Designing for Group Math Discourse

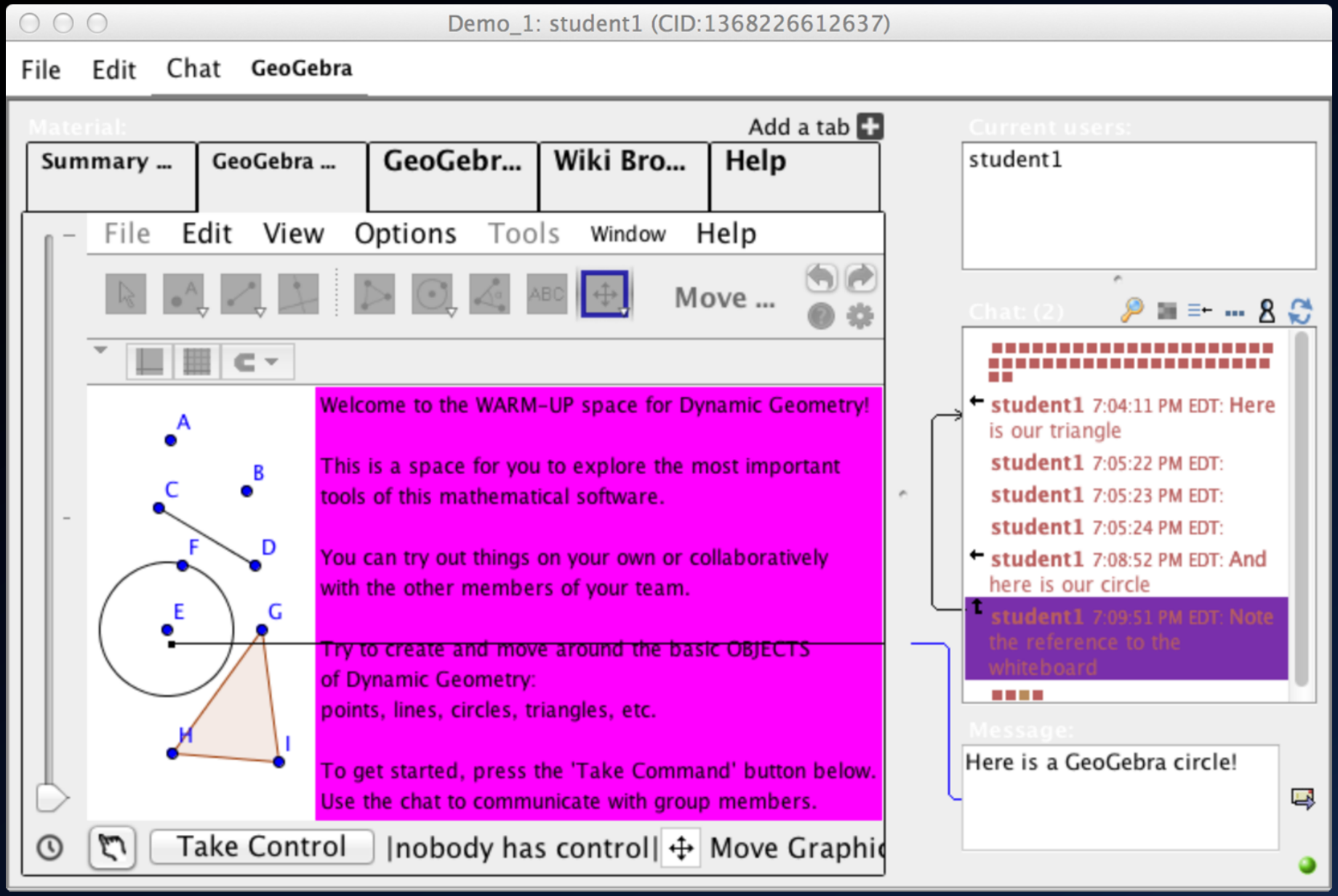
Rachel M. Magee @rachelmmagee
Christopher M. Mascaro
Gerry Stahl

Research Context

- Group Cognition (Stahl, 2006)
- Mathematical Discourse (Sfard, 2008; Stahl, 2008)
- Current online learning environment
- Dynamic Mathematics

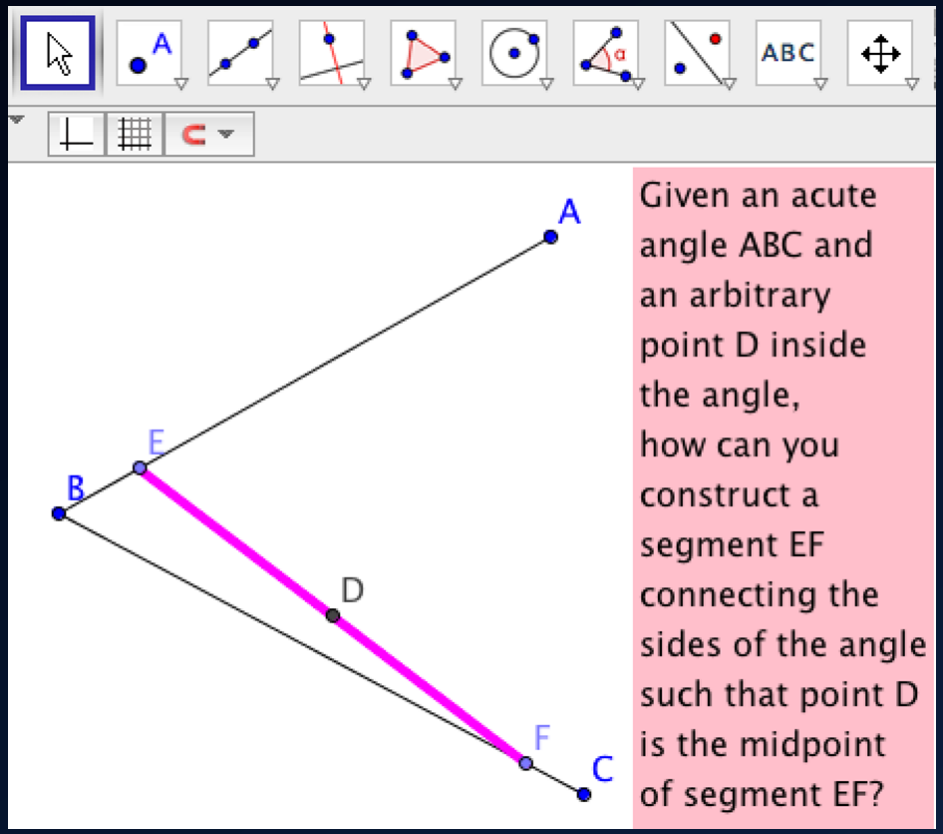
Research Goals

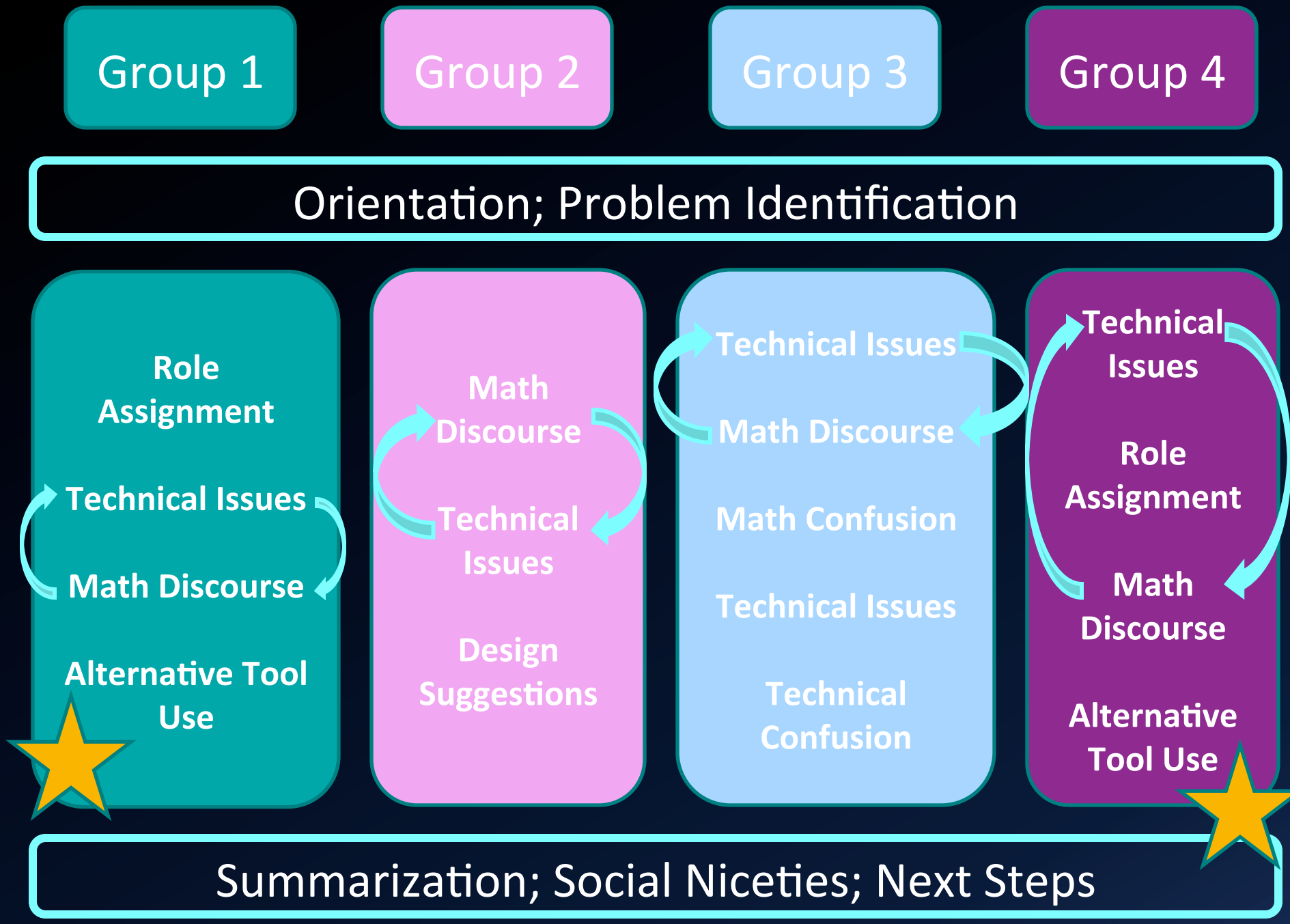
- Successfully combine VMT & GeoGebra
- Pilot tests for a realistic sense of student interaction within the new environment
- Iterative design
- Curriculum development


Demo_1: student1 (CID:1368226612637)
File Edit Chat GeoGebra
Material:
Add a tab
Summary ...
GeoGebra ...
GeoGebr...
Wiki Bro...
Help
File Edit View Options Tools Window Help
Move ...
A
B
C
D
E
F
G
H
I
Welcome to the WARM-UP space for Dynamic Geometry!
This is a space for you to explore the most important tools of this mathematical software.
You can try out things on your own or collaboratively with the other members of your team.
Try to create and move around the basic OBJECTS of Dynamic Geometry:
points, lines, circles, triangles, etc.
To get started, press the 'Take Command' button below.
Use the chat to communicate with group members.
Take Control
|nobody has control|
Move Graphic
Current users:
student1
Chat: (2)
student1 7:04:11 PM EDT: Here is our triangle
student1 7:05:22 PM EDT:
student1 7:05:23 PM EDT:
student1 7:05:24 PM EDT:
student1 7:08:52 PM EDT: And here is our circle
student1 7:09:51 PM EDT: Note the reference to the whiteboard
Message:
Here is a GeoGebra circle!

Methods

- Four one-hour group chats in the VMT/GeoGebra environment
- 3-4 Information Science graduate students per group
- Grounded, iterative analysis




Group 1
Group 2
Group 3
Group 4
Orientation; Problem Identification
Role Assignment
Technical Issues
Math Discourse
Alternative Tool Use
Math Discourse
Technical Issues
Design Suggestions
Technical Issues
Math Discourse
Math Confusion
Technical Issues
Technical Confusion
Technical Issues
Role Assignment
Math Discourse
Alternative Tool Use
Summarization; Social Niceties; Next Steps

Cycling

Technological Barriers

I'm trying to figure out how to delete this line… I kind of messed up… do you still see a line on the screen? (Group 3, line 24-25)

One thing we can state is how the lettering got messed up… I think that is helping to confuse us. (Group 3, lines 58-59)

Is there an undo function… not that I could find. That would be nice. (Group 1, lines 97-99)

Engaging (and Re-engaging) in Math Discourse

Ok, we are on the same page now… we need a point in the middle. (Group 4, lines 179-180)

Well, anyway, do we all at least see i, j, k? (Group 4, line 83)

Can I start by drawing two lines to create an angle? (Group 3, line 22)

If you try to construct a line EF trying to connect AB and BC, wouldn't that mean A=C. (line 94)

Discourse About Math Difficulties

I haven't done geometry in a long time… I'll need the hints. (Group 1, line 18)

I'm not sure if its cause I haven't done these types of problems in a while or the hints just aren't that good. (Group 3, line 95)

Technical and Mathematical Skills

I'm an IT consultant and have to deal with various software programs meaning I'm familiar with how software should be designed and navigating my way around…this was definitely tough. (Group 4, lines 310-313)

My High School Math teachers are furious with me right now I can feel it. (Group 3, line 96)

Discussion

- Familiar technologies were employed to achieve solutions
- Building technological familiarity into systems

Implications of the Design-Based Research Cycle for the VMT Project

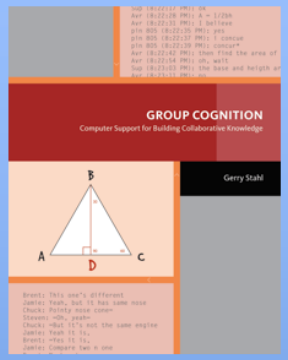
- Need to provide tutorials in use of the software
- Need to provide coherent curriculum and resources to guide exploration and collaborative learning
- Need to make all the software more robust

Recent Usage Cycles

- Tested groups of researchers, teachers, students using:
  - A set of 10 Tours introducing VMT and GeoGebra functionality
  - A set of 8-21 hour-long Topics introducing collaborative dynamic geometry
  - VMT-with-GeoGebra with more functions and no known bugs
- Currently analyzing Fall & Winter 2012 and starting Summer and Fall 2013 usage cycles

The Virtual Math Teams Trilogy

Group Cognition (2006)



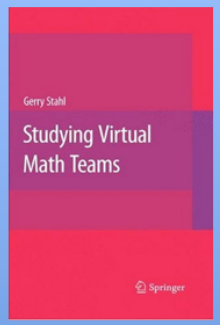
Computer Support for Building Collaborative Knowledge

MIT Press, 510 pages
Available for Kindle

The theory of group cognition emerges from several studies of CSCL and CSCW technologies. Analysis of interaction. Theory of CSCL.

www.GerryStahl.net/elibrary/gc

Studying Virtual Math Teams (2009)

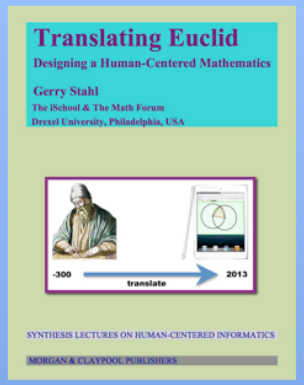


Springer Press, 626 pages
CSCL Book Series, paperback

Studies of the VMT Project technology, pedagogy, analysis, theory by team members and international collaborators

www.GerryStahl.net/elibrary/svmt

Translating Euclid (2013)



Creating a Human-Centered Mathematics

Morgan Claypool Publishers, 325 pages, e-book & paperback

Latest results of this design-based CSCL research from many perspectives.

www.GerryStahl.net/elibrary/euclid

Questions?

Thanks!

Rachel M. Magee

@rachelmmagee

rachelmagee@drexel.edu

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Discussion

- Connections to Curriculum Design
- Collaborative learning
- Curriculum Goals
  - Engage
  - Explore
  - Construct
  - Notice, wonder, and form conjectures
  - Understand

Conclusion

- Iterative work with socio-technical goals
  - Technology development
  - Pedagogy
- Logs demonstrate the social nature of work and cognition
- Cycling as a potential issue in this and other technical systems

Cycles of Problems

- Groups focused on math, but technical problems intervened again and again
- Technical and cognitive issues consequences of the situation

Today's talk

- Design based research approach to an online group math learning environment
- Research Context & Goals
- Methods
- Findings
- Discussion