and use of a new generation of wikis that pro-actively foster and support the creation of communities among its participants.

Deborah A. Fields (University of California at Los Angeles, USA) is researching on identities in social spaces. The dissertation aims to document, describe and analyze the ways in which youth attempt to use identities or practices from different parts of their lives as resources to become certain types of people in other parts of their lives, and to explore the relationship between their identities as constructed in practice and their own and others' understanding of who they are.

Andreas Gegenfurtner (University of Turku, Finland) is researching on ontogenetic and sociogenetic perspectives on learning, technology, and medical image diagnosis. The dissertation explores the development of visual diagnostic expertise and the transformation of clinical practice, which both are associated with the increasing use of digital imaging technologies in medicine, and aims to answer the research question: "What are the interdependencies between learning, technology, and medical imaging diagnosis?"

Katherine D. Knight (University of Wisconsin-Madison, USA) is researching on methods for analyzing teacher facilitation of collaborative learning in the science classroom. The dissertation aims to study how can teacher professional development and educative curriculum materials that emphasize Knowledge-Building Communities and conceptual change reduce task-oriented discussions and behaviors of teachers and students engaged in CSCL in support of science inquiry, and increase concept-oriented discussions.

Richard Medina (University of Hawai'i at Manoa, USA) is researching on the intersubjective construction of representational practice in multimodal collaborative environments. The dissertation aims to answer the research questions "How are figure/ground relationships produced in multimodal online environments?", "What are the features of "invented" representations and how do they emerge from inscriptions in joint online meaning making", and "What is the range of meanings enabled by the juxtaposition of available media and specific problem or knowledge domains?"

Hedieh Najafi (OISE, University of Toronto, Canada) is researching on learning in science classrooms within a Knowledge Community approach. The dissertation aims to study how to use technology scaffolds and well-established collaborative inquiry models to promote cooperative knowledge construction and deep understanding of climate change concepts, and support teachers in adopting the new approach while responding to science content standards.

Michele P. Notari (PHBern, School of Teacher Education, University of Applied Sciences, Switzerland) is researching on computer mediated communication. The dissertation aims to understand the impact of computer supported written communication in a collaborative project based learning scenario.

Suparna Sinha (Rutgers University, USA) is researching on the impact of technological affordances on cognitive engagement in computer supported collaborative learning environments. The dissertation aims to understand the impact of affordances of technology on the process of fostering cognitive engagement within computer supported collaborative learning environments.

Joshua Underwood (LKL, Institute of Education, UK) is researching on the design of technology enhanced learning contexts. The dissertation aims to explore how technology can be used to scaffold a learner's interactions with the resources available to her, not aiming to structure the learner's interactions within a designed bounded system but with the world as a whole.

Johnny Yuen (University of Hong Kong) is researching on collaborative knowledge building. The dissertation aims to explore the relationships between students' personal epistemology and their participation and behavior in collaborative knowledge building activities.

Acknowledgments

We would like to acknowledge Sharon Derry, Susan Yoon, and all our faculty mentors for their assistance in preparing and conducting this year's workshop.

Supporting and Fostering Online Communities with Wikis

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Abstract: Wikis are commonly used to support (learning) communities in their work processes. However, they offer insufficient support for community processes that go beyond writing and reading content. I propose the development and use of a new generation of wikis that pro-actively foster and support the creation of communities among its participants. This could lead to larger involvement and thus better results in learning and working.

General Notes

I am working at the Center for LifeLong Learning and Design and pursuing a joint PhD at the Department of Computer Science and the Institute of Cognitive Science at the University of Colorado at Boulder. My advisor is Dr. Gerhard Fischer and the anticipated title of my dissertation is "Supporting and Fostering Online Communities with Wikis".

Over the last two years, I have been working on two NSF grants titled "Increasing Participation and Sustaining a Research Community in Creativity and IT" (a NSF-CISE-IIS) and "A New Generation Wiki for Supporting a Research Community in Creativity and IT" (also NSF-CISE-IIS). As part of these grants, I have been researching online communities, especially those that make use of so-called Wiki-technologies. Wikis provide users with a collaborative web-environment through which they can easily modify existing content and add new pages via a web browser. Wikis aim to be low-threshold systems, that is, systems that do not require specialized knowledge or tools. However, this approach can often also lead to a "low ceiling", that is, the resulting system does not provide enough functionality to be useful for the participants needs and interests.

"New generation wikis" offer functionality beyond classic wiki systems while still retaining their low use threshold. Such a "low threshold, high ceiling" approach requires "smarter" systems. While the original inventor of wikis, Ward Cunningham, described wikis as "the simplest online database that could possibly work" (Cunningham, 2002), I think that we need to find to provide simple ways to work with complex information.

Examples of such simple-to-use complex systems are commonly found in so-called web 2.0 systems. For example, in services like youtube, flickr, or Netflix, complex algorithms and huge databases provide easy to find and easy to use recommendation functions. These recommendations help the participants to explore and learn about (to them) new ideas and concepts. They allow participants to explore the long-tail (Anderson, 2006) and learn in ways and in detail they could never have before.

Proposed Research

At the current state of my dissertation work, I have created a theoretical framework of how wikis can and should support communities, based on a survey of the literature and our own research at the Center for LifeLong Learning. The underlying hypothesis is that an increased feeling of community and the exploration of information in the long-tail lead to increased interest and to increased motivation to work in and on an online environment.

I have started to work on implementations that provide such additional information to the participants without requiring extra learning efforts from them and started to collect usage data and administering questionnaires with wiki-participants. The preliminary data seem promising but require a more structured analysis.

The next steps will be to complete the implementation phase and to use the developments in large-scale environments (particularly the wiki for the NSF program CreativeIT and several classes, in different departments, at CU Boulder).

I feel that I could improve upon my framework of collecting, evaluating and analyzing the collected data. As online communities are supposed to develop over extended periods of time, experimental setups are rarely suited for an evaluation. The most promising approach seems to distribute two different versions of the wiki – one without the new developments—thus providing a control group to compare the results with. However, while this might be possible for the use in university classes it is much harder to accomplish in more open and voluntary environments like the CreativeIT wiki. Therefore, I am particularly hoping to get feedback on my ideas and get new inspirations on how to evaluate my research at the Doctoral Consortium.

Connection to CSCL

Wikis have been used and researched in the field of CSCL, e.g. in (Cress & Kimmerle, 2008), and have been used in learning environments. For example, as part of our own work and research at the Center for LifeLong

Learning and Design, we use wikis to augment classroom activities and to support the community of students in the classes. While the formerly used wiki-systems have allowed students to upload their homework and receive posted information from teachers, they fell short in the goal to build a community between the students.

The hypothesis behind my research is that an increased support of the community – via technical efforts like awareness tools and better facilities for representation of student's interests, as well as via social efforts like requiring participants to interact more – will result in more activity in the class and wiki and subsequently in better learning results. Our preliminary results from questionnaires as well as analysis of usage data support this hypothesis but more research is needed to find reliably significant results.

A special focus of my research is the support of learning activities beyond those in the classroom by fostering independent and self-guided learning. Wikis are well suited for this as they provide individuals the opportunity to explore their own work and that of others individually, while at the same time interacting with participates that share their interests.

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Understanding Identities Across Social Spaces

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Abstract: In recent years there has been a renewed recognition that youth bring resources for learning from different places in their lives or different "social worlds." One resource available to youth when they are learning is their identity—how they act, talk, believe, and otherwise get recognized as certain kinds of people. From this viewpoint identities from different social worlds can be seen as potential resources for changing participation in a particular area – as explanations for how something new or innovative can be created. Yet we know very little about how people actually draw on an identity in one situation to impact an identity in another situation. In this study I examine how individuals draw on their identities in different spaces of their lives as resources for learning, observing two youth as they navigate across spaces in their lives over the course of a year.

Introduction and Research Goals

In recent years there has been a renewed recognition that youth bring resources for learning from different places in their lives or what some refer to as different "social worlds" (Holland, Lachiotte, Skinner & Cain, 1998). One way to describe these resources is in terms of identity - how youth act, talk, believe, and otherwise are recognized by others as certain kinds of people in a given social world (Gee, 2001). Since learning a discipline such as science or math involves not only knowing facts but knowing how to reason and communicate in a disciplinarily appropriate way, the practices and ways of talking that one already knows and that are tied to one's identity can be seen as a resource to participate in and understand a new or unfamiliar context (Lave & Wenger, 1991). Recent research into culturally relevant pedagogy suggests that one approach to help students succeed is to make school resonate more with whom they are in order to help them develop a new academic identity that preserves whom they are outside of school while allowing them to add new academic practices to their repertoire (Enyedy & Mukhopadhyay, 2008). Still, we know very little about how people actually draw on whom they are in one situation to impact who they are in another situation. Studying people across multiple spaces of their lives longitudinally and doing this by analyzing both how they act in practice and how they talk about themselves in narratives is necessary to understand this kind of learning. In this study I examine how youth draw on their identities in different spaces of their lives as resources for learning, focusing especially on how certain computer supported collaborative learning environments might facilitate youth making connections between identities.

The main premise of my research is that a person's different identities, formed by ways of acting, talking and valuing in different social worlds of one's life, are potential resources for changing who one is in relationship to a group of people. Lave and Wenger (1991) claim that learning means becoming a different person with respect to a local community of people such as a good student, a tailor or a dancer; in other words learning involves building a local social identity. Expansive learning (Engeström, 1987) involves more than simply imitating the practices of a group of people, it entails integrating practices and identities to create a new identity in relationship to others when there is a contradiction or conflict between identities. In order to study this, we have to be able to document individuals' identities and everyday practices in different parts of their lives to demonstrate how they draw on those to change who they are in a given setting.

My goals for this study are two-fold: (1) to document, describe and analyze the ways in which youth attempt to use identities or practices from different parts of their lives as resources to become certain types of people in other parts of their lives and (2) to explore the relationship between their identities as constructed in practice and their own and others' understanding of who they are (self-perception or narratives). In both of these goals I hope to contribute to our understanding of how change can occur in a person's life and how social interaction affects such learning in the everyday moments of individuals' lives, with a special focus on computer supported collaborative environments.

Theoretical Background

From the perspective of cultural historical activity theory (CHAT), one way that individuals and communities can learn something new when faced with a contradiction is to draw on ways of acting, talking, and valuing from different areas of one's life. This brings a horizontal developmental perspective alongside a more traditional vertical perspective. While vertical development is generally discussed in psychology as moving to higher stages, horizontal development involves using something from one part of one's life to impact another area of one's life (Engeström, 1987; Gutièrrez, 2008). One can view different social areas of engagement as potential resources for changing participation, for instance as explanations for how the new can be created from a situated perspective; however, what does this look like, for instance when practices from home or with peers are used to solve a dilemma in school?

Related to CHAT, another important theoretical lens that I draw on is that of situated learning and identity (Gee, 2001; Lave & Wenger, 1991; Wenger, 1998). From this viewpoint, when one learns it is not just learning a body of abstract knowledge but learning how to be and act and believe within a particular group (or community) of people (Lave & Wenger, 1991). Though the concept of identity is attractive because it helps to explain individuals in social context, there is a tension between using the word identity to mean 'who one is in a given situation' and 'who one understands oneself to be.' Many researchers say in the same breath that identity refers to "one's understanding of herself" and "the ways in which one participates in the world" (Brickhouse & Potter, 2001, p. 966) or that aspects of identities may shift as the scene of interaction changes while individuals may still hold some idea of themselves, i.e., a "core identity" (Gee, 2004). In general, the idea of identity as being 'a certain kind of person' within a particular social space refers to identity acted out in practice (often described as "identities-in-practice"). But the term identity also has a history of describing who one imagines or conceives oneself to be (or who others imagine someone is). Erickson (1980) popularized this concept of identity, using the term to refer to understanding and committing to a certain notion of oneself. In particular Sfard and Prusak (2005) suggest that identities be understood as narratives, "as collections of stories about persons or ... as those narratives about individuals that are reifying, endorsable, and significant" (p. 16). Both concepts have their advantages in understanding people. But how do identities in narratives and practices relate, interact, and affect a person? In this study I reconcile and capture the strengths of both a theory of identity created and situated in practice (identities-in-practice) and a sense of self-understanding in identity (what I call identities-in-narratives).

Methods of Data Generation and Analysis

I have recently begun a comprehensive study of two youth, aged 11 years old (6th grade students) from an elementary school whose population roughly represents the ethnic and socioeconomic diversity of the state of California. Data collection will continue from October 2008 to August 2009. In this research I am building on methods and analysis from a five-month pilot study with two other 6th grade students conducted in Spring 2008 that included their participation in an after school technology design club. In order to capture both practice- and narrative-based aspects of the youths' identities across many places in their lives, I draw on three kinds of data collection under the general umbrella of connective ethnography (Leander, 2008): participant observation, interviews, and artifact collection. I am observing two case study youth in many places of their lives (e.g., school, home, sports, music, peers), approximately 8 hours a week in addition to one interview a month with the case study youth and two interviews each with important adults across their lives (e.g. parents, teachers, coaches). I am reducing data (field notes, video logs, transcripts) and conducting preliminary analyses each month through thematic coding and narrative analysis. This allows me to continually refine my focus during the study. Below I describe some preliminary findings from one case study of the pilot study.

Through observing one case study participant, Matthew, a 6th grade African-American boy, over the course of 6 months, I documented a positive change in his identities associated with his engagement in computer technology across spaces. There were two main issues with Matthew's engagement with digital technology at the beginning of the study. First, his parents and teachers did not support his identification with it because he used it at times they saw as inappropriate (i.e. when he should have been doing homework). Second, he saw himself as a consumer rather than a designer of technology – he read anime rather than wrote it, he played games rather than creating them, he browsed programming projects (in Scratch) online rather than designing them. Further complicating his academic participation in school was his peers' ostracizing of him because they saw him as demeaning, probably because comments intended to be sarcastically humorous such as "You're stupid" were not interpreted that way by his classmates. One affect of this was that Matthew was generally unwelcome in group projects, and his peers ignored his ideas and efforts to contribute. Over the course of the study, Matthew's identities with his parents, teachers, peers, and digital technology shifted in ways that cannot be understood apart from each other.

Two of the primary influences in Matthew's changing identities were his participation in an after school technology design club and a class project where the students developed geometric art projects in Scratch, a visual media programming environment. In the after school club, members used Scratch for the first two months, with no expectations other than that the only use of the computers in club was related to Scratch. Matthew's primary participation included browsing anime Scratch projects online through the social networking site scratch.mit.edu and browsing the Internet for good illustrations of anime characters for his own projects. Thus his social participation with Scratch and the related online site was primarily as a consumer rather than a designer, though he did work on a couple of projects that remained unfinished. After the Scratch club ended, his class used Scratch in math to develop geometric art projects. During the three weeks of this project he was able to draw on practices developed in the after school club to make suggestions that helped his partners accomplish their goals for their project and resulted in a positive change in his classmates' actions toward him – they began talking about Matthew as a leader and expert. They also uploaded their project, one of the highest acclaimed in the class, to the Scratch website, signaling a shift in Matthew's participation with the social networking site. Here we see a direct interaction between Matthew's identity with Scratch and his identity with peers that led to new identities as a leader amongst his peers and as a programmer/designer.

These new identities – as a programmer and a leader among his peers – also impacted Matthew's relationship with his parents and teachers. During his final parent-teacher conference, he highlighted the geometric art project as his best achievement in math, aligning his participation with Scratch (and thus the computer and Internet at large) with his parents' and teachers' norms for positive academic behavior. In fact, he even cited becoming "the fifth best Scratch programmer in the school" as one of the academic highlights of his school year.

This detailed study of youths' identities across different social worlds of their lives documents and analyzes the everyday ways in which youth draw on their identities as resources for learning to become someone new in a particular social world. As the case of Matthew illustrates, identities in different parts of youth's lives can serve as resources for learning and positioning themselves as valued participants in academic contexts. The larger study promises to build a more robust and expansive theory of identity that contributes to educational research generally and to computer supported collaborative learning in particular. Further, my findings will illuminate practices that can be used by educators and designers to help youth connect their learning in computer supported environments with other areas of their lives, strengthening the learning gains possible through specific interventions.

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Ontogenetic and sociogenetic perspectives on learning, technology, and medical image diagnosis

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Abstract: This two-page document aims to provide an overview of my dissertation's work-in-progress at the Centre for Learning Research, University of Turku. My advisors are Professor Erno Lehtinen, University of Turku, and Professor Roger Säljö, University of Gothenburg.

Introduction

Diagnostic decision-making in medicine involves meaning-making of what can be seen on medical images, such as X-ray photographs or microscopic slides. In clinical practice, seeing and interpreting the features of medical images are not exclusively cognitive processes located within an individual. Rather seeing is "a socially situated activity accomplished through the deployment of a range of historically constituted discursive practices" (Goodwin, 1994, p. 606). These discursive practices form what Goodwin describes as professional vision (1994, 1997), and they are negotiated around a common object of disciplined perception (cf. Lindwall & Lymer, 2008), in this dissertation: pictorial representations of the human body produced by medical imaging technologies.

The increasing use of digital imaging technologies creates a number of challenges to professional and educational practice in medicine. First, it is evident that different representational tools have different affordances asking for different diagnostic skills. For example, while an X-ray photograph is an analogical, two-dimensional, and static image, a positron emission tomography (PET) picture is digital, three-dimensional, and dynamically changeable by the physician. Digital imaging techniques thus not only require seeing and interpreting what is seen but also modifying (zooming, rotating) the image to see each relevant aspect; they require a certain level of skillful human-computer interaction. Second, the increasing use of digital technology also transforms the clinical institutional context. It forms new discursive practices that are needed to diagnose digitally-processed images. It also creates new expert cultures within new communities of practice that develop around new medical computer tools. Third, the use of digital imaging techniques implies changes in how to address the development of visual diagnostic expertise (Crowley et al., 2003; Morita et al., 2008) in medical education and training. More specifically, it is still unclear how to promote the transfer of diagnostic skills from one technology to another and how to help reducing errors in the diagnostic process that result from personal histories. Also, there is still an interest to explore how computers are used in and for professional training, and how technology in medical education mediates human interactions and learning.

How are technology and expertise intertwined in medicine? Medical expertise is frequently defined as superior performance in routine tasks (cf. Mylopoulos & Regehr, 2007), or as Anderson (1980, p. 292) has put it almost thirty years ago: "One becomes an expert by making routine what to the novice requires creative problem-solving ability". For example, diagnosing a mammogram is part of the normal work routine for an expert radiologist, who may well read more than 3,000 mammograms a year (Nodine et al., 1999). Definitions of expertise that are based on the premise of routine tasks assume work conditions to be stable. Approaches based on this assumption, however, are only partly helpful in telling us how the expertise of experts develops in such dynamically changing domains like medicine, for two reasons. First, the constant development of medical imaging techniques challenges routine tasks--or renders them totally obsolete--and creates new fields of expertise. Second, the multidisciplinarity in medicine affords the horizontal expansion of expertise: specialists in one field (i.e., X-ray reading) can become specialists in a second, neighboring field (i.e., reading of PET pictures). In both of these instances, transitions of expertise can be facilitated through professional training. To summarize, the use of technology relates to challenges for the development of professional vision and diagnostic expertise; it shapes the clinical institutional context; and it impacts medical education and training.

Aimed at addressing these issues, the purpose of this dissertation is to explore the development of visual expertise and the transformation of diagnostic practice which both are associated with the increasing use of digital imaging technologies in medicine. Through a combination of different methodological approaches, it strives to answer the research question: "What are the interdependencies between learning, technology, and medical imaging diagnosis?" The dissertation project includes five studies; each is described in turn.

Description of the Studies

Study 1: Integrative Literature Review

The first study aims to provide a broad overview of existing research on the expertise in diagnosing medical images. It does this by summarizing and critiquing concepts and measurements used in the past to tell the reader about current evidence. Using three criteria for inclusion, we searched for appropriate articles that (a) reported empirical investigations, (b) analyzed experts who diagnosed a medical image, and (c) were reported in peer-reviewed journals between January 1992 and December 2008. The purpose of Study 1 is also to identify gaps in the literature that can be filled with this dissertation, specifically concerning representational technologies and their relation to medical image interpretation, diagnostic errors, and visual perception.

Study 2: Interview Study

The second study aims to explore the sociogenesis of tools, activities, and institutional practices on medical image diagnosis. We will interview six experts in the fields of radiology, pathology, and nuclear medicine with at least twenty years of work experience. Our interest is to understand how technology has evolved during the last decades and how changing technological artifacts, division of labor, and policy issues have transformed the institutional context for diagnosing medical images. What have been the most influential technological developments in medicine over the past decades? How have they changed the requirements for expertise and the context experts are working in? With this study, we aim to answer a call for more research on how institutional contexts shape learning through technology (cf. Arnseth & Ludvigsen, 2006).

Study 3: Processing Study

The third study aims to trace transitions of expertise associated with cognitive and perceptual processes in medical image diagnosis. We address three training cases that highlight how the visual expertise of medical experts develops. First, we follow radiologists who are experts in reading X-ray pictures and are now trained to become experts in reading digital radiography images. The transition of expertise in this first case is from one technique to another within one speciality. Second, we follow expert radiologists who get trained in reading PET pictures. The transition of expertise in the second case is not only between imaging technologies, but also between domains: from radiology to nuclear medicine. Third, we follow clinical experts (cardiologists), who are not yet experts in any imaging technology, to become experts in reading PET pictures. The purpose is to trace transitions of expertise associated with the three training cases described above. What are the initial differences in the diagnostic process before training? What are the training effects? To what extent do professionals adapt to the new diagnostic situation, and to what extent do they keep in their old routines? Finally, to what extent are diagnostic skills transferable across imaging techniques? To answer these questions, data will be collected at three points in time. (1) Before training, the study participants will diagnose a routine task in their domain. We will contrast their diagnostic performance with the new, non-routine task: a digital radiography picture for the radiologists and a PET picture for the radiologists and cardiologists. We will also contrast their performance with those of radiography experts and PET experts respectively. (2) After training, the training participants will diagnose the formerly non-routine task again. (3) Six weeks after training, the training participants will diagnose the same images as immediately following training. At each time, we will collect eye tracking data and think-aloud protocols. Both eye movements (Kundel et al., 2008) and verbal reports (Morita et al., 2008) have been used as data material in past studies on medical image diagnosis, though independently. In contrast, we aim to synthesize eye tracking and think-alouds in our research, to trace the interdependence of vision and cognition as evidence for the development and expansion of expertise in medical image diagnosis.

Study 4: Observation Study

The fourth study aims to closely examine the discursive practices associated with diagnosing medical images. It is closely linked to Study 3 and works within the same PET training context. It adopts a situative perspective in that it considers the training environment as an activity system in which learners interact with each other and with material, informational, and conceptual resources in their environment (cf. Greeno, 2006). The purpose is to investigate the possible interrelations associated with medical image diagnosis. To what extent are vision and cognition interdependent? How is this interdependence affected by student-teacher interaction and human-technology interaction? How do the spontaneous teaching practices employed by the medical teacher, along with power relations and personal histories, contribute to shaping this set of interrelations? To answer those research questions, we will follow sequences of 1 teacher and 2 training participants who diagnose collaboratively 1 PET image in an authentic group work session. A special focus will be given to trace how teachers give feedback, since feedback is proposed to stimulate the development of expert perceptual diagnosis (Ericsson, 2004). We will collect eye movement data of the participants and video recordings of how they interact with each other and with the technology. The eye-tracking data will be analyzed with a focus on visual attention and scan patterns (Duchowski, 2007). The video recordings will be transcribed and analyzed according to discourse analytical methods with a focus on conversation analysis (Schegloff, 2007) and interaction analysis (Jordan & Henderson, 1995). The synthesis of individual cognitive data and interactional patterns with the environment intends to combine the strengths of cognitive science and interactional studies with the goal of better understanding how learning and instruction to diagnose medical images occurs in this PET training setting. Results of this study can explore the use of computers for professional practice and training, and how technology mediates human interactions and learning.

Study 5: Emerging Issues Study

The last study does not yet have an explicit aim. Its purpose however is very clear. It should address issues that are emerging during the dissertation process, such as conflicting or surprising findings in the previous studies worth to be investigated in more depth.

Concluding Remarks

This document has briefly outlined my proposed dissertation work. It includes five studies designed to explore relations between learning, technology, and medical image diagnosis. The dissertation aims to understand the development of expertise (ontogenetic perspective) and the transformation of clinical practices (sociogenetic perspective) which are both associated with the increasing use of shared external artifacts, i.e. digital imaging technologies in medicine.

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Methods for Analyzing Teacher Facilitation of Collaborative Learning in the Science Classroom

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Introduction

Understanding how instructional contexts assist or constrain collaboration within computer environments is important to CSCL research (Stahl, 2002). A key aspect of the classroom context is the facilitation that a teacher provides as groups of students collaborate as they work on complex problems, an important feature of design-based approaches. Collaborative discussions in the classroom are not always productive without teacher support. For example, Tabak and Resier (1997) suggested that during small group collaboration, teachers can help students attend to features within the computer environment, help students reflect on local construction of understanding, and assist students in adopting scientific ways of thinking about and explaining phenomenon. They also found that interleaving whole class discussions between small group sessions provided opportunities to extend local constructions into generalizable global understandings of important concepts and theories. Because some groups may have richer experiences than others, whole class discussions also provide opportunities for groups to publicly share their findings and insights.

But teachers, especially middle school science teachers with little or no inquiry teaching experience, face a myriad of challenges when enacting design-based curriculum. One challenge in particular relates to the strategies teachers choose as they facilitate whole class and small group discussions during synchronous collaboration using a computer tool. Because many teachers are themselves the product of traditional didactic science education, a tendency exists for teachers to teach in a manner similar to the way they were taught, emphasizing the acquisition of factual information through closed and authoritative question-and-answer sessions (Bartholomew, Osborne & Ratcliff, 2004). Research into teacher facilitation strategies has identified little distinction between strategies used during whole class and small group discussions (Dawes, 2004, Web, Nemer & Ing, 2006), or focus on procedural knowledge rather than on helping students draw inferences or synthesize ideas (Webb, et al., 2006). Student responses tend also to mirror teacher strategies when working collaboratively with their peers (Tharp & Gallimore, 1998). This didactic behavior is not conducive to fostering collaboration. One way to address this issue is to provide professional development opportunities for teachers.

This project proposes to use the synergistic relationship between research on knowledge-building communities and conceptual change to design teacher professional development. Iterative idea improvement is the centerpiece of Scardamalia & Bereiter's (2006) Knowledge-Building Communities. Seen as a shift away from students as learners or inquirers, knowledge building as an educational approach recognizes understanding as emergent, regards idea improvement as a result of community rather than individual achievement, values knowledge *of* over knowledge *about*, and stresses that classroom discourse emphasize collaborative problem solving rather than argumentation. If we accept symmetric knowledge advancement as expertise distributed within and between communities (Scardamalia, 2002), the participant structures created as students cycle between small group collaboration and whole class discussions form different communities. Thus, a second collaborative community exists during whole class discussion that provides a space for metadiscourse that uses the first-order discourse from collaborative groups as its subject (Scardamalia, 2002). Eliciting initial student ideas and constantly monitoring the status of student ideas is the focus of conceptual change. When teaching for conceptual change, Hewson, Beeth, & Thorley (1998) propose that (i) student ideas must become an explicit part of classroom discourse, (ii) students must be metacognitive as they think *with* and *about* their ideas, (iii) the status of competing ideas must be constantly monitored and (iv) when two or more ideas or explanations are considered for the same phenomenon, decisions must be made through justification on explicitly agreed upon standards of evidence. By explicitly incorporating the tenets of each into professional development, teachers can better understand how attending to students and their evolving ideas may lead to fundamental changes in their facilitation of classroom discussions, thus improving peer collaboration at both levels of community.

My proposed research compares teacher facilitation strategies during whole class and small group discussions before and after professional development experiences that emphasize student idea improvement within a knowledge building community and conceptual change. The intervention will address a common misconception of teachers new to inquiry teaching that students are responsible for 'discovering' or learning science from activity without teacher support, emphasize the importance of creating and maintaining a classroom culture that engenders collaboration, and focus teacher attention and practice on student ideas. While the major emphasis will be on fostering a knowledge building community at both the group and whole class level, conceptual change literature will be used to provide teachers with a mechanism or framework for moving their communities forward. Combining elements from the conceptual change model with knowledge building pedagogy emphasizes both the role of the teacher and students to explicitly identify initial ideas and to continuously monitor the status of ideas in an effort to advance the state of knowledge in the classroom community. Therefore, the research questions driving this proposal are:

- What are the characteristics of teacher discourse strategies that foster student collaboration?
- How does a teacher facilitate the formation of a knowledge building community in a class at both the group and whole class level?
- How can teacher professional development activities foster the formation of a knowledge building community?

Context of Study

The CoMPASS Work & Energy curriculum consists of two components: design-based investigations and a hypertext software system called CoMPASS. The overarching design challenge is to design and build a machine composed of at least three different simple machines to help a person with a wrist injury easily lift heavy items. Mini-design challenges throughout the curriculum ask students to design and test six different simple machines. The second component of the unit, CoMPASS (Puntambekar, Stylianou, & Goldstein, 2003), is a hypertext system that integrates text and a concept map on a single page to produce a conceptual unit. Students navigate through CoMPASS either by selecting science concepts from the text or from the accompanying concept map. (See Figure 1.)

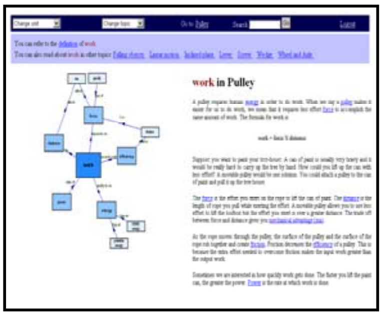

Figure 1. CoMPASS Screen Shot

After each selection, a new concept map is constructed that places the chosen concept in the center of the map. Concept relationships are indicated both by color and proximity to the central concept. Students conduct research on CoMPASS in groups after brainstorming questions about science concepts that they think will help them design a machine to successfully complete challenges. Groups also return to CoMPASS to connect the formal abstract scientific concepts and terminology to their concrete hands-on experiences.

Student Collaboration

The CoMPASS inquiry cycle is composed of cycles of small group collaboration and whole class discussion and can be envisioned as being composed of three distinct phases. During the *introductory phase* students learn about the design challenge, brainstorm their initial ideas about the challenge and the science related to the challenge, become familiar with the equipment they will use, and make predictions. During the *research phase*, students collaboratively formulate questions that can be researched using the CoMPASS hypertext system that will help them successfully complete the challenge, conduct the research in small groups sharing a single computer, and then share the results of their research as part of a whole class discussion. During the *design challenge phase* students collaborate in groups to conduct the physical challenge, repeat the same or similar challenges using computer simulations, and then share group findings within a whole class discussion.

CoMPASS Inquiry Cycle

WC	Introducing the simple machine
WC	Brainstorming prior knowledge
GP	Familiarization with lab supplies
GP	Individual and group predictions
GP	Generating group questions
WC	Sharing group questions
GP	Research using CoMPASS
WC	Sharing CoMPASS research
GP	Conducting design challenge
WC	Sharing challenge results
GP	Analysis questions
WC	Reviewing analysis questions

Teacher Facilitation

Previous research (Knight, 2008) of teacher-student interactions during design-based CSCL revealed that: (i) teacher strategies were similar during whole class and small group work; (ii) teacher strategies rarely related group work to the overarching design challenge and instead were primarily task oriented and discrete; (iii) teachers experienced difficulty providing appropriate scaffolding by providing too much independence followed by episodes of “science telling” when student frustration and time became an issue; and (iv) with few exceptions, teachers rarely used student initial or evolving ideas as the basis for co-constructing knowledge and instead seemed to lead students to pre-determined outcomes based upon a pre-determined agenda. Teacher professional development that includes teaching explicitly for conceptual change and iterative idea improvement is proposed to address these findings.

Methodology

Data will consist of classroom video of enactments of the CoMPASS Work & Energy curriculum by four middle school teachers during the 2008-2009 and the 2009-2010 implementations. Pre-and post-test student data will also be considered for both years.

Data analysis will consist of quantitative analysis of student outcomes from testing and qualitative analysis of teacher strategies used during both whole class and small group collaborations. Results of the two implementations will be compared to determine the effect of the intervening professional development opportunities. An earlier study of teacher dialogic strategies (Knight, 2008) revealed a dilemma between extracting coding categories and maintaining fidelity to the richness and the context of the video being analyzed. The recent collection of articles appearing in *Video Research in the Learning Sciences* (Goldman, Pea, Barron, & Derry, 2007) will provide guidance for selecting additional methods for analyzing, interpreting, and reporting the results of my research that will be of the most value to the CSCL community.

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Intersubjective Meaning Making as Representational Practice in Multimodal Collaborative Environments

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Abstract. This research summary discusses the need to explore research methods and techniques for understanding intersubjective development of representational practices. Key issues include generalization of qualitative findings that leverage productive tensions between descriptive and scalar accounts of computer supported collaborative learning and interaction.

Research Topic and Summary

Analytic accounts of meaning making practice in technology mediated interaction are motivated by questions concerning how the work of collaboration gets done and how these processes are reflexively aligned to the social and material contexts in which they are enacted (Koschmann, Stahl, & Zemel, 2007; Koschmann et al., 2005; Stahl, 2007). In a somewhat related vein, others have drawn attention to representational practice as an important line of inquiry for understanding the role of inscriptions in learning interactions (Enyedy, 2005; Kozma & Russell, 2005; Roth, 2003). Further, many CSCL tools enable the use of inscriptional devices that extend the range of affordances beyond linguistic modalities. This gives cause for deeper inquiry into the nature of multimodal interaction as a elemental property of technology mediated learning. The research program outlined in this paper discusses a proposal for conducting investigations into the intersubjective emergence of joint representational practice.

Representational practices as meaning making practices (e.g., how inscriptions are interpreted as joint representations) are implicitly negotiated through cycles of innovation, adoption and revision (Danish & Enyedy, 2006; Dwyer & Suthers, 2006; Shipman & McCall, 1994; Stahl, 2006). Although much of this research has been undertaken in face-to-face contexts, our data as well as others’ (Overdijk & van Diggelen, 2008) shows that this happens in online settings as well as face-to-face, and can even take place over extended periods of asynchronous interactions. The practices and roles so negotiated have implications for learning, as they can affect the extent to and ways in which learners collaborate and influence each other’s views. A central motivation for my doctoral research is to uncover features of representational practice that are observable from records of small group interaction within CSCL environments.

Analyses of representational practice that we have conducted to date indicate that important aspects of shared understandings are derived from and embedded in the inscriptional work of the participants. In these prior efforts I have applied descriptive methods influenced by Conversation Analysis to document single episodes of interaction. This approach entails doing microanalysis on relatively short segments of interaction in which the participants are demonstrably oriented to inscriptional artifacts. Each analysis is punctuated with a narrative of the segment along with references to relevant transcripts, software log files, and screen shots of the interaction environment. Revealing the workings of each immediate situation in this manner has provided qualitative insights on how participants both order their interaction in the moment; produce inscriptional artifacts in support of this work, and/or appropriate available prior inscriptional media to meet issues of subsequent interactions.

Complementary to the above approach is the identification of relationships between episodes. The persistent nature of inscriptions (e.g., drawings, diagrams, and figures) challenges the notion of immediacy in situative analyses. Inscriptions survive in more expansive temporal frames however are available in situ for multiple subsequent interpretations by potentially multiple participants. The extension of relevance to more distant interaction histories is facilitated through persistent artifacts. This macro view has indicated that joint interaction is sensitive to prior interaction histories over time and that many of these relationships (between episodic frames) are constituted by the formation, transformation, and elaboration of representational practice. In summary these analyses have revealed patterns of interaction that are identifiable in the immediate context but have contingencies to a more distant interaction history (Medina & Suthers, 2008; Medina, Suthers, & Vatrapu, 2009a).

Descriptive accounts are useful for providing baseline understandings of how group interaction in small groups develops over time in what are essentially trajectories of meaning making. One formative question is how to apply these descriptive methods and their products in order to articulate broader impacts on design of interactive learning spaces. This is a question of generalization. Are representational practices idiosyncratic? How does a detailed account, however richly described, help us understand collaborative learning in shared media? What can we extract from such accounts to systematically understand action potentials offered by configurations of material and social matrices? What follows are a series of proposed research questions that are addressable partly through methods I have applied in previous analyses. More important to the construction of my program of research however, is determining a strategy for articulating generalized patterns and features relevant to the CSCL body of research. Having worked in both qualitative and quantitative research paradigms I see a productive tension between rich descriptive analysis and larger scale quantitative hypotheses testing. This kind of research approach, I believe, is important to explore. Ultimately it is our research practices that most effectively influence and simultaneously draw from teaching and learning practices.

Preliminary Research Questions and Brief Discussion

Q1. What are the features of "invented" representations and how do they emerge from inscriptions in joint online meaning making?

The inscriptions becoming representations notion has been slightly developed in (Medina, Suthers, & Vatrapu, 2009b). This is a question of transformation and points at two complementary dimensions of technology-mediated interaction. On one hand, the movement of inscriptions to representations for a group of participants is an indication of shared understanding. Certain inscriptions emerge and are interpreted as representations for the group. On the other hand, in appropriating the medium for inscriptional work, it is the mediating tool itself that undergoes changes. That is, emergent representations so developed become mediating artifacts in their own right. They may function as mediating interfaces for further action. This second point is a clear indication of the role of the learning environment in supporting the development of representational practice.

Q2. How are figure/ground relationships produced in multimodal online environments?

This is a question that implicates the extent at which a media representation is sufficiently malleable to support a wider range of expression and enablement of multiple joint interpretations of representations.

Q3. What is the range of meanings enabled by the juxtaposition of available media and a specific problem or knowledge domain?

This question addresses applied research. Are there important alignments to consider when designing learning environments with respect to the kinds of representational practices that emerge from distinct knowledge domains such as music, the arts, mathematics, science, or language learning? What are the implications for technology affordances in these domains with respect to normative practices and techniques?

Closing Remarks

I am currently a Doctoral candidate in the Department of Information and Computer Sciences at the University of Hawaii. I expect to present a dissertation proposal at the beginning of the fall semester, 2009. This consortium is timely I hope to gain feedback from my peers and mentors on formalizing my research proposal with regard to hybrid methodologies. In addition I look forward to learning others' approaches and strategies for addressing the most relevant questions for the CSCL research community and the stakeholders they, we, serve.

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Transforming Learning in Science Classrooms: A Hybrid Knowledge Community Approach

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Introduction and Problem Statement

The complex problems of today's "knowledge society" (Drucker, 1986) require students to dynamically apply their existing knowledge to situations they have never experienced before (Brown & Campione, 1990; Hargreaves, 2003). Schools are expected to educate students who value life-long learning and can understand and creatively resolve multi-faceted, open-ended and often unforeseen or completely novel problems that are characteristic of an innovation-driven society take initiative in creatively addressing knowledge problems (Scardamalia, 2002; Scardamalia & Bereiter, 2003). Classroom instruction, particularly in science, will ideally help students gain lifelong learning skills, respond to personally relevant problems, think critically and succeed in evidence-based arguments. Yet typical classroom instruction in science focuses on rote learning of content, performance of problem solving and coverage of standards and expectations (Slotta & Linn, 2008).

Several traditions in the learning sciences, e.g. Fostering Communities of Learners (Ann Brown and Colleagues) and Knowledge Building (Carl Bereiter and Marlene Scardamalia), propose pedagogical approaches that transform teaching and learning by emphasizing a knowledge community within the classroom, where students and teachers work together to negotiate their learning objectives and aggregate their knowledge base. However, numerous challenges have made a knowledge community approach difficult to scale in classrooms or even to replicate in research (Slotta & Peters, 2008). These include lack of concrete guidelines for designing collaborative activities that capitalized on community knowledge; ambiguous roles for teachers and students; and the challenge of bridging small-group collaborative activities with the wider community knowledge base. One way to alleviate these challenges is to introducing structured collaborative inquiry to complement the collective knowledge construction process (e.g. Slotta & Peters, 2008; Hmelo-Silver & Barrows, 2008). My doctoral research investigates a new model of collaborative inquiry and knowledge community (Slotta, 2007) that enables students and teachers to engage with technology-supported collaborative activities that deeply connect with a broader knowledge base. This model allows for pedagogical designs that help students and teachers develop a rich understanding of the science and scientific connections related to a topic—in this case, global climate change.

Research Objectives and Research Questions

The objectives of this research are twofold: Using technology scaffolds and well-established collaborative inquiry models to promote cooperative knowledge construction and deep understanding of climate change concepts; and supporting teachers in adopting the new approach while responding to science content standards.

This study is situated in two grade ten science classrooms in a Canadian high school where a research team, including technologists, the classroom teacher, and myself co-designed and implemented a new climate change curriculum unit. The main question that guides this study is: "How does a knowledge community perspective enhance collaborative inquiry in a science classroom?" The following sub-questions elaborate on the main question: (1) What connections can we build between well-established models of collaborative inquiry and a wider classroom knowledge base? (2) How can technology enable new connections between community knowledge and individual learners during collaborative activities? And (3) How can we measure students' contributions to the knowledge community, and the impact on their understanding of science topics?

Theoretical Framework

Theoretical perspectives of learning and pedagogical practices that overcome "inert knowledge" and "passive learning" are advocated by educational researchers, but difficult to implement within k-12 education (Brown & Campione, 1996; Bereiter & Scardamalia, 2003). Complex problems of the "knowledge-society" that require graduates to apply their knowledge to new situations also necessitates these approaches. Learning scientist researchers advocate the notion of "Knowledge Community" to support learning (Brown, 1990; Scardamalia & Bereiter, 1994). Conceptualizations of Knowledge Communities focus on collaborative advancement of shared knowledge and expertise. Of special interest to my research are the conceptual frameworks of Fostering Communities of Learners (FCL; Brown & Campione, 1996) and Knowledge Building Communities (KBC; Scardamalia & Berieter, 2003) that have been intensively researched in the context of k-12 education. To some extent, these two perspectives share a common focus: increasing students' agency, collaborative knowledge construction and scaffolding knowledge construction. However, they differ in some guiding principles: FCL follows a cycle of "research, share and perform" while KBC pursues idea improvement with real emphasis on any final project or product of students' knowledge construction efforts (Bielaczyc & Collins, 1999;

Scardamalia & Bereiter, 2006). I synthesize these two perspectives along three dimensions: (1) Distribution of cognitive responsibility, (2) Community knowledge characteristics and (3) Knowledge construction processes.

Study Design

This study proposes an innovative design for fostering a knowledge community around climate change and is framed as design-based research (Brown, 1992; Collins, Joseph & Bielaczyc, 2004). Design-based research brings researchers and classroom teachers together and allows the researcher to recursively examine the interactions among multiple design elements and gradually improve the design.

Setting and Participants: Students in this school are actively engaged in school-wide and community initiatives related to environmental issues and as a result are highly aware of climate change issues. Climate change is an inspirational contemporary curricular topic with ample science connection (Brown, 1997) that can motivate students to build a knowledge community around it. Participants of this research are a science teacher and 42 grade 10 students in two classes. The co-design team met for three months to design an eight-week climate change curriculum which has now been implemented. The co-design meetings continued after the unit began, in order to address unforeseen situations and modify planned activities. Their design implemented the Knowledge Community and Inquiry model.

Curriculum Materials and Activities: The co-designed climate change curriculum took an innovative approach by distributing knowledge construction activities throughout the unit rather than making a knowledge base and then using it for structured collaborative inquiry. The curriculum started with an initial knowledge construction activity where students identified useful resources about climate change then annotated, evaluated and finally added them under relevant category in a designated wiki page. To promote a sense of knowledge community a discussion about "philosophy of science" was conducted. Students also identified important issues related to climate change in Canada that were then used to guide small group collaborations. Collaborative inquiry activities included small-group, cross-group, and whole class collaborations. Students formed regional groups to investigate the effects of climate change within each region with regards to three Science dimensions (Greenhouse effect, Weather and wind patterns and Ocean circulation). Within the regional groups, students Specialized in primary industries, secondary industries, environmental activism and tourism industries. For the final project, specialists from all regions join new advisory groups to synthesize the community's knowledge and provide national guidelines for reducing the adverse affects of global climate change in Canada. All groups were formed across two sessions of the class so that students collaborated with some peers asynchronously.

Data Sources and Analytical Approaches

Marshall and Rossman (2006) recommend that qualitative researchers combine multiple data sources to compensate the limitations of one source with the strength of another. I followed this guideline by collecting data from different sources using different methods: *Pre- post interviews of teachers* allowed collection of rich qualitative data and deeper insight into participants' points of the view (Marshall & Rossman,2006). *Content of student created wiki pages* were analyzed based the characteristics of common knowledge delineated in my theoretical framework. This provided a measure of the quality of students' collaborative knowledge construction. Logs of students' wiki contributions provided complementary data to the wiki content by capturing the contribution of individual students in terms of quality and quantity. *Interviews with student*s, conducted at the end of the curriculum unit, provided additional insight into how the wiki and other technologies impacted students' collaborative activities. *Pre-post unit questionnaire* helped to capture students' epistemological perspective, as well a their knowledge of climate change science. This open-ended questionnaire allows me to probe students' perception of their meta-cognition and their depth of understanding on climate change science. Finally, *Classroom observation field notes* were collected throughout the unit, to help establish patterns of practice (Lincoln & Guba, 1985).

Data analysis in qualitative research is an inductive process of interpreting collected data corpus and starts as the first piece of data is collected (Stake, 1995; Creswell, 2003). The researcher can further adjust and refine data collection methods based on the initial interpretations (Merriam, 1998; Marshall & Rossman, 1999) to address the research questions. I have followed this recommendation and have continuously reviewed the body of data that I have collected up to now. Having said that, I need to go beyond categorizing data into emergent themes (Merriam, 1998). Thus I will use the aforementioned three dimensions of knowledge communities as an analytical lens to identify: Changes in students' metacognitve knowledge and their perceptions of distributed cognitive responsibility; quality of collaboratively constructed knowledge; the connections made among individual knowledge, small group constructed knowledge and collective knowledge constructed in two classes; and effectiveness of the technology environment.

Contribution to CSCL

Sustaining a knowledge community perspective in k-12 classrooms has proved to be challenging for teachers to orchestrate (e.g. Sherin, Mendez, & Louis, 2004). In this research I will investigate a new model (Slotta &

Peters, 2008) that blends the pedagogical perspectives of knowledge community with computer supported collaborative inquiry. I will examine how this model can facilitate deep understanding of science topics and pervasive collective knowledge construction in science classrooms. Thus, findings of this research will further inform theoretical conceptions that characterize knowledge communities in k-12 education.

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The impact of computer supported written communication in a collaborative project based learning scenario

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Absract: In my thesis we analyze the Computer Supported Written Communication (CSWC) behaviour of sixty pre-service teachers engaged in a collaborative long term project based learning unit. With a process-oriented user-centred design approach [Bannon, 1991] we compare the interchanged Text messages of project groups (twenty groups of three people) with their personal perception. A preliminary study has been implemented to capture the capability to formulate and write down thoughts on a keyboard-based computer interface. Two surveys are proposed, one at the beginning and one at the end of the project. The content of the interchanged written communication is analyzed by qualitative content analysis following the communicative model of collaborative learning [Cecez-Kecmanovic, 2000]. The preliminary research showed that the range of typing efficiency was more homogenous than the content quality. The results of the surveys and the content analysis and the project outcome is presented.

Introduction and theoretical framework

Collaboration implies an interaction between the collaborating persons and "collaborative learning" is not always effective (Dillenbourg 1999). Its effects depend on the richness and intensity of interactions engaged in by group members while collaborating (Dillenbourg et al. 1996). Based on common theoretical backgrounds, collaborative learning takes place when learners get involved in knowledgeproductive interactions such as argumentation, explanation, and mutual regulation (Dillenbourg 2008). The "knowledge-productive interactions" take place whenever the involved persons communicate to each other. Some communicative actions lead to explanation, some to argumentation, and some to mutual regulation of the collaborating group. The most open definition of communicative action given is that it is action in which the actors seek to reach an understanding about the action situation and their plans of action in order to coordinate their actions by way of agreement. … (It is) a type of interaction that is coordinated through speech acts and does not coincide with them. (Habermas 1981, p. 101).

Communicative action is based on an analysis of the social use of language oriented to reaching common understanding when action is coordinated by the validity claims offered in speech acts (Habermas 1981). Project-based, collaborative learning experience has been shown to promote long-term retention of material, foster higher-order cognitive activities such as analysis, synthesis and evaluation, and introduce the student to an experience that closely models the environment he or she will encounter in the workforce (Ellis, 2007).

Computer Mediated Written Communication is nowadays important for all types of collaborative project-based learning (PBL) and work. Studies have indicated that Computer mediated communication (CMC) systems can support both cognitive and social aspects of online learning (Parker, 1999). Many research projects have focused on the CMC system as a tool that facilitates collaboration, interaction, and learning (Harasim, 1990). Most of the research focuses on the effectiveness of asynchronous CMC networks, as these are the major means of instructional technology used in distance education (Lewis, Snow, Farris, & Levin, 1999).

Research methods

Preliminary investigation

The usability of human-computer interfaces expresses the relationship between end users and computer applications [Chou et al., 2006] and is therefore one key factor for the quality of the outcome in e-collaboration and e-communication. Successful communication requires the capability to formulate thoughts concisely in adequate length and depth. The combination of event tracking and qualitative content analysis enhances the quality of the preliminary decision quasi-experimental settings by combining the assessment namely typing efficiency, with the outcome, namely text quality.

Our method proposes to capture several writing parameters while participants are all answering the same question asked in a mail. Apart from the typing speed, the number of different corrections and the pauses within the writing are recorded as well. The texts are collected and their content is analyzed: number of different threads, their (un-)ambiguousness and complexity. Integrating typing efficiency (TE) and content quality (CQ) leads to a co-factor for our further research.

Questionnaire

The participants answer questions concerning their communication behaviour before and after the project. All questions use a four-point Likert scale format. The questionnaire used after the project work also contains questions related to the two dimensions of the Communicative Model of Collaborative Learning (CMCL – see following section).

Qualitative content analysis

Coding scheme: Our coding scheme is based on the Communicative Model of Collaborative Learning proposed by Cecez-Kecmanovic (2000). This model integrates the two dimensions of communicative analysis into a comprehensive model.
Knowledge domains of linguistic acts:

- addressing (relating to) the subject matter and the topic of discussion
- addressing norms and rules governing the process of collaborative learning
- addressing personal experiences, desires and feelings

Lerner's orientation: Student's linguistic acts cannot be fully explained by their reference to a type of knowledge only. To understand the performative meaning, what is being done by saying, we have to pay attention to student's orientation in the collaborative learning process. The following distinction of dominant student orientation in the learning process is proposed: a. Learning, b. Achieving an end c. Self-presentation.

The CMCL model proposes a matrix built on these two dimensions as good indicators for the collaborative 'acts' within the communication during the project.

Results of the preliminary investigation

In our preliminary research we computed typing efficiency (TE) and content quality (CQ) as indicators for 60 participants. TE ranged from 0.46 to 1.03 and CQ from -4 to 15. There was no correlation between TE and CQ (Spearman's Rank Correlation (SRC): -.085), but a high correlation between CQ and content length (number of characters in the text body) (SRC .286 $p<0.05$), and CQ and total time without pauses >= 3sec (SRC .353 $p<0.01$).

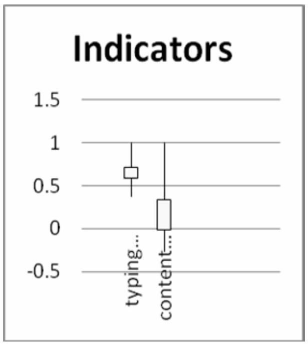

Figure 1. Box Plot of typing efficiency and content quality indicators. The range of the latter is wider. Maximums normalized as value 1.

In the prospective teachers' class under investigation, the range of typing efficiency was more homogenous than the content quality indicator. The boxes represent 75% of the participants around the median. As far as typing efficiency is concerned, they are closer to the best than in respect to content quality.

The investigation is still taking place; we will present further result concerning our questionnaires and the content analysis at the conference.

Discussion

The preliminary investigation showed us that TE is comparable within the target group. The wider range of CQ leads us to the assumption that some participants formulate more unambiguous or/and complex threads than others. In our research about communication in a project-based setting it is interesting to analyze whether these participants use the CMWC-channel in a different way than their colleagues who had a better performance in the preliminary investigation. The correlation between CQ and content length may be founded by the motivation to participate to the study. We are interested in the comparison of the personal perception of communication behaviour with the content analysis of the interchanged texts. I will further analyze the communication patterns and look if there is a regression of the pattern on the outcome of the project work.

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Impact of technological affordances on Cognitive Engagement in computer supported collaborative learning environments

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Abstract: Comprehending complex systems is difficult as some interactions between parts are invisible and as result, that makes them difficult to perceive (Feltovich et al., 2001). In order to strengthen their conceptual understanding of such complex phenomena, students need to have a great amount of interest, and an enhanced psychological investment in learning i.e. persistence in the face of failure or challenge, all of which are indicators of cognitive engagement. By providing ease of use, aesthetic appeal, choice, feedback, challenge, variety and interactivity, technology has great potential to engage learners. This also provides students with opportunities where they can think critically, make judgments and solve complex open ended problems. This study uses three different kinds of technologies to engage students as they study about one such complex system -the aquatic ecosystem. The purpose of this dissertation is to observe how affordances of these technologies encourage the students to remain cognitively engaged.

Introduction

Cognitive engagement is a prerequisite for student learning (Blumenfeld et al., 1991). From a social constructivist approach students who are engaged are more inclined to select tasks that are within their zone of proximal development, initiate activities that display a preference for challenge and display a high level of positive emotions such as interest, enthusiasm and curiosity (Skinner & Belmont, 1993). Students who actively engage with the material are more likely to recall information later and be able to use that information in different contexts (Bruner, 1961). From a social constructivist perspective knowledge is constructed through social interaction and is the result of social processes (Gergen, 1995; Palinscar, 1998). This study will explore the affordances of three different types of technologies: hypermedia, simulations and a representational modeling tool that can sustain students' cognitive engagement as they study about the aquatic ecosystem, within the context of a collaborative learning environment. The hypermedia helps students to develop background knowledge about aquarium ecosystems. Simulations on fish spawn and the nitrification cycle provide a context for students' investigation of the system. It affords opportunities for designing experiments, manipulating variables, making predictions, and discussing conflicts between predictions and results (Hmelo, Holton, & Kolodner, 2000; Wilensky & Reisman, 2006). In addition, it also provides dynamic feedback that learners can use to revise their ideas. Each of the simulations allows learners to explore key features that are relevant to the model. The modeling tool, called the Aquarium Creation Tool (ACT), assists in creating specialized concept maps realized as structure-behavior-function models (Goel et al., 1996).

Conceptual Framework

Sabelli (2006) states that understanding complex systems is critical for becoming a scientifically literate person. However, as many interactions within these complex systems are invisible, students fail to draw the connections between important relations. This study uses three different kinds of technologies to support students' understanding of and engagement with complex systems. These technologies help draw attention to system dynamics that the students can observe how different aspects of the system are related and how they work (Hmelo-Silver et al., 2007) and provide representational tools with which students can negotiate, compare, and repair understanding to achieve conceptual change (Liu, 2008; Roschelle, 1996). In order to strengthen their conceptual understanding of such complex phenomena, students need to make a greater effort in terms of time and dedication to stay focused on the task irrespective of the difficulties that they encounter. The purpose of this study is to observe how certain affordances of these technologies encourage the students to remain cognitively engaged.

Corno and Mandinach (1983) emphasized that cognitive engagement can be understood holistically by considering the students' investment in learning, situational interest in the task and basic cognitive processes, such as a combination of knowledge and reasoning skills. Newman (1992) defines psychological investment in learning as an indicator for cognitive engagement owing to the "active involvement, commitment and concentrated attention in contrast to superficial participation, apathy or lack of interest" (p.72). Situational interest may impact the students' level of effort, persistence for hard work and positive coping in the face of failure. In addition clarity of procedural and conceptual knowledge i.e. comprehension of the steps involved in investigating a phenomena and a conceptual understanding of why it supports execution of the task are characteristics of conceptual engagement, which is a crucial component of cognitive engagement.

Besides attempting to increase conceptual clarity between various structures and their behaviors and functions (Hmelo et al., 2007), working in technology mediated environments also has an impact on the students' motivations to learn and strategies they adopt to engage in self regulated learning. Barab et al. (2007) argued that by allowing the learner to enter a situation where they have a goal, a definite role and perform actions for which they get immediate feedback, is the perfect setting for them to know what to do, when to do it and why it makes sense, all of which are key indicators of conceptual engagement.

The purpose of this study is to develop a conceptual framework for understanding and thinking about cognitive engagement in a computer supported collaborative learning environment. The following research questions will guide this study: (a) How have the different affordances of technology been used to sustain students' cognitive engagement?; (b) How does situational interest (evoked as a result of interacting with a specific feature of the technology) influence task engagement? (c)Which technological tool affords varying degrees of psychological investment in learning and why? (d) How is conceptual engagement established by the use of different technologies? (e) What is the impact of working in collaboration been on sustaining cognitive engagement?

Description of Pilot Study

My pilot study investigated the process by which various affordances of technology can foster or constrain cognitive engagement in a computer supported collaborative learning environment. The participants (twenty middle school students from two schools) collaborated in groups to study about the aquatic ecosystem. Three technologies were used in the classroom. The students used a function-oriented hypermedia as a resource for background knowledge (Liu & Hmelo-Silver, in press). The used a NetLogo simulation to allow them to model macro and micro scale processes in the aquarium (Liu, 2008; Wilensky & Reisman, 2006). The third technology was the Aquarium Construction Kit (ACT), a structure-behavior-function modeling environment. ACT allowed the students to create their own models and the simulations gave them a chance to modify certain variables at the macro level (fish spawn) and the micro level (nitrogen cycle) (Goel et al., 2009).

A case study approach was adopted to closely examine technological affordances that impacted cognitive engagement. Multiple sources of data (two rounds of interviews- including a stimulated recall, field notes, students' models, audio and video data of classroom interactions) were studied from multiple perspectives in an attempt to build a portrait of cognitive engagement in the two classrooms.

Findings

In terms of understanding how different affordances of technology were used to sustain students' cognitive engagement, initial data analysis revealed that the three technologies used in the study helped to facilitate three different aspects of cognitive engagement. This has become a limitation for me to make a comparison on the use of one technology over the other. Measures to study the effects of collaboration were unable to coherently address the issue on its impact on learning and sustenance of engagement within such environments.

Based on classroom observations, and the interviews 33% of the students used the simulations to set goals and plan experiments to test their assumptions such as modifying the number of fish and changing the water button a couple of times to observe the effect. Field notes of classroom observations indicated several instances where the students (when working on the Nitrification simulation) made attempts to relate the visible behaviors within the simulation screen with the accompanying graph showing the rate of change of Ammonia, Nitrite and Nitrates. Data analysis revealed that 60% of the students from school B made use of the information gathered from the simulations in their data modeling using the ACT. 20% of the students' responses from school A implied that they could draw the connections between the structure, behavior and functions, using the simulation technology. A plausible explanation for this phenomenon could be due to the fact that students in school B were assigned class work which had a set of questions that asked them to focus on certain aspects of the aquarium systems. For example, 50% students from school B responded that by having the teacher assign them small tasks such as trying to keep the fish alive for a prolonged period or trying to draw a connection between the graph on water quality and increasing the number of fish, enhanced their understanding of the simulations. These results imply that the simulation technology served the dual purposes of compelling the students to apply greater psychological investment in learning which in turn enhanced their conceptual engagement.

In addition, approximately 90% of the students indicated that features such as the ease of navigation, freedom to choose what they wanted to explore about the physical and chemical components of the aquatic ecosystem and answers to possible questions made their experience of exploring the aquarium hypermedia very enjoyable. While interacting with the hypermedia may evoke situational interest, this can also be regarded as an indicator of psychological investment in learning as it provided them with a sense of control (flexibility of increasing their knowledge by browsing through topics that were of interest to them and not being forced to follow a fixed order of presentation similar to what is found in textbooks), which reinforces their task engagement on learning about the physical and chemical components of the aquarium.

The impact of working in groups during this study using these technologies did not highlight an increased cognitive engagement in the students. This may have to do with the manner by which questions to address its impact was formulated.

Current Status of Study

The methodology to develop a more holistic understanding of affordances of technologies on cognitive engagement needs to be refined. The next steps towards achieving this goal call for developing procedures that will allow me to think of innovative ways to gather and analyze appropriate data that will better address my proposed research questions. At this stage I am preparing to collect data for a second study within the same setting. My attention is focused on reviewing literature that has investigated similar phenomena within a computer supported collaborative learning environment.

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Designing Technology Enhanced Learning Contexts

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Abstract: Through iterative participatory design-based research I aim to explore the application of the Ecology of Resources (EoR) Framework (Luckin, 2008) to the design of technology enhanced contexts that scaffold learning and collaboration. Technology enhanced learning (TEL) contexts engage learners and the ecology of resources available to them as they move through time and space, in coordinated and distributed activity towards learning. Such ecologies may include technology, environmental features, humans and any other resources that can support learning. The challenge is to help the learner become aware of, access, and co-ordinate her interactions with these resources. I will formatively evaluate the EoR through participatory design of TEL contexts that scaffold language learning using mobile technology. Face-to-face and remote collaboration with teachers, native speakers and other learners will be a central part of this technology-enhanced language-learning context.

Background

Learning takes place throughout the full range of contexts in which humans operate and frequently it is the context that determines success or failure of a learning activity. While designers of TEL have long recognized the impact of the contex in which a system is used (Wood, Underwood & Avis, 1999) attention has tended to focus on understanding formal and relatively static settings. More recently personal and mobile technologies have extended TEL opportunities to all contexts in which we live and learn while also enabling change and disruption in the more familiar and traditional contexts of learning (e.g. mobile phones in schools). This situation has led to the exploration of a much wider range of learning contexts and new approaches to understanding these. However, context is still typically understood in terms of the features of a location or range of locations. As digital technology becomes increasingly personal, mobile and ubiquitous it is important to move beyond static and location-based models of context to an understanding of the dynamic learner centred context created by a learner's interactions with the ecology of resources within which she moves.

Designers of TEL systems have employed various approaches to better understand contexts of use. Contextual Design (Beyer & Holtzblatt, 1998) provides insight through workplace observations, interviews and mapping activities. Other approaches employ ethnographers or engage users as proxy ethnographers in detailed observation of activity over protracted periods of time. Participatory approaches bring designers and users together and enable users, with detailed understanding of their own contexts, to co-design contextually appropriate systems. However, as designers of TEL *contexts*; systems that are distributed across technologies, humans and other resources; we need to understand context not only in terms of its impact on the way learners use systems but also in terms of the ways in which technology can exploit context to better support learning. Research in ubiquitous and context-aware computing contributes to such and understanding.

Dey (2001) defines context as the information that characterizes a particular situation with respect to an entity; Dourish (2004) highlights the importance of the surrounding human activity and Chalmers (2004) notes the importance of the history of previous interactions to current context. Similarly, Beale and Lonsdale (2004) describe context as changing relationships that may be shaped by their own history. Drawing on these descriptions and a sociocultural account of learning (Vygotsky, 1986) Luckin (2008) suggests that, for a learner, context is defined through her relationships and interactions with the ecology of human and other resources she encounters as she moves through time and space and that these are themselves situated historically and culturally. From a learner's perspective, context is the current conditions of her situation in a physical and social environment, *as she perceives it*, shaped by her previous experience and expectations. This is similar to Wertsch's (1984) situation definition; situations consist of participants' interpretations of physical space, their own roles and status, the task, and the concrete objects in the space (Park & Moro, 2006). Hence, we arrive at an understanding of context that is dynamic, learner centred and also recognises the importance of the various participants' (e.g. teachers, learners, designers) differing interpretations of that context.

The Ecology of Resources

Luckin (2008) describes a learner's context in terms of inter-related elements (knowledge, environment and resources) and corresponding filters. In other words: What is to be learnt, and the way in which this is recognized, validated and structured as a skill or knowledge in formal and informal ways; The social and physical environments with which the learner interacts and the organisation of these; Resources both human (e.g. peers, teachers, parents) and inanimate (e.g. books, WWW, microscopes and telescopes) and the administration of these. These elements of the EoR are situated within and filtered by the prior cognitive structures which exist both in the learner's subjective consciousness and the objective world, embedded into technologies, organisations and other "persistent structures" (Nardi, 1996) such as norms and legal procedures. For the learner, filters both channel in and filter out aspects of the surrounding world. Hence, the range of possible interactions a learner may have is constrained by what is actually available and by the organisational filters and socio-cultural filters active at this moment in time and space. A third layer of filters acts at the level of the learner; her body and senses shape the way she perceives and interacts with the world around her, as do her emotional and cognitive state (Niedenthal, Barsalou, Winkielman, Krauth-Gruber & Ric, 2005). The utility of identifying these filters is revealed when we turn our attention to learning.

Westerman et al (2007) describe how the young infant's limited visual acuity and motor control filter her sensory experience of the world and suggest the gradual fading of these constraints, as the infant body develops through interaction with the environment, is what results in an orderly and gradual understanding of the complexity of the external environment. Filters at other levels in the EoR may be adjusted to support learning in a similar way, for example a curriculum may structure a learner's exposure to a body of knowledge so as to gradually increase complexity. Similarly access to resources (e.g. dictionaries) may be administered so as to enable a learner to perform tasks (e.g. read a foreign language) above her current level of competence. Hence, in design the EoR draws our attention to the ways in which we might support learning by adjusting the various filters that stand between a learner and the resources, environment and knowledge that surround her. When such adjustments are dynamic, enable performance at a higher level than the learner's unassisted competence but within her Zone of Proximal Development (ZPD) (Vygotsky, 1986), and are faded as her competence increases, they are equivalent to *scaffolding* (Wood, Bruner & Ross, 1976) and can lead to learning. Other kinds of action on EoR filters are also possible and can also enable performance at higher levels and contribute to an improved context for learning; for example the provision of a telescope will enable a learner to see what she could not see previously. However, this kind of action has different consequences and may better be considered a way of distributing cognition or intelligence than scaffolding learning (Pea, 2004).

Scaffolding requires a more able partner that understands the learner. In TEL contexts, human and/or technology may provide scaffolding. Many systems have developed effective methods for modelling learners in order to provide appropriate help (e.g. Jackson, Krajcik, & Soloway, 1998). More recent systems have also modelled metacognitive and affective characteristics of the learner (e.g. Rebolledo, du Boulay, & Luckin, 2005). Less work has been done on systems that scaffold the learner's interactions beyond a bounded software system with the external world. The role of technology in TEL contexts may be to help find, make the learner aware of, connect her to and structure her interactions with the most appropriate resources (human, digital or other). This requires models of the learner's objectives, her current knowledge and context, the knowledge domain, and the filters between the learner and the available resources. Designing such TEL contexts brings together work in context aware computing, learner modelling and scaffolding and requires a deep understanding of the learner and her context. In order to formatively evaluate the utility of the EoR framework as a tool for the design of TEL contexts I plan to apply it to the design of support for adult foreign language learners

Mobile Assisted Language Learning (MALL)

The advent of portable and personal multimedia digital technology has placed what used to be the language lab, self-study and resource centre in the learner's pocket. This, together with near ubiquitous access to the Internet, Web 2.0 technologies supporting personal publishing and peer-to-peer collaboration and the ease with which audio-visual media can now be captured and shared, have created exciting new affordances for language learning. The language learner now has the potential to interact when and where they want with an immense and varied range of appropriate human (e.g. teachers, native speakers, learners) and other resources (e.g. dictionaries, concordancers, and authentic multimedia target language content). The challenge is to filter these interactions so as to create personal TEL contexts that optimally support language acquisition.

Underwood (2002) described how learner and content modelling techniques could be employed to structure interactions with target language content on interactive television in ways that support language acquisition. More recently, Fallahkhair, Pemberton, & Griffiths (2007) demonstrated the use of mobile phones to scaffold language learning from audio-visual content viewed on TV in a distributed system. The next step is to use mobile technology to scaffold language learning from authentic content in the wider world; for example to support 'on the spot' *noticing* and recording of relevant language features in the wild (Kukulska-Hulme & Bull, 2008). Kukulska-Hulme and Shields' (2008) review suggests MALL research has only just begun to explore the opportunities for using authentic multimedia content, supporting learner directed and situated learning and promoting 'collaborative speaking and listening activities that allow learners to co-construct knowledge'. However, a survey (Clough, Jones, McAndrew, & Scanlon, 2007) of experienced users found mobile devices were used to support self-directed informal learning, exploit unforeseen opportunities for situated learning and, in conjunction with Web 2.0 technologies, for collaborative learning.

Initially, I will work with a small number of experienced users of mobile devices who are also independent language learners to explore the use of the EoR framework both as a lense through which to understand the opportunities afforded by mobile technology and as a tool in the participatory design of TEL contexts. This will involve studying learners in context, using the EoR to map their learning contexts and the ways they already use mobile technology to support language learning, working with learners to identify both unexploited opportunities to employ existing technology to better support language learning and requirements and design challenges for new technology to better support language learning. This will lead to iterative design experiments (Brown, 1992) in which I will introduce prototype technology designs to create and evaluate novel TEL contexts. Throughout these studies I will use multiple methods to capture rich data about participants' language learning, use of technology and their contexts over extended periods of time. Methods will include: observation and video recording of selected key events (e.g. classes, self-study), self-report of unforeseen learning events, participant diaries, interviews and focus groups.

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Fostering collaborative knowledge building through advancing students' personal epistemology

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Abstract: This study explores relationship between students' personal epistemology and their participation and behavior in collaborative knowledge building activities. Collaborative knowledge building (KB) (Bereiter & Scardamalia, 1993) is continuous creation and refinement of knowledge artifacts through collaborative intentional efforts. Personal epistemology (PE) (Perry, 1970) is a construct about a person's views on diversity and uncertainty with respect to new learning. The thesis of this study is that to foster sustainable, self-initiated knowledge building among students, personal epistemology and approach to knowledge (Bereiter & Scardamalia, 1998) have to be addressed and advanced simultaneously. It will be explained that the two constructs capture complementary aspects of people's beliefs on nature of knowledge, including knowledge objectification, likelihood of modification on understanding, and structure of justification, which are critical to knowledge building. Survey questionnaire and content analysis of online discourse will be used to investigate student's personal epistemology, and design research to test the thesis.

Knowledge building & objectification of knowledge

Collaborative knowledge building (Bereiter, 2002; Bereiter & Scardamalia, 1993) refers to epistemic discourses where concerted communal efforts in continual improvement of understanding lead to the creation and refinement of new knowledge valuable to a community. At the same time, participants "learn" (analogous with scientific discovery and theory formation, (Hakkarinen, Lipponen, & Jarvela, 2002)) as a side product of their participation in the processes of working toward a more thorough and complete understanding (Bereiter, 2002). Hence, a KB discourse is where people put forward ideas and theories intentionally to refine knowledge artifacts together to address real-world, authentic, ill-structured problems.

Research on pedagogical implementation of knowledge building has been conducted at various educational levels and perspectives over the last two decades. For example the levels of explanations, proposed by Hakkarinen, Lipponen & Jarvela (2002), is a scheme aims at investigating the epistemic nature of note postings in knowledge-seeking inquiry by a five-step scale starting from (1) separated pieces of facts to (5) well-elaborated explanation. On the other hand, the twelve knowledge building principles (Scardamalia, 2002) characterized socio-cognitive dynamics among participants virtue to knowledge building discourses, have been employed in so many studies to assess and gain deeper insights onto KB discourses (to name a few, Law & Wong, 2003; Law, 2005; Lee, Chan, van Aalst, 2005; Zhang, Scardamalia, Lamon, Messina & Reeve, 2006). These researches evaluate characteristics of the KB discourse as process or outcome of KB carried out by its participants.

Apart from addressing discourse characteristics, one distinctive feature of knowledge building not many analysis had addressed is that it sees knowledge not as something to be stored in one's mind, but as knowledge artifacts "existing out there" of certain value or function to humans (Bereiter, 2002). The view of knowledge as abstract conceptual artifacts created by humans to specify relationships of other objects (e.g. physical, mental or abstract), such as in the form of explanations or theories, originates from Popper (1972, in Bereiter 2002). At the knowledge artifact level, Bereiter & Scardamalia (1998) propose, from the perspective of objectification of knowledge, that there are seven developmental levels of approaches to knowledge: starting with knowledge as mental states and gradually developing to view it as Popperian world 3 objects that one can evaluate and improve. For example, young children especially treat knowledge as individuated mental states that reflect reality as facts. At a later, more mature stage, knowledge is no longer considered as facts in the head that could only be expressed or taken-up, but as representations (still mental) that affords to be shared, and interpreted from different perspectives by others. A big progress in knowledge objectification would be moving on to treat knowledge as improvable personal artifacts and eventually semi-autonomous artifacts that can take on a life of their own, through seeing oneself as constructors of provisional solutions to theoretical problems, instead of as constructors of knowledge representations like opinions or interpretations as in earlier levels. At these higher levels, one have to also consider whether their knowledge artifacts are up to the standards commonly accepted in the specific knowledge domain, for example scientific requirements on scientific knowledge artifacts, in order for the artifact to be recognized as significant to the community (Bereiter, 2003). However, the levels of approach to knowledge framework have not been further researched over the years. Little can be found in research literature on the possible differences in discourse dynamics and quality of knowledge built between people who operate at different levels of approach to knowledge.

Personal epistemology in collaborative knowledge building discourses

Personal epistemology (PE), as a field of research, is the study of people's beliefs about the nature of knowledge and the knowing process, and how these beliefs affect engagements at different learning situations, for example, how an individual reacts when his/her view (possibly naïve) is confronted by others'. Perry's (1970) model of personal epistemology describes critical intertwining of cognitive and affective perspectives as a person develops more complex forms of thought about the world, one's discipline of study, and one's self during college years. This model is employed over other models of personal epistemology (e.g. Schommer, 1990) in this research as Perry's model of PE do not take learning into account. Excluding learning as one of the theoretical constructs in models of PE accords with knowledge building's claim that learning is only a side product of KB processes, not a core objective of it. Also, latest literatures (Elby, 2009; Sandoval, 2009) argue that whether to include learning in an expansive definition of personal epistemology should be decided in view of the theoretical underpinnings of the research discourse. Conflating the theoretical base of PE would possibly obscure efforts to understand the underlying theoretical relationship.

According to Perry's nine developmental stages model, people with different PE positions hold different views on diversity and uncertainty with respect to new learning, which underpins the likelihood of modifying their current framework of understanding for possible restructuring or refinement. The early positions of Perry's model captures students' transition from holding a dualistic view of knowledge as either right or wrong, backed up by personal feelings; to a multiplicity view that acknowledge diverse views as "equally right" claims, and an ultimate truth is not yet known. At the higher levels of development, Perry's model describes contextual relativistic positions where people acknowledge the complexity and uncertainty of knowledge and knowing, and yet commit themselves as active maker of meaning to lifelong, ongoing refinement of knowledge. To some extent, Perry's positions also reflect elements of knowledge objectification, which is more explicitly captured by King & Kitchener's reflective judgment framework (1994, 2002). This latter framework is more or less parallel to Perry's 9 positions, derived through analyzing peoples' views of knowledge and their concept of justification (Moore, 2002). In the pre-reflective thinking stages, people make justifications onto uncertain ill-structured situations by using their own beliefs or their beliefs on the authority of information sources. As people develops to quasi-reflective thinking stages, they start with seeing all knowing and justification as idiosyncratic, and develop to accept knowledge as contextual and results in legitimate differences in conclusions. Towards the stage of full reflective thinking, justification is built onto the explanatory coherence of evidences coming from different perspectives of an issue, which parallels the properties of knowledge artifacts suggested by Popper and Bereiter.

To conclude, research on PE and levels of approach to knowledge together detailed a more in depth and complementary insight to the importance of 3 aspects of a person's beliefs in knowledge and ways of knowing for knowledge building: 1) level of objectification of knowledge (from personal inner representation to knowledge artifact), 2) likelihood of modifying own understanding (from unlikely to open for continual improvement), and 3) structure of justifications (from personal beliefs to explanatory coherence of data from different perspectives). To foster student-initiated, sustainable advancement of ideas leading to progressively in-depth understanding and perhaps even creation of new knowledge in classrooms**,** all three aspects have to be addressed and advanced simultaneously**.**

Research Questions and potential contribution to the field of CSCL research

A number of research questions would be addressed in this study. First of all, it is the overall validity of the claim. While the three aspects of a person's beliefs in knowledge and knowing complement with each others in theory, would data from real world subjects support this claim? To what extend would the three aspects of a person's beliefs in knowledge and ways of knowing be sensitive to other factors, like individual preferences, domain differences or even teacher facilitation style? Bereiter (2002) argued that knowledge artifacts need to comply with domain standards to be of significance to a community. Would it imply that PE is domain or topic specific? Would current PE frameworks, which are constructed from researches on college students, be applicable to young children?

Second, a more deepening question is the applicability of a person's beliefs in knowledge and ways of knowing to explain differences in engagements in knowledge building discourse. In what ways would the three aspects be related to one's quantitative and qualitative participation in knowledge building discourse? If students in knowledge building discourse show deepening engagements in terms of quantity of participation and quality of postings, would there be corresponding changes in beliefs towards seeing knowledge as artifacts? Studies have shown that even young children can knowledge build and benefit from the process, deepening in both subject matter understanding as well as the capacity to contribute to the advancement of collective knowledge (Lamon, Reeve & Scardamalia, 2001), would higher levels of PE be found among young children who demonstrate knowledge building? Furthermore, would the same student show different PE positions or levels of approach to knowledge in different subject domains? It is hoped that this research would better inform pedagogical design and teacher facilitation of KB on- and off- line.

To answer the research questions above, this research draws insights from both psychometric as well as behavioral data sources. First, a paper-and-pen based pre- and post- test instrument will be developed to explore students' personal epistemology, on topics related to their collaborative knowledge building online discussion. This instrument will be able to collect and differentiate large amount of students' view on knowledge and knowing with diverse background. It is expected that results from this instrument would afford clustering of students with similar beliefs in knowledge and knowing for more in depth qualitative investigation. In depth interviews will be designed and conducted to further investigate the influence of factors related to personal epistemology. At the same time, logs of online knowledge building discussions will be analyzed to triangulate with psychometric data obtained by the questionnaire. On one hand, it will be analyzed with established KB analysis frameworks from literatures, for example analysis on socio-cognitive dynamics of knowledge building (Zhang, et. al., 2002) for qualitative evaluation of the KB discourse. On the other hand, discussion logs will be further evaluated with content analysis frameworks that focus on collaborative epistemic acts as well as the 3 aspects of a person's beliefs in knowledge and knowing suggested here, in order to look for indicators of students' beliefs in knowledge and knowing in KB discourses.

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EDUCATIONAL POLICY SYMPOSIUM

CSCL and the Transformation of Education

Chairs
Stella Vosniadou, University of Athens, Greece, svosniad@phs.uoa.gr
Lone Dirckinck-Holmfeld, Aalborg University, Denmark, lone@hum.aau.dk

Invited Participants
Lone Folmer Berthelsen, Jouni Kangasniemi, Looi Chee Kit, Naomi Miyake, Marcia Linn

Summary

The symposium addresses the challenges educational systems are exposed to in the transformation towards the knowledge and learning society. It will focus on the following aspects:

- CSCL and a socio-cultural understanding of human learning
- CSCL and innovative approaches to teaching and learning

The aim of the symposium is to establish a dialogue between the researchers within the area of CSCL and education policy makers in various countries, the EU and internationally. It concerns all levels of the educational system from primary school to higher education and vocational adult training.

Themes to explore:

- Good examples of educational application of CSCL
- What are some of the national /international issues and barriers in order to promote CSCL in schools, higher education and vocational adult training? Does the test and evaluation system allow for collaborative learning?
- What should be the plans, strategies, and actions that we could apply in a national, EU and international context in order to promote CSCL activities in schools, in higher education and in vocational training? Can we/should we use the same strategies within the different educational systems?
- Who are the actors to promote changes: ministries, centers for teachers professional development, association for teachers, portals for teachers, researchers?
- What kind of research is needed in order to promote CSCL in schools, higher education and vocational training? Should action research and design based research methods being promoted? What kind of current activities are teachers and students already doing. Is CSCL integrated?

A summary document will be presented at the plenary session in the main conference.

The symposium will be honoured by the invited participation of:

- Lone Folmer Berthelsen, Head of Department, Ministry of Education, Office of Adult Vocational Training, Denmark, Lone.Folmer.Berthelsen@uvm.dk
- Jouni Kangasniemi, Senior Adviser, Ministry of Education & Science Policy, Finland, jouni.kangasniemi@minedu.fi
- Looi Chee Kit, Head of Center of Excellence for Learning and Innovation, A. Professor, National Institute of Education, Nanyang Technological University, Singapore, cheekit.looi@nie.edu.sg
- Marcia Linn, Professor, University of California at Berkeley, USA, mclinn@berkeley.edu
- Naomi Miyake, Professor, University of Tokyo, Japan, nmiyake@p.utokyo.ac.jp

It will be also enriched by the active participation of key CSCL researchers' representatives of a variety of countries and continents.

Index of Authors

Aehnelt Mario, 144
Ainsworth Shaaron, 35
Aleahmad Turadg, 12, 14
Amelung Chris, 171
Anastopoulou Stamatina, 34, 35
Andriessen Jerry, 31, 32
Antle Alissa, 15
Aprea Carmela, 237
Avouris Nikolaos, 180

Baker Michael, 31, 32
Baker-Doyle Kira, 237
Barron Brigid, 22, 23, 25, 26
Berthelsen Folmer Lone, 279
Betbeder Marie-Laure, 177, 227
Bétrancourt Mireille, 153
Blondel Francois-Marie, 177, 227
Bopardikar Anushree, 69
Bourdeau Jacqueline, 228
Bransford John, 46
Bratitsis Tharrenos, 227
Brecht John, 233
Brennan Karen, 76, 217
Brown Megan, 46
Bruillard Eric, 82, 174, 227
Button Graham, 28

Cakir Murat, 237
Calvo Rafael, 231
Camacho Heilyn, 97
Carlsen William, 94
Caspi Shai, 29
Caviale Olivier, 82
Chan Tak-Wai, 211
Charles Elizabeth, 211
Chaudhuri Sourish, 59, 192
Chee Kit Looi, 211, 279
Chen Weiqin, 228
Cheng Haugan Britte, 123, 238
Chin Doris, 123
Cocciolo Anthony, 103
Collins Allan, 22, 23
Crook Charles, 33

Daskolia Maria, 85
de Jong Ton, 36
de Hoog Robert, 144
De-Groot Reuma, 220
De Wever Bram, 238
Demetriadis Stavros, 231
Dick Holger, 245, 247
Dillenbourg Pierre, 6, 11, 37, 211, 231, 237
Dimitracopoulou Angelique, XV, 21, 168, 227
Dimitriadis Yannis, 229, 231, 233
Ding Ning, 238
Dirckinck-Holmfeld Lone, 97, 211, 279

Duffy Thomas, 135
Dong Chaoyan, 132

Eke Jacqueline, 28
Eligio Xolocotzin Ulises, 238
Ertl Bernhard, 238

Ferraris Christine, 201, 229
Fessakis Georgios, 168, 227
Fields A. Deborah, 54, 245, 249
Fischer Frank, 38, 195, 231, 237
Fischer Gerhard, 22, 23
Fisher Charles, 94
Fishman Barry, 159
Fraser Simon, 15, 135
Fujita Nobuko, 162, 165, 238
Fuks Hugo, 211

Galyen Krista, 171
Gavota Monica, 153
Gawel Drue, 46
Gegenfurtner Andreas, 71, 245, 252
Giguet Emmanuel, 174, 227
Gkotsis George, 126
Gnesdilow Dana, 68
Goehring Elizabeth, 94
Goggins Sean, 112, 171
Goldman Ricki, 132, 211
Goodwin Charles, 5
Greenhow Christine, 239
Greiffenhagen Christian, 28
Grigoriadou Maria, 231
Guribye Frode, 239
Gweon Gahgene, 186

Hambach Sybille, 144
Harrer Andreas, 198, 218, 229, 231
Hatzitaskos Markos, 126
Henrik Kjell Johansson, 100
Hernández Monroy Andrés, 217
Herrenkohl Leslie, 25
Hesse W. Friedrich, 21
Hoadley Chris, 12
Hong Ran-Young, 171
Hoppe Ulrich, 14, 21, 198, 211
Howley Iris, 59, 192
Hsu Ying-Shao, 150
Hußmann Heinrich, 195
Hwang Fu-Kwun, 150

Ioannou Andri, 115
Isotani Seiji, 228

Jacobson Michael J., 38
Jalonen Satu, 141
Jarvela Sanna, 211

Jermann Patrick, 212
Jorczak Robert, 239
Joshi Aasha, 123
Jovanovic Jelena, 228

Kafai Yasmin B., 54, 237
Kampylis Panagiotis, 85
Kangasniemi Jouni, 279
Kapur Manu, 37, 239
Karacapilidis Nikos, 126
Karlgren K., 32
Karousos Nikos, 126
Kerawalla Lucinda, 129
Kerlin Steven, 94
Kim Beaumie, 38, 120
Kim Misong, 120
Kirschner Paul, 207, 211, 237
Knight D. Katherine, 245, 255
Kohen-Vacs Dan, 198, 218
Kollar Ingo, 38
Kooken Jose, 144
Korn Matthias, 73
Koschmann Timothy, 28, 29
Kosonen Kari, 141
Kumar Rohit, 59, 186, 192
Kumar Swapna, 118, 239
Kynigos Chronis, 15, 16
Kyza Eleni, 12

Laferriere Therese, 211
Laffey James, 112, 171
Lakkala Minna, 141
Lambropoulos Niki, 85
Lansiquot Reneta, 132
Larsen James, 94
Law Nancy, 21, 211, 225, 237
Lee Jason, 120
Lewis Sarah, 106
Lin Hsien-Ta, 159
Lin Li-Fen, 150
Lindgren Robb, 65
Lindstaedt Stefanie, 144
Lindwall Oskar, 239
Linn Marcia, 34, 237, 279
Littleton Karen, 35
Liu Chen-Chung, 22, 23
Liu Lei, 240
Loll Frank, 189, 232
Long Patti, 51
Lucas Nadine, 174, 227
Luckin Rosemary, 8
Lund Kristine, 32, 225
Lundh Patrik, 123
Lyons Leilah, 15, 16

Madeira Cheryl Ann, 79
Malzahn Nils, 198
Marshall Paul, 15
Martel Christian, 201, 229
Martin Kennedy Caitlin, 25, 26
Matsumoto Kenichiro, 100
McLaren Bruce M., 39, 189, 232
Medina Richard, 29, 245, 258
Meier Anne, 156
Mercier Emma, 25
Mertl Véronique, 25, 26
Milrad Marcelo, 35
Miyake Naomi, 25, 211, 237, 279
Miyatani Takashi, 100
Mizoguchi Riichiro, 228
Mochizuki Toshio, 100
Moher Tom, 15, 17
Monachesi Paola, 147
Moraveji Neema, 65
Mossel Eelco, 147
Müsebeck Petra, 144
Musielak Marleen, 144

Najafi Hedieh, 245, 261
Nakahara Jun, 100
Ng Keong Foo, 240
Nishimori Toshihisa, 100
Notari P. Michele, 245, 264
Nüssli Marc-Antoine, 212

O'Malley Claire, XV, 11, 34, 211
Oehl Michael, 138
Oura Hiroki, 100

Pang Alexis, 120
Pathak Suneeta A., 38
Paulus Trena, 51
Pea Roy, 13, 21, 25, 35, 65, 106, 211
Pemberton Lyn, 109
Peters Vanessa, 240
Petrou Marilena, 129
Pfister Hans-Rüdiger, 138
Phillips Rachel, 46
Pinkwart Niels, 189, 232
Posea Vlad, 147
Puntambekar Sadhana, 56, 68, 255

Quintana Chris, 12, 13, 245

Rebedea Traian, 183
Reece Anton, 51
Reffay Christophe, 177, 227
Reimann Peter, XV, 211, 227
Resnick Mitchel, 217
Retalis Simeon, 231
Richle Urs, 153
Ronen Miky, 198, 218
Roschelle Jeremy, 11, 12, 13, 211
Rose Carolyn, 225
Rosé Penstein Carolyn, 59, 186, 192
Rosen Joe, 106
Roth Benedikt, 198
Roussou Maria, 15, 16
Rummel Nikol, 12, 37, 39

Sahib Zina, 88
Sato Tomomi, 100
Scanlon Eileen, 35, 129
Schank Patricia, 233
Scheuer Oliver, 189, 232
Schmidt Carla, 112
Schmidt Matthew, 112
Schneider Daniel, 153
Schwartz Daniel, 123
Schwarz Baruch, 237
Sfard Anna, 29
Sharples Mike, 35, 233
Shuyska Alexen Jane, 219
Sinha Suparna, 245, 267
Sins P., 32
Slotta James, 12, 79, 91
Slotta Jim, 14, 34
Smith Garrett W., 56
Soloway Elliot, 13
Spada Hans, 22, 156, 211
Stahl Gerry, 21, 28, 29, 207, 211, 237
Stegmann Karsten, 195
Steinbock Daniel, 25, 27
Stewart Heather, 51
Stichter Janine, 112
Streng Sara, 195
Stylianou-Georgiou Agni, 115
Sugimoto Masanori, 211
Sullivan Sarah A., 56
Suthers Daniel, XV, 29, 211, 225
Svihla Vanessa, 43, 46, 240

Tchounikine Pierre, 231, 245
Teasley Stephanie, 11
Teplovs Christopher, 162, 165, 225, 240
Tissenbaum Mike, 91
Trausan-Matu Stefan, 147, 183
Tsiatsos Thrasyvoulos, 231
Tsubakimoto Mio, 100
Tzagarakis Manolis, 126

Underwood Jody S., 237
Underwood Joshua, 245, 270

van Joolingen Wouter, 12, 14, 36
Varma Keisha, 240
Varma Sashank, 240
Vassileva Julita, 88
Vatrapu Ravikirian, 29, 241
Veith Michael, 73
Vignollet Laurence, 201, 229
Villalba Serena, 123
Villiot-Leclercq Emmanuelle, 201
Vosniadou Stella, 279
Voyiatzaki Eleni, 180
Vye Nancy, 46

Walter Sarah, 25, 26
Wasson Barbara, 211, 228
Watanabe Shinichi, 100
Wecker Christof, 38
Wegerif Rupert, 211
Weinberger Armin, 36, 231
Winter Marcus, 109
Wise Alyssa, 241
Wise Friend Alyssa, 135, 241
Wu Hsin-Kai, 150

Yamauchi Yuhei, 100
Yeo Jennifer, 241
Yuen Johnny, 245, 273

Zemel Alan, 29
Zhang BaoHui, 38
Zimmerman Timothy, 241
Zourou Katerina, 241

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9 781409 285984