Social Computing for Educational Knowledge Building

Gerry Stahl & Johann W. Sarmiento

Drexel University
www.ischool.drexel.edu/faculty/gerry
Gerry.Stahl@drexel.edu

Research and development activities in social computing, although still in exploratory stages, have already inspired a wide array of undertakings aimed at fostering the collective engagement of small groups and larger collectivities. Social computing research combines theory building and design work; experiments supporting small social groups or large online communities create new interaction settings that allow testing and expanding theoretical perspectives. We are interested in harnessing social computing for educational purposes, facilitating the building of knowledge by distributed small groups of students working collaboratively. We want to understand how knowledge-building social activity can be accomplished and how effective social computing environments can be designed and deployed to promote collaborative learning.

Our project, the Virtual Math Teams (VMT) project at mathforum.org, is an attempt to develop a social computing environment that promotes scaffolded discourse about mathematics among teens and to study the forms of collective interaction that take place there. The VMT project is based upon an evolving theory of *group cognition*. This theory hypothesizes that "small groups are the engines of knowledge building. The knowing that groups build up in manifold forms is what becomes internalized by their members as individual learning and externalized in their communities as certifiable knowledge" (Stahl, 2006, p. 16). The VMT project is an on-going effort to catalyze and promote a math discourse community. Starting very simply in 2003 from a successful online math problem-of-the-week service (mathforum.org/pow/) and taking advantage of popular off-the-shelf chat software to make it collaborative, we have since then gradually evolved a more sophisticated environment involving carefully scripted pedagogical interventions, open-ended math issues and custom software—guided by extensive analysis of student behaviors through cycles of trials. We now want to strengthen its social networking supports to facilitate wider adoption and to further our research agenda.

While the ubiquity of networked computers connected through the Internet from homes and schools creates an exciting opportunity for students around the world to explore math together, the practical difficulties are enormous. We are interested in facilitating the development of high-level thinking skills and the deep understanding that comes from engaging in effective dialog and merging personal perspectives, but we find that students are accustomed to using text chat and the Internet for superficial socializing. Furthermore, their habits of learning are overwhelmingly skewed toward passive acquisition of knowledge from authority sources like teachers and books, rather than from self-regulated or collaborative inquiry. Finally, attempts to invent technological solutions have failed for lack of regard for issues of social practice. Designers of online environments have too often been driven more by technological capabilities than by careful analysis of the needs of people trying to work or learn together. Moreover, they have assumed that online environments will be used as intended by the designers rather than as adapted by the users through creative social practices constrained by institutional contexts. Our experience to date suggests three stubborn challenges that need to be addressed:

- *Productive Engagement*: How to *deepen* the collective learning that takes place, given that most current examples of teenager social networking and teen online communities remain shallow.
- *Transformative participation*: How to promote *inquiry* learning by student-centered informal online communities within social contexts now largely dominated by formal schooling.
- *Integrative Design*: How to *synthesize* (a) pedagogical scaffolding, (b) technological affordances and (c) motivational sociability into a coherent service that fosters a growing community.

We believe that many social computing endeavors—in the realms of theory, design and practice—face these three challenges. In our particular case, in order to address these needs we have been using our emergent online community as a laboratory for studying the social practices of group cognition and social computing "in the wild." Virtual math teams are small groups of students who meet in a chat room to discuss mathematical topics.

There are typically three to six teenage students who interact for about an hour at a time. The chat rooms are set up by staff of the Math Forum. New students are invited through Math Forum initiatives, although students can subsequently set up their own rooms and invite friends or the online public. These meetings may be encouraged by teachers, but they occur online while the students are at home, in a library or elsewhere. In the long run, these small, short-lived teams may evolve to become part of a global community of math discourse.

As designers of educational chat environments, we are particularly interested in how small groups of students construct their interactions in online media with different possible configurations of technical features. How do students with similar interests find each other and schedule meetings? How do software users learn about the meanings that designers embed in the environment and how do they negotiate the practices that they will adopt to turn technological possibilities into practical means for mediating their interactions? How do math students make sense of problems presented for them or formulate their own challenges? How can we design with students the technologies, pedagogies and communities that will result in desirable collaborative experiences?

For several years, we have been studying the collaborative interactions that take place in VMT chat rooms. We have organized student use of the VMT environment for discussing challenging problems during single hour-long sessions, sequences of sessions and even ten-week long courses. We have collected over a thousand student-hours of data and published dozens of research papers (e.g., Çakir, Zemel, & Stahl, 2007; Litz, 2007; Sarmiento & Stahl, 2007a, 2007b; Stahl & Zemel, 2006; Stahl & Zhou, 2006). For interaction analysis, we have developed detailed qualitative methods of chat analysis.

At the GROUP workshop on Social Computing, we propose to discuss:

- *Research issue*: How to *conceptualize* the interdependence between sociality and educational knowledge building and how to *design* software to unify social computing and knowledge building.
- *Area of study*: The potential role of social computing in computer-supported collaborative learning (CSCL).
- *Method of study*: Conversational micro-analysis of *interactions* in logs of online text chat and social networking.

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