Technology + Information + Collaboration =

THE VIRTUAL MATH TEAMS PROJECT

Coming down the stairs: Stephen Weimar, Director of Math Forum, co-PI on VMT grants; Annie Fetter, staff at Math Forum; Ramon Toledo, *iSchool* PhD Student; Murat Cakir, *iSchool* PhD student; Gerry Stahl; Nan Zhou, *iSchool* PhD student; Wesley Shumar, Assoc Professor of Culture & Communications, co-PI on VMT grants

The VMT project's goal is to discover and better understand how groups of people think, come to decisions, solve problems and learn.

Society is global.

With just the push of a button, the dance of fingers across a keyboard, we can connect with people and information from all corners of the globe. We network, bank, research and shop worldwide, but we do it all online from the comfort of our homes and offices. *iSchool* Associate Professor Gerry Stahl's research looks beyond the basics of international electronic communication, exploring how groups of people can more effectively learn through computer-supported collaborative learning (CSCL).

Stahl is lead researcher for the Virtual Math Teams Project (VMT) at the *iSchool* and the Math Forum at Drexel. The project utilizes chat interaction analysis to explore how students solve problems through online discussion and collaboration, with the goal to discover and better understand how groups of people think, come to decisions, solve problems and learn.

"When we started, we didn't even know if collaborative learning could be effective in math because people are so used to thinking about math on their own," Stahl said. "It's not typically considered an area where group interaction is beneficial to the learning process. The first thing we learned through this project is how effective collaborative learning can be, even with math, and how it could be a very effective classroom approach in general. It is a new form of not only math education, but education as a whole. I try to use it in my own *iSchool* courses."

The VMT service utilizes the Internet to connect students with global sources of knowledge, including other students around the world, information on the Web and digital resources. Through these links, participants can engage in mathematical discussions, which are, according to Stahl, rarely found in schools. Through this collaborative process, participants can challenge one another to understand formulas and problem solving in different ways, better understand one another's perspectives, and explain and defend their own ideas. VMT research shows that through this technique, students not only solve math problems, they better comprehend theories, expand their critical thinking and learn to work as a team. Knowledge is created through group interaction processes — what Stahl calls "group cognition."

"Anyone can benefit from it," Stahl said. "Other research has shown that collaborative small group work can be effective at any level, from kindergarten through graduate school, and in professional math, even. In particular, though, VMT provides a venue for interacting with peers, and we've found in studying our logs of student interaction, there's a lot of social activity that is highly engaging for students."

This interaction encourages learning, increasing interest. According to Stahl, he plans to expand on the analysis of how collaborative group learning can change learning in his next two books. One will be a collection of analyses of data from the VMT Project; the other will be a book-long reading of a four-hour-long series of chats by one group of students, discussing in fine detail the many facets of their interaction and joint knowledge building.

Though it may sound simple enough — observing the collaboration and communications among groups of students — the VMT Project has faced a number of challenges, and research plans have continually evolved in order to respond to what was learned about the needed chat environment, math problem design, data collection and analysis methodology. Collaborating closely with four PhD students, colleagues at the Math Forum, the colleges of Education and Arts & Sciences, and a series of international visiting researchers, Stahl and his team have committed a good deal of time to fine tuning and coordinating a unique combination of pedagogical research, software development, analysis of interaction data and theory about collaborative learning.

"This is a complex research project," Stahl noted. "Nobody comes in with all the background they need in terms of educational theory, software design, etc. For the past four years we experimented with the best ways to collect and analyze robust, naturalistic data."

According to Stahl's Web site, the project evolved from a very basic chat service environment to elaborate programming developed specifically for VMT through a relationship with researchers and developers in Germany. This system includes a number of chat tools and thread features with an integrated shared whiteboard for students to construct drawings related to a problem, a wiki for sharing findings with other teams, and a VMT Lobby that allows students to return to chat rooms or locate sequences

of rooms arranged by VMT staff and teachers. The goal in development was to make the software as effective as possible to assist learning, offering students flexible tools without overloading them with options. The system supports students in exploring provided math problems, discussing open-ended mathematical situations and allows them to go on to create their own rooms to discuss topics of their own choosing.

The VMT service is available through the Math Forum at Drexel. To date, it has mainly been used by researchers — including labs at CMU, Rutgers, Hawaii, Brazil and Singapore — working with classroom teachers. The next step is to explore its use at online high schools and by home-schooled students. The end result is a new form of math education, melding technology and worldwide interaction with engrossing discussions and problem solving, offering students a different understanding of what math, learning and knowledge are all about.