AN EXAMINATION OF HOW PEOPLE WITH DIVERSE BACKGROUND TALK ABOUT MATHEMATICS TEACHING AND LEARNING BOTH FACE-TO-FACE AND ON-LINE

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The purpose of this study is to examine how the diverse members of the mathematics education community (in-service secondary mathematics teachers, in-service secondary mathematics teachers, university mathematicians and university mathematics educators) talk about a multimedia case study on mathematics teaching and learning when they interact both face-to-face and on-line. Also, the researchers compare on-line and face-to-face discussions. Initial findings indicate that both on-line and face-to-face discussions of the case study promoted questioning, answering and informing among the participants.

INTRODUCTION

The purpose of this study is to examine how the diverse members of the mathematics education community (in-service secondary mathematics teachers, in-service secondary mathematics teachers, university mathematicians and university mathematics educators) talk about a multimedia case study, Making Weighty Decisions (Bowers, Doerr, Masingila & McClain, 2000), when they interact both face-to-face and on-line. In addition, we will examine how the computer-mediated discussion differs from the face-to-face discussion by using computer mediated discourse analysis (CMDA), an area of study in the field of computer-mediated communication that employs the tools of discourse analysis to understand issues related to language and language use in computer-mediated settings. CMDA is applied to face-to-face communication as well as on-line communication (Herring, 2001).

The present study is an extension of a previous one (Koc, Herring & Brown, 2002) that examined how pre-service secondary mathematics teachers, in-service secondary mathematics teachers, mathematicians, and mathematics teacher educators communicate about the same multimedia case study through on-line communication. This research focuses on face-to-face communication as well as on-line communication, and their comparison.

LITERATURE REVIEW

Teachers frequently experience a sense of isolation in their professional life at schools (DuFour, 1999; Rogers & Babinski, 1999; NCTM, 2000). This routine of school life prevents teachers from engaging in collegial relationships with other teachers; for example, sharing, discussing, reflecting and planning with colleagues (Cochran-Smith & Lytle, 1993; Hyde, Ormiston & Hyde, 1994; Little, 1987). Efforts are being made to

transform this common culture of teacher professional from one of isolation and individualism to one of professional community. The new social reality brings its own norms, including collegiality and trust among teachers (Lieberman & Miller, 1999). Collegiality breaks the isolation of the classroom; in particular, teachers begin to participate "in a professional community that discusses new teacher materials and strategies and that supports the risk taking and struggle entailed in transforming practice" (McLaughlin & Talbert, 1993, p.15). In addition, building effective relationships among teachers may entail a common or shared professional language of teaching (Brandes & Erickson, 1998). Talking about teaching and learning in a discourse community is an invaluable opportunity for teacher educators as well as in-service and pre-service teachers to reflect on personal and colleagues' teaching experiences.These current reform ideas are not only applicable in face-to-face interactions, but also in computer-mediated contexts (Levin & Waugh, 1997).

Teacher conversation is proposed as a medium of learning to teach. In particular, talking about teaching and learning provides opportunities for teachers to construct knowledge about their practice (Richert 1992). Conversing with other teachers creates a venue for teachers "to examine their beliefs and experiences (p.190)," so it promotes being reflective about teaching and learning. In this study, we examine what teachers, teacher educators and mathematicians are doing when they talk about mathematics teaching and learning.

The literature indicates that educators possess a large amount of interest in online environments for teaching. As yet, however, little systematic research is available that compares online communication with face-to-face communication in educational settings. Since Internet use has become widespread in teaching and learning contexts, it is essential to examine how computer mediated communication (CMC) influences human learning with respect to face-to-face communication. Key questions that need to be examined include, "Is CMC an effective tool in teaching and learning?", "Does CMC affect equality of participation among individuals?" and "Does CMC, in as much as it provides more time for reflection, enhance the sophistication of language used in educational settings?". This paper illustrates some applications of Computer-Mediated Communication (CMC) in a university-school collaboration project, the Collaboration for Enhancement of Mathematics Instruction (CEMI) project.

In the proposed paper, we will report how the computer-mediated discussion differed from the face-to-face discussion by using computer mediated discourse analysis (CMDA). Computer-mediated discourse analysis (CMDA) is a discourse analysis method to identify patterns of structure and meaning in language use in computer-mediated communication (CMC) (Herring, 1996). CMDA utilizes various data analysis tools, including rate of participation and speech acts. Rate of participation includes counting the number of messages, sentences, and words said/posted by the individuals. Speech act is an utterance conceived as an act by which the speaker does something. Some of the frequently used speech acts are informative, inquire, neutral proposal, conclusion, confirm, qualify, directive, comment, and prompt (Francis & Hunston, 1992).

RESEARCH QUESTIONS

Specifically, this paper reports answers to the following questions:

> What are diverse members of the mathematics education community (in-service secondary mathematics teachers, in-service secondary mathematics teachers, university mathematicians and university mathematics educators) doing as they talk about mathematics teaching and learning?

> How does computer-mediated communication (CMC) differ from face-to-face communication with respect to the first research question?

METHODS

This study examines the discussions about the multimedia case study *Making Weighty Decisions*. Six discussion groups were formed with each group consisting of a high school mathematics teacher, a university mathematician or instructor (a graduate level mathematics student), a mathematics educator, and several pre-service teachers (two to four per discussion group). Each discussion group member was then asked to view the multimedia case individually and then engage in face-to-face and online discussions. Online discussion prompts were provided initially to encourage discussion group members to reflect on the teacher's role in planning for and facilitating classroom activities, the mathematical content of the lesson, and the level of student thinking throughout the lesson. Members were also encouraged to raise their own issues. Online discussion proceeded for approximately five weeks. Discussion groups met face-to-face to discuss the case study twice during those five weeks; all face-to-face discussions were audiotaped.

The goal of the discussions was to encourage discussion among the participants that was focused on mathematics teaching and learning. Since they had diverse backgrounds in teaching and learning mathematics, development of a way of talking about mathematics education among them was necessary. It was hypothesized that talking about teaching and learning would be an effective means of building a common language among the participants with diverse backgrounds-- mathematics teachers, pre-service mathematics teachers, university mathematicians and mathematics educators. Also, it was thought that on-line discussion opportunities could produce more discussions and have more participants be engaged in the discussions. In addition, on-line communication would attract more participation from the group members who do not participate well in face-to-face communication. On-line discussions took place within the Inquiry Learning Forum (ILF) (http://ilf.crlt.indiana.edu). The ILF, hosted at Indiana University, "is a web-based professional development tool designed to support a community of in-service and pre-service mathematics and science teachers creating, sharing, and improving inquiry-based pedagogical practices" (Barab, Makinster, Moore, Cunningham & the ILF Design Team, 2001, p. 3).

DATA SOURCES

Each of six discussion groups engaged in two online discussions. The first discussion lasted two weeks (from 09/11/2000 to 09/25/2000) and then members met face-to-face to discuss the CD for approximately one hour. Next, another three-week online discussion took place (from 09/25/2000 to 10/16/2000). Finally, a second face-to-face meeting

provided an opportunity for the participants to share their ideas. The transcripts of on-line and face-to-face discussions of the multimedia case study by six discussion groups are our data sources. Totally, we analyzed postings and transcripts of 38 people.

DATA ANALYSIS

We used the exchange structure of Francis and Hunston (1992), originally developed by Sinclair and Coulthard (1975) for the analysis of classroom discourse, to analyze the transcripts of the discussions. Exchange structures were sequences of speech acts (agree, inquire, inform, react, etc.) produced when individuals are engaging in conversation. The model was developed for face-to-face conversation, but has been applied to educational CMC by Herring and Nix (1997). The goal of the present analysis was to understand what kind of speech acts takes place in face-to-face and on-line communications in discussing the multimedia CD. Additionally, we compared the speech act usage of groups within the groups.

RESULTS

What follows are some examples of the initial results. Although we have many interesting results, we cannot report all of them due to space limitations.

The average number of messages per individual for discussion1 and discussion2 is 3.81 and 2.50, respectively. Interestingly, in discussion1, the average number of messages per mathematician (5.00 messages) is significantly higher than the average number for the entire population in discussion1 (3.81 messages). Because the mathematics educators posted only two messages during the first discussion (average= .67 messages), the average number of messages in that discussion session was decreased.

Overall, the participants were engaged in 678 speech acts throughout the online discussions. The speech act analyses indicate that generally the participants are informing each other, sharing their observations, inquiring and commenting on their own statements as they discuss the multimedia case study. These results are consistent with the findings of Herring and Nix (1997) for a distance education course. However, unlike in Herring and Nix's study, the participants use very few directive speech acts, suggesting a relatively polite and egalitarian environment.

It was also revealed that that males share their observations (45 times) more than females (31 times), while females asked more open-ended questions. Pre-service teachers shared their observations mostly (47 out 76 times). This may be because as students they regularly prepare assignments including reflections, descriptions and observations.

Basically, the on-line and face-to-face discussions of the case study promoted questioning, answering and informing among the participants. The initial findings include only qualitative representations of the data. Quantitative findings will accompany qualitative reports. Also, we compare and contrast on-line and face-to-face discussions, so it is helpful to understand the benefits of on-line professional development tools.

The big benefits of the present study are twofold: 1) Teacher educators will understand how people with diverse backgrounds in mathematics education talk about mathematics

teaching and learning, and 2) Effects of an on-line professional development tool will be observed.

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