

AERA 2006 Interactive Symposium

Engaged Learning in Online Communities: Forging a Research Agenda

Abstract:

This interactive session will consider the forms of deep and engaged learning of science and mathematics that occur in online communities. An interdisciplinary group of researchers will briefly present the results of a network of workgroups who developed a preliminary research agenda for basic research on this topic as part of the NSF-sponsored Science of Learning Centers catalyst program. They will then interact with the audience to refine and discuss the contents of this research agenda.

Description

The richness of interactions fostered by the Web and efforts to leverage that potential have resulted in the building and study of network-based services with the aim of fostering online communities that promote learning (Renninger & Shumar, 2002a; Barab, Kling, & Gray, 2004). These attempts to define innovative spaces for learning in small and large collaborative groups has yielded new potential for furthering understanding of learning and thinking in both formal and informal contexts, especially in the domains of science and mathematics (Stahl, 2006; Suthers, 2005a, 2005b). For example, since 2002, students' evaluative ratings of the activities and tools provided by the Socio-Technical Environments for Learning and Learning Activity Research (STELLAR) Lab have been stable and positive underscoring students' preferences to work collaboratively rather than individually on activities (Derry, et. al., 2005, in press). Similarly, in-depth semi-structured interviews with 43 teachers using Math Forum (mathforum.org) resources over a three-year period reveal sustained engagement, as well as changed activity and sense of possibility—e.g., teachers who do not like or think that they can teach mathematics, finding out that they can (Renninger & Shumar, 2002b). These teachers both liked working with others on the site and deepened and developed their understanding of mathematics and mathematics pedagogy through various types of collaborations (dyads, small groups, and with the site, or community of the site, as a whole).

It appears that the online context may support learners to ask questions and seek resources to learn mathematics and science content (Marlino, Sumner, Fulker, Manduca, & Mogk, 2001). The online context may support learners to overcome barriers based on geographic location, time constraints, gender, initial interest, self-confidence, minority status, age, disability, or skill level (Shumar & Renninger, 2002). However, the complexity of interacting factors and differences among the individual, small group, and community dimensions of online learning are not well defined. They also have not been systematically studied in terms of what learning means and how it can be effectively supported.

In the proposed interactive symposium, five researchers whose training and research context vary will briefly draw on current findings to consider what takes place when deep and engaged learning occurs in online communities—and, of what a research agenda that addressed this issue would consist. Each researcher will first overview his or her prior study of engaged learning and online contexts, and use this information as a basis for addressing the following questions:

1. What is engaged learning in online communities?
2. How might engaged learning be assessed?
3. Which methods and analytical approaches have proven fruitful for the study of engaged learning?
4. What do your findings suggest about how learning develops and can be sustained over time?
5. What are the open questions in the study of engaged learning in online communities?

Interactive Symposium Format:

Wesley Shumar will serve as moderator for the session. He will introduce the researchers and hold each to a 10-minute presentation. He will then facilitate discussion among the presenters and audience members about what a research agenda for studying engaged learning in online communities might consist. Session questions will be used as a basis for this discussion.

Presentation summaries:

Developing and Sustaining Online Communities of Engaged Learners:

How do the development and structure of online learning communities affect the nature and sustainability of engaged learning?

Mary Marlino, UCAR, Digital Library for Earth System Education Program Center

At a societal level, the growth and development of networked computer and communication technologies are rapidly expanding and reconfiguring the social and institutional contexts within which learning takes place, and redefining who learners are. Groupware and online community technologies now make possible distance learning in both centralized and “many-to-many” decentralized configurations, focused either on a central curriculum and instructor, and/or on the support of learning and knowledge generation amongst the community members themselves. Education digital libraries, with their emphasis on providing universal access to quality mathematics and science based educational resources, are technologies that can contribute significantly to such developments and possibilities.

Learning may be relatively easy to track in a classroom, but how is it to be conceptualized in networks of teachers, students, and resource creators—in what ways for instance does each group learn from the other groups in the network? Furthermore, what counts as a quality resource when needs can vary across grade level, class size, educational intent, etc. (Sumner, Khoo, Recker, & Marlino, 2003) Methods such as ethnography, participant observation, in-depth interviews, focus groups, and usability

studies have been applied to understanding community engagement, including the perceived quality of collections and the usability and usefulness of provided services (Khoo, 2001; Renninger & Shumar, 2004; Sumner, et. al., 2003). Findings from this work will be used as the basis of discussing session questions.

Motivation for and Facilitation of Learning:

What kinds of connections do learners need to make to content in order to be engaged and develop as problem solvers and thinkers, and how can these connections be supported?

K. Ann Renninger, Swarthmore College, Math Forum @ Drexel

The online context appears to have particular promise for increasing access to fields such as mathematics and science that have not previously been accessible to all learners. Although preliminary, studies of online learning conducted with mixed methods (ethnography, participant observation, coding of online artifacts from mentored exchanges around rich, complex problems, think-alouds, and online surveys) have begun to suggest that these contexts can lead learners to new senses of possibility (Renninger & Shumar, 2002b) because they enable learners to explore and to shift their identities as learners (Linehan & McCarthy, 2000). Moreover, it appears that the web and interaction on and with the web enable learning to take place that typically is not documented for teachers in professional development, or for students in the mathematics classroom (Renninger & Shumar, 2002b; Renninger, Farra, & Feldman-Riordan, 2000).

While it is likely that the process of interactions in online contexts provide a foundation for asking the kind of curiosity questions which allow for a changed and deepened engagement with mathematics (Renninger, 2000), for example, open questions remain. Who are these people who work with and learn from their work with online communities and their resources? What is their immediate culture and what is their larger cultural context? What are their fears and resistances? What is the coordination of external and site specific facilitation that makes it possible for them to re-engage a site over time? What forms of interaction support them to learn? What forms of feedback during work with online services is effective?

Technology Mediation:

How do technology affordances mediate intersubjective meaning making, and how does this mediation change at different granularities from small group to community?

Daniel D. Suthers, University of Hawaii, Hawaii Networked Learning Communities

Online learning is mediated by technology, so we must understand how technology affordances are appropriated for and can influence the success of intersubjective meaning making. We need to consider pragmatic, cognitive, affective, and social dimensions of phenomena at granularities ranging from dyads through small groups to large communities and multiple time-scales of genesis (Cole, 1995). Open questions include: How do people use technology resources to manage the mechanics of their interaction? To express and co-construct ideas? To indicate attitudes towards these ideas and towards each other? To participate in the ongoing activity of a team or community? How do the available affordances influence the fluidity and direction these intersubjective processes take? How does our account of technology mediation change

with scale, going from dyads to small groups and larger communities? What, then, are the implications for the design of technology to support learning in a social context?

Given the multidimensionality and scale of the phenomena of interest, only through integrated methodologies and long term collaborations between researchers can we hope to answer these questions. We have used aggregate analyses of behavior to show that representational properties of the medium matter (e.g., Suthers & Hundhausen, 2003); analyzed sequences of "uptake" as intentional acts to understand how meaning-making is distributed across graphical and linguistic media (Suthers, 2005a); and used grounded theory analysis to identify how participants interacting via different kinds of media appropriate media affordances for coordinating their work (Dwyer & Suthers, 2005). We also need to examine longer term collaborations (e.g., Yukawa, 2005), and larger scale communities within which multiple groups are embedded (e.g., Suthers et al, 2004) in order to understand how technology can mediate the formation and development of social relationships and alliances that underly knowledge-building.

Meaning Making in Small Groups:

How is meaning constructed interactionally by online groups, and how does this collaborative knowledge building drive engaged learning and community evolution?
Gerry Stahl, Drexel University, Virtual Math Teams Project at the Math Forum @ Drexel

We are interested in exploring and analyzing how small groups in online settings engage in constructing group meaning and building collaborative knowledge, for instance at mathforum.org. Our analysis is conducted within a theoretical framework that focuses attention on the small group unit of analysis as the site of problem-solving agency, rather than primarily on cognitive processes of the individual participants (Stahl, 2006). The analysis results in the identification of interactive methods of "doing mathematics" as a group (Livingston, 1986). This, in turn, suggests mechanisms that sustain individual engagement and drive community evolution (Cobb, 1995; Shumar & Renninger, 2002).

Online math chats differ from ordinary informal conversation in a number of ways. They are focused on the task of solving a specific problem and they take place within a somewhat formal institutional setting. They are primarily text based (Garcia & Jacobs, 1999; Livingston, 1995; Zemel, 2005). The approach of conversation analysis (Sacks, 1992) that we build upon and adapt is based on ethnomethodology (Garfinkel, 1967), which involves the study of the methods that people use to accomplish what they are doing. So we are interested in working out a systematics of the methods that are used by students in online math chats (Sacks, Schegloff, & Jefferson, 1974), i.e.:

- How do groups constitute themselves, start their work, disband, change topics (Stahl, 2005a)?
- How are mathematical proposals made, affirmed, critiqued, checked (Stahl, 2005b)?
- How are accounts given and proofs developed (Stahl, 2005c)?
- How are inquiries conducted and reports narrated (Sarmiento, Trausan-Matu, & Stahl, 2005; Zemel, Xhafa, & Stahl, 2005)?
- How are mathematical objects constructed, shared, identified (Sfard & McClain, 2003; Stahl, 2004)?

- How are turns taken and leadership passed around (Cakir *et al.*, 2005)?

Transdisciplinary Online Learning Communities: Possibilities and Design Challenges
Sharon J. Derry, University of Wisconsin, Wisconsin Center for Education Research

Several studies have now focused on engaging students in learning through participation in personally and socially relevant problem solving (Derry & Hmelo-Silver, 2005; Derry et al., 2005; Derry, Levin, Osana, Jones, & Peterson, 2000). Relevance and authenticity are strong motivators and help learners make connections between content knowledge and real world applications. However, designing authentic contexts for learning is not easy, going against the grain of traditional schooling (Derry et al., 2000; Derry, Seymour, Steinkuehler, Lee, & Siegel, 2004). One problem is that instruction organized around authentic problems doesn't honor the disciplines that structure schools (Campbell, 2005/1969). Yet today's global problems cannot be adequately addressed by individual minds or disciplinary communities with one mind; they require interaction that is distributed, not only across people representing cultures and disciplines and levels of development, but also across time, space, and technologies (Fischer, 2005).

Session questions will be addressed using findings from design experiments in attempting to achieve socio-technical learning environments that effectively scaffold complex problem solving while helping students acquire collaborative skills and deep disciplinary knowledge. While successful with respect to many indicators, including validated measures of transfer, these efforts also met with complex institutional and social resistance. A communities of interest (CoIs; Fischer, 2001) model for learning through "transdisciplinary" (National Research Council, 2003) problem solving across graduate and undergraduate STEM disciplines will be described. CoIs, in which members of different disciplinary cultures organize around mutually interesting problems, supported in their efforts by socio-technical systems (Mumford, 1987), may become essential learning and problem-solving organizations of the future if, through design research, we learn to seed sustainable, effective CoIs and interface them successfully with schools.

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