Teacher Experiences of Learning in a Computer-Mediated Communication Context

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Abstract: Based on constructivist learning theories, this study focused on examining the use of an online discussion board in a graduate course as a place where forty-six inservice teachers could share experiences and ideas. Discussions held outside class were conducted by computer conferencing software. Data collection focused on online discussion transcripts of all the messages for three separate weeks and was supplemented by interviews and teacher self-evaluation reports. The study examined the nature and development of the discussions over one semester by analyzing teachers' online discussions in two domains: critical reflections and social interpersonal rapport. Additionally, teachers' perceptions of using online discussion board were revealed by interviews and teacher evaluation reports. **Keywords:** Computer-Mediated Communication, Critical Thinking, Social-interpersonal Rapport.

Introduction

Constructivist learning theory views knowledge as constructed by people, or groups of people, in a shared context based upon interpretation of experience and knowledge (Bruner, 1960; Jonassen, 1992; Vygotsky, 1978). Constructivism highlights the social nature of knowledge, which means that meaning is constructed as a result of social interaction (Dean 1994; Granger, 1990; Piaget, 1973; Saba & Shearer, 1994).

According to Piaget (1973), learning in social contexts is largely a matter of cognitive development and social interaction leads to confrontative and contradictive conversation and cognitive changes. Vygotsky (Rogoff, 1990, Tharp & Gallimore, 1988) developed the socio-constructive approach to mental functioning. This means that higher forms of mental activity are derived from social and cultural contexts and are shared by members in those contexts because these mental processes are adaptive. They lead to knowledge and skills that are essential for successful learning within a particular social-cultural context.

Critical thinking is another field that is emphasized more and more in educational research. Critical thinking is essential in cognitive presence, which is defined as "the extent to which learners are able to construct and confirm meaning through sustained discourse in a critical community of inquiry" (Garrison et al., 2001). In other words, cognitive presence reflects higher-order knowledge construction and application, or critical reflection.

Much effort has been invested in addressing theories in education from social, cultural, and critical thinking learning contexts. The application of computer-mediated communication (CMC) technology is an example of creating such a context for human learning, especially in teacher education. It also addresses teachers' views about the use of computer conferencing in teaching practices and professional development.

Levin (1999) conducts study with thirty-five prospective elementary teachers enrolled in an undergraduate teacher education program and uses a network-based environment. She concludes there are three reasons that web-based discussion supported reflection including (1) an appreciation of the chance to learn from others, (2) a sense of validation because their feelings and experiences were similar to others, and (3) enjoying feedback on their ideas from more than one person. Hawkes (2001) uses Simmons et al. (1989) reflective thinking taxonomy to analyze online and face-to-face discourse among the 28 teachers and to determine whether an exchange from online or face-to-face discourse was reflective. He finds that neither face-to-face nor online communication had high overall reflective discourse, yet in comparison the networked-based discussions resulted in higher reflective discourse than did the face-to-face discussions. In addition, focused topics, that are immediately applicable to the classrooms, subjects and grade levels, will promote more reflective discussions in his study than other unfocused topics such as general discussion forum.

Merseth (1991) conducts a year-long study with 39 first-year teachers participating in the beginning teacher program and finds the computer networking provides moral support and allays feelings of helplessness and embarrassment for beginning teachers.

Tannehill, Berkowitz and LeMaster (1995) link physical education teachers with nine physical education doctoral students by establishing a working relationship via email and using a newsgroup. They explore perceptions of teachers about technology as an important factor in their feelings regarding isolation and providing them valuable access to expertise.

Computer conferencing provides a social presence that is often missing in other forms of distance education (Harasim, 1990). More studies have found that CMC has the power to transmit great social support and facilitate social-interpersonal rapport (Schrum, 1993). The adoption of computer conferencing in professional development highlights the importance and value of social presence in quality teacher education programs.

Barab and colleagues (in press) have developed a web-based professional development system, which is designed to support a community of inservice and preservice science and mathematics teachers sharing, observing other teachers' classrooms through online video vignettes. Teachers in this project believed that the participation was helpful in thinking more about their practice even though the results had not yet show the impact on how teachers actually teach.

McGinnis (1996) used an action research approach in a graduate level elementary science methods course and had his students use email to communicate between members in the class. Most students in this course believed that a computer conferencing network could enhance their teaching practice and lead to increase teaching professionalism. Moreover, he also found the student believed that using email communication could foster a sense of community.

Current educational standards emphasize the concept that teachers are learners and members of a professional community. Communication has always been crucial to professional developmental activities in many places, but until recently available CMC technologies provided communication capabilities primarily between schoolteachers and professionals in education fields. This precluded the opportunity in conventional professional developmental activities for dialogue, debate, conversational learning and collaborative work among and between teachers. The interactive nature and potential of computer conferencing is very powerful and has a major role to play in the future of professional developmental program.

The Study

Science Cooperatives: Effecting Local Systemic Change in Rural Missouri and Iowa (Science Co-op) connects 8 regional clusters of elementary schools formed from 38 school districts spread over 40, 000 square miles and includes more than 1,400 teachers and 20,000 elementary school students. The collaborative units in the Science Co-op Project involve significant distance and time dislocations that require combining face-to-face and technological deliveries to address ideas, to share resources, to solve common instructional concerns, and to meet the needs of elementary teachers. There are three central ideas behind the Science Co-op project. The first idea is to help elementary teachers in rural districts construct content-pedagogical knowledge and implement specific science modules that stress reform standards and principles. The second central idea is the intention to build a supportive community of teaching practices for the long-term. The third idea is the mission to promote the effective use of new technologies in science teaching and learning. Therefore, the Science Co-Op Project offers the opportunities of distance education for the participating teachers to take every semester from 2000.

"Curriculum Construction in Elementary and Secondary Schools" was a graduate-level course sponsored by the Science Co-Op Project and was taught by one university professor through interactive technologies in Fall, 2003. The course focused on the discussion of the applied curriculum (FOSS, STC, INSIGHT) and its implementation, resulting in action research. The emphasis of the course was placed upon aligning curricula with the National Science Education Standards (NSES). A science lesson was analyzed in this course to determine its alignment with NSES and then enhanced to be in complete alignment. This model lesson became the focal point of the action research to be undertaken. However, the main focus of this study was to examine the impact of applying the computer conferencing network to stimulate teachers' reflective discourse and to build sociability.

The purpose of the study was to describe and improve understanding of teachers' experiences as they learn in a CMC context within a distance education environment. Data were gathered in three ways, with any one method providing support for the veracity of the data collected by the others. The bulk of data was collected through three-week's computer conferencing transcripts. Content analysis was used to address the specific research objectives using computer transcripts to identify patterns of participation, reflection, and social-interpersonal rapport inherent in the teachers' professional growth. Two criteria were applied to analyze the online discourse with constructivism serving as the theoretical background for the two coding criteria. The qualitative data source was discourse content analysis resulting from use of Garrison's (1991) "Practical Inquiry Model" to examine the first aspect namely, critical thinking. Henri's (1992) model for content analysis of computer-mediated communication was applied for assessing the social aspects.

Qualitative data were collected from online discussion transcripts, interviews, and self-evaluation reports while quantitative data were obtained from online discussion transcripts. Online discussion transcripts were collected during the semester. Online discussion transcripts for a semester period were analyzed quantitatively to

explore the pattern of participation. However, only three selected weeks of online discussion transcripts were analyzed both qualitatively and quantitatively to reveal changes in cognitive presence and social presence.

In addition, six interviews were conducted via the online chat room, which was synchronous and could record the transcript. Further evidence was gathered through self-evaluations secured from thirty-six out of forty-six teacher participants.

Findings

The level of participation varied during the semester but was higher at the beginning of the semester and lower at the end of the semester. After Week 7, the quantity of online discussion participation was not included in course requirement anymore and the level of participation still increased after Week 7 until Week 9.

Mean	Median	Mode	Standard Deviation	Range	Confidence Level
32.16	31	23	15.88	68	(95.0%) 4.5127

Table 1. Descriptive Data of Overall Participation in Computer Conferencing
(Unit: Number of Messages Per Teacher)

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Total # of Messages	121	263	168	158	240	82	112
	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	
Total # of Messages	119	136	97	19	53	3	

Table 2. Overall Participation in Computer Conferencing (Unit: Number of Messages)

The pattern and quality of the teacher critical reflections in computer conferencing over three selected weeks were the primary outcomes evaluated in this study. The total number of critical thinking messages in three selected weeks is shown in Table 3 and Figure 1. In total, 48 teachers posted 552 messages using critical thinking skills during the weeks of 3, 6, and 10 of online activity, for an average of 11.5 messages where critical thinking skills were used. Ninety percent of the total messages in the three weeks were categorized as critical reflection messages. The number of critical reflection messages varied over the three selected weeks of the course. As can be seen in Figure 1, it peaked at Week 3 (214 messages) but began to decline after Week 3 until Week 10.

	Week 3	Week 6	Week 10
Content Forum	32	123	56
District Forum	124	55	25
Grade Forum	46	9	20
Lounge Forum	12	6	17
Total	214	193	118

Table 3. Total Critical Reflection Over Time: Number of Critical Reflective Messages in Week 3, 6, 10

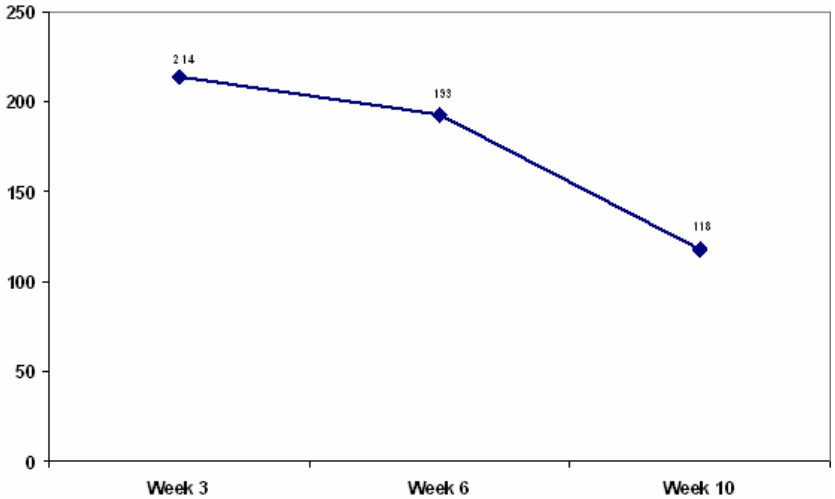

Figure 1. Total Critical Reflection Over Time: Number of Critical Reflective Messages in Week 3, 6, 10

The content analysis was conducted in two phases. First, the online discussion transcripts were analyzed for indicators of the critical thinking skills identified in the framework (Garrison's critical thinking model). Then, in the second phase, the messages with the indicators of the critical thinking skills were scored (see Table 4), ranging from a low of one (triggering) to a high of four (resolution). The content analysis revealed that the means of scores concerning critical thinking during the three weeks increased considerably from Week 3 (2.02) to Week 10 (2.19) (see Figure 2).

Level of Critical Reflection	Triggering	Exploration	Integration	Resolution
Score	1	2	3	4

Table 4. Rubric for Scoring Messages in What Levels of Critical Reflection

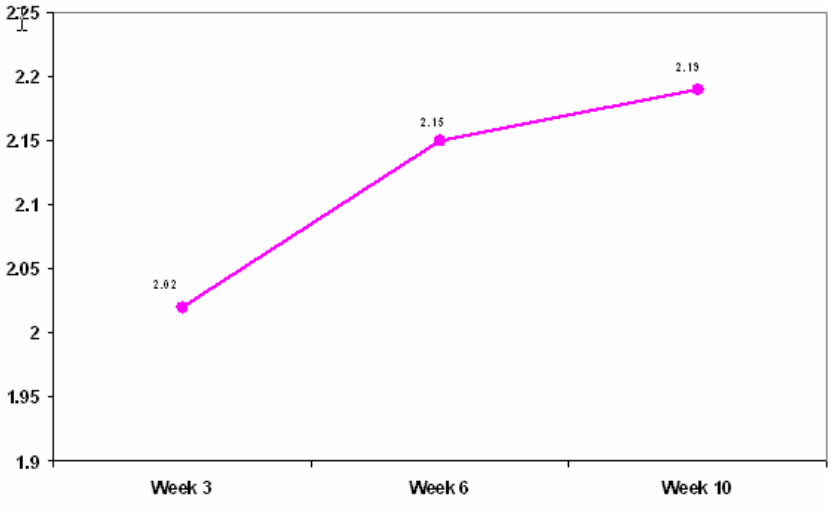

Figure 2. Mean Critical Reflection Score in Week 3, 6, & 10

Teachers' critical reflection developed over time as a result of the online discussion board according to mean critical thinking scores in three selected weeks. Even though the growing trend of quality of improved critical reflection was reported in this study, the majority of critical reflection was still at a low level of critical thinking, in terms of the triggering and exploration phases. In addition, the length of the messages in these phases was shorter in general. In other words, teachers tended to have more surface talk or information exchange in the discussion forums.

Teachers identified many positive factors that affected their learning of using critical thinking skills. Being able to gain ideas, to share experiences, and to feel more willing to reflect on their own thinking were the main factors that helped teachers develop in terms of cognitive learning. The factors that affected critical reflection in computer conferencing also influenced positively in four components used to describe adult learners. These included: being self-directed, utilizing their own experience, identifying their own readiness to learn, and organizing their learning around life problems. However, time-consuming and quantity of posting as course requirement were the two main factors that hindered their learning in some ways. To read and to respond to messages of other teachers took tremendous time, especially for reading low-quality messages, which were forced conversation caused by course requirements.

Opportunities to compare similarities and differences "I also enjoy any and every opportunity I get to compare similarities and differences with other districts." (SE4)
Being able to synthesize and relate their thoughts "Having a good understanding of the learning helps me to then synthesize and relate my thoughts online." (SE 17)
Solving the same problem or feeling "An important thing is that we have a place to discuss learning and not feel like we are the only ones with that problem or feeling. At first I was reluctant to share because I might sound like I a lot to learn. Now I know that we are working on our science knowledge and it's ok." (SE15)
Feeling that other teachers have the same concerns "It has been interesting to read the insights from different teachers. It sounds as if many teachers have the same concerns that I do when I teach science...ie. knowing scientific terms and concepts." (SE10)
Feeling secure in sharing the ideas "Communicating with the other sites throughout the week, helped us feel more confident with each other and secure in sharing our ideas. My content knowledge of the different Science concepts increased." (SE32)
Feeling freer to express opinions "I feel a little freer to express myself as I sometimes feel on the spot when it's my turn on the ICN. I can take time to reflect and think about what I want to write or to respond to." (SE 35)
Convenience "The discussion board helped me to learn outside of regular class time. I could ask questions when it was convenient for me, and look for answers when it was convenient too. Other students shared articles via attachments that I could read." (Interviewee #1)
Increased content knowledge "My content knowledge of the different Science concepts increased." (SE32)
Gaining enrichment from varied backgrounds "It helped because I was able to hear other perspectives and I gained enrichment from varied backgrounds." (SE4)
Applications "The ideas presented from other sites have been interesting and given me some new ideas to try in my class." (SE 18)
*SE: Self-Evaluation Respondent

Table 5. Examples Identifying by Teachers that Indicated the Factors which Helped Learning

Easy Access
"Hindered--not having internet at home, slowness of internet system." (SE9)

Failure to use discussion board before
"I was hindered at first by the newness of it all. It is a computer for heavens sake. I did not know what to expect and how it would be beneficial, save time, and be useful." (SE2)

Design of discussion board
"It hindered me because there were too many forums active at once. I have limited time and I never know where to start first. If I want to respond or reread a certain topic I can't always remember which forum it's in and some of the discussions are spread out all over the place!" (SE5)

Too Time consuming
"I was probably hindered by the amount of time I could devote to being online reading and responding to postings." (SE5)

Feeling Hard to prepare the presentations with other districts
"It was very difficult to coordinate a presentation with more than one site over the discussion board though." (SE20)

Feeling Uncomfortable to Express Opinions
"I would rather not have to constantly worry that I'm not contributing enough or that I might be saying the 'wrong' thing and have my grade lowered. I don't feel that this contributes to learning. I wouldn't want my own students to have to worry about something like this. It's not always easy to write things that everyone else can scrutinize." (SE1)

Feeling Required to Post (Quantity but not Quality)
"It was also a hindrance that we were told that quantity was a criteria of our grade. This led to several postings that were repetitious and not really high quality." (SE5)
"Some of it is very good. But sometimes, I think that people are just "putting their time in" -quantity, rather than quality. We are required to do it and I think some people are concerned about their grade being lowered if they don't contribute enough." (SE1)

Delayed feedback
"I like the online component but sometimes it's a little frustrating due to time constraints and delayed feedback. I miss the personal interaction with my colleagues but value all the feedback that is posted." (SE35)

*SE: Self-Evaluation Respondent

Table 6. Examples of Factors Identified by Teachers which Hindered Learning

In the community of teacher educators in computer conferencing, cognitive presence was found mostly in focused discussion forums (content, grade). In addition, social presence mainly existed in the unfocused discussion forums (district, teacher's lounge).

The total number of social cues in the messages varied during the weeks of 3, 6, and 10. The number of social cues in the messages increased initially but declined significantly over time. When teachers focused more on on-task discussions or critical reflection, there was less social conversation. However, most of the teachers held positive perceptions about the social-interpersonal interactions in computer conferencing and thought that social interactions helped with their professional growth. Lastly, unfocused discussion forums (district, teacher's lounge) tended to have more social presence compared to focused discussion forums.

	Week 3	Week 6	Week 10
Total Number of Units	240	208	130
Total Social Cues	136	151	72
Total (Social) %	56.7%	72.6%	55.4%

Number of Social Cues/Message	0.57	0.73	0.55

Table 7. Total Number of Messages of Week 3, 6, & 10 and Total Number of Social Cues in Messages of Week 3, 6, & 10

Enjoying social conversation "It's been fun and enlightening to share ideas with others and not be limited by distance." (SE9) Enjoying have more discussions with the teachers among the sites Enjoying have more discussions with the teachers within their site "There has been good conversation between in-house groups and out-of-house groups using the discussion board. It seems as if the comments are more "meatier" than at first." (SE10) Being able to know the others better "I feel that I have actually be able to get to know the others better now than over the last 3 1/2 years." (SE8) Improving the relationship "I like when teachers discuss the concepts being discussed and share their ideas or understandings. I think some very valuable learning is taking place. At first, we just seemed to communicate more with the teachers in our own districts, but that's changing. Classmates we just saw on the ICN screen are becoming more than just faces. This exchange between individuals is strengthening our relationships." (SE 38) Feeling more confident with each other "Communicating with the other sites throughout the week, helped us feel more confident with each other." (SE 32) Making group more accountable "I think that we have much more interaction than we have had in previous ICN courses with other groups because of the discussion board. I also think it makes the group more accountable." (SE 20) Everyone in the group being so involved "I think they are going wonderfully!!! Everyone is very involved. It's really great to have a reply submitted to one of our own entries. It gives a great feeling to have someone agree with you or compliment!!" (SE24) Enjoying being able to chat with colleagues on a daily basis "I really enjoy being able to chat with my colleagues on a daily basis. We teach in different buildings and see each other at class or at the ICN on Tuesday nights." (SE33) Creating a sense of community "It is very interesting to read other people's comments about the class topics. I have learned a lot from others. I do think it creates a sense of community." (SE35) Picking and choosing who to communicate with I like interacting with students this way. You can pick and choose whom to communicate with when they write something that you want to reply back to. (SE6) *SE: Self-Evaluation Respondent

Table 8. Examples of Positive Factors which Affected Social-Interpersonal Rapport

The researcher, the instructor, and teachers found some advantages for using computer conferencing for improving teaching practices, and for professional development. Discussions regarding science teaching and learning made teachers evaluate more of their own teaching and become more aware of the importance of teaching strategies, including using misconceptions and constructivist pedagogy. Teachers experienced the philosophy of the learning processes when participating in computer conferencing. However, teachers rarely mentioned that they applied the things they learned from computer conferencing in their classrooms.

Most teachers thought participating with computer conferencing was beneficial and better than traditional face-to-face professional developmental workshops because:

1. They could participate at any time and any place;
2. They could discuss science teaching and learning more in depth continuously;
3. They felt more comfortable in sharing their problems or experiences;

4. They felt they knew other better and their relationships improved.

In summary, the results revealed that: (a) teachers' critical thinking developed over time as a result of the online discussion board; (b) teachers' social-interpersonal rapport improved as a result of the online discussion board; (c) focused discussion forums served as the place for critical reflection (cognitive presence) and unfocused discussion forums served as the place for social presence; and (d) experiences with using the online discussion board had a positive impact on the teaching practices and professional development of teachers.

Conclusions

The results of this study strongly suggest some interesting and exciting aspects of critical reflection, social-interpersonal rapport, and teaching practices with computer conferencing. This supports Garrison's et al., (2001) model of "Community of Inquiry" that is specifically applied to the practice of computer conferencing in higher education. Cognitive presence, social presence, and teaching presence are essential for successful development of community. Cognitive and social presences have been studied in depth in this study and identified as very important for knowledge construction and formulation of understanding. Teaching presence is addressed briefly in two parts of this study and found critical for successful facilitation of effective learning in computer conferencing. However, many questions in applying computer conferencing or other CMC-based technologies in education are left unanswered.

The results support the conceptual framework, which guided the study. Participation was conceptualized as resulting from the interactions among teachers from different backgrounds, with different conceptions regard computer conferencing, and with different successes with facilitating learning. However, because this was a case study, isolating the impact of particular factors was not possible. Future research could build on the results of this study by focusing on one or more factors. For example, it would be useful to know what impact different learning styles of students have on participation in computer conferencing. In this course teachers were the learners with varied learning styles and the participation rate of teachers also was significantly different. For example, it was really time-consuming to read and respond to the messages for so many teachers. Some teachers, who tended to learn passively, felt they wasted time on discussions. However, some teachers who were more active learners, commented that they preferred to participate online discussions as the assignment instead of writing papers that they never went back to read. Another example was, teachers who did not feel comfortable to speak in public chose to share their thinking on the discussion board where they could spend as much time as they could to formulate their thinking. Future research might focus on particular learning styles of students and their impact on student participation.

Two other related factors that emerged from this study were the lack of experience with participating computer conferencing and difficulty of using this type of technology. These factors could serve as the basis for a future study that compared the participation of students who have used computer conferencing in other courses with those who have never used this tool. Do students who have used computer conferencing before tend to participate more actively than students who never use computer conferencing? And, do students with higher technology literacy find it easier to participate?

There also appears to be a need for research that compares the participation of the community with participants with more varied backgrounds with the participation of the community with participants with more similar backgrounds. A comparative study might help to isolate the impact of the richness of the community concerning participation and critical reflections. Do students in a community with varied participants find more encouragement to participate than those in a community of more uniform participants? Is the quality of critical reflection of students in a community of uniform participants less effecting than the critical reflection of students in a more heterogeneous group?

Lastly, teacher understanding of quality reflection is one issue that appeared to have played a role in teachers' abilities to participate. This could prove useful as a basis for future research. The instructor in this course provides a brief explanation of what he meant by quality reflection and how he expected teachers to use the online discussion board. However, no extended instruction or guide in quality reflection was provided. A future study might examine whether or not to offer more guidance in making quality reflection and its impact on the quality of student reflections and what types of facilitation could lead the students to understand what quality reflection is.

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