IN-SERVICE TEACHERS' PERCEPTIONS OF ONLINE LEARNING ENVIRONMENTS

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In this study, the participants were in-service teachers ($N = 28$) enrolled in an advanced methods course in science teaching, organized to include a mix of face-to-face meetings and online discussion. The teachers were assigned to synchronous audio conferencing, synchronous text chat, and asynchronous discussion board groups for the online portion of the course. Perceptions of the quality of the online learning environment were compared using the Constructivist On-Line Learning Environment Survey. ANOVA analyses revealed significant differences among the groups on items assessed. Post-hoc analyses indicated that teachers participating in synchronous text chats perceived their online learning experiences more reflective, interactive, and supportive.

INTRODUCTION

With the availability of computer technologies, online and blended forms of learning have grown considerably in higher education in the last decade. According to a Sloan Consortium national survey of online learning in the United States, nearly 4 million college students took at least one online course in the fall of 2007 (Allen & Seaman, 2008). Blended or hybrid courses are also growing in popularity and many universities are responding by expanding their distributed education offerings. These programs merge the boundaries between distance education and face-to-face instruction by presenting portions of courses both online and on-campus (Carr-Chellman & Duchastel, 2000). In-service teachers pursing graduate degrees are especially attracted to programs with online education components. These programs offer flexibility for working teachers and the chance for geographically isolated teachers to complete degrees (Osguthorpe & Graham, 2003). However, many online learning environments are instructor-centered, often modeling knowl-

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edge transmission (Taylor & Maor, 2000). Effective teaching and learning in distributed education programs must engage students in socially interactive learning environments where students coconstruct understandings with both instructors and peers (Blanton, Moorman, & Trathen, 1998; Duffy & Kirkley, 2004). A common method used to facilitate the social construction of knowledge is focused discussions, with open and rich discourse among both instructors and peers. These discussions can help students consider multiple perspectives, negotiate meaning, and understand the knowledge gaps they may possess (Haavind, 2006). In order for students to feel like insiders in a constructivist online learning environment, social climate development is important (Rourke, Anderson, Garrison, & Archer, 2001). Early studies on computer-mediated communication suggested that online learning environments did not support the development of interpersonal relationships. However, more recent work has challenged those conclusions (Oren et al., 2002).

This research investigated three different forms of computer-mediated communication among in-service teachers enrolled in a graduate science education course. In this study, students were assigned to synchronous audio conferencing, synchronous text chat, and asynchronous discussion board groups. Perceptions of the quality of the online learning environment were compared among the three groups to answer the following questions:

1. How do the students in assigned to different groups rate the quality of their online learning environments in terms of social interaction, relevance, reflective thinking, and understanding meaning?
2. Which form of communication is most effective for use in blending learning environments for in-service teachers?

At the time of our study, the use of discussion boards was the most common method used for blended learning environments involving in-service teachers at both university sites. While there are many other emerging technologies that offer a vast range of opportunities for promoting collaboration, the distance education programs at our universities faced challenges that limited the implementation of these technologies at the time. As a result, we selected forms computer-mediated communication that our students were familiar and comfortable with, while at the same time needing little university support.

Synchronous interchanges support real-time communication, and therefore provide a more direct sense of interaction and support (Carr-Chellman & Duchastel, 2000). In addition, in most cases there is immediate feedback and resolution to the questions posed. Audio conferencing is more similar to face-to-face communication than text chatting; however, it lacks some of the social context cues (Sproull & Kiesler, 1986). While students are still cued by tone of voice, physical cues such as facial expressions and posture are absent. Text chats are an alternate means of synchronous communication. However, this type of synchronous communication may not lend itself to all types of discussions equally (Ingram, Hathorn, & Evans, 2000). Text chats can encourage quick interactions with little reflective thought. One example of a discussion thought to be appropriate for text chats are brainstorming discussions. In addition, the inability to type quickly may interfere with students' ability to participate and concentrate on the topic at hand. The final form of communication investigated in this study was a discussion board. Asynchronous online discussion is one of the most widely used instructional activities for online and blended learning environments, however there is still a question of what students learn from discussion boards. While students are more likely to feel a sense of social disconnection, this type of communication is thought to be better suited for discussions that require more background research and reflection (Branon & Essex, 2001). It is thought that students have more time to process their peers' experiences and offer insights from their own prac-

tice as well as from their readings of the literature.

METHODOLOGY

The participants of this study were science education graduate students ($N = 28$) enrolled at one of two southeastern research universities. All participants were in-service teachers taking an advanced methods course in science teaching at their respective universities. The course was set up so that half of the class time was spent in face-to-face meetings; the other half of the class time consisted of online discussions. The course was codesigned by both instructors to ensure the same syllabus and topical outline were shared, the same instructional strategies and assessments were used, and the same focus questions for the online class discussions were followed. For the online discussion portion of the course, students were randomly assigned to one of three groups: an audio conference (AC) group (synchronous spoken communication without video); a text chat (TC) group (synchronous written communication); or a discussion board (DC) group (asynchronous written communication). Each group consisted of 4-5 students in addition to the instructor. The instructor served as a moderator, facilitating the discussion. The discussion topics and focus questions were the same for each group. The discussions centered on readings from the science education literature as well as observations and experiences from the teachers' own practice.

At the culmination of the 15-week course, students had participated in six online discussions. Their perceptions of the online experience were assessed using the Constructivist On-Line Learning Environment Survey (COLLES), an instrument designed to provide information about the learning environment from a social constructivist perspective. The COLLES allows for the assessment of a student's preferred and actual online learning experiences; it contains 24 statements arranged into the following scales: professional relevance, reflective thinking, interactivity, interpretation of meaning, tutor support, and peer support (Taylor & Maor, 2000). The COLLES contains a 5-point Likert-type response scale (1 = *almost never*, 2 = *seldom*, 3 = *sometimes*, 4 = *often*, 5 = *almost always*). In this article, only students' actual online learning experiences were examined.

An ANOVA was conducted using the score on the COLLES question as the dependent variable and the assigned group (AC, TC, or DB) as the between-subjects independent variable. Following the ANOVA, a post-hoc Bonferroni was conducted to test for significant differences between the group means. The corrected alpha was set at 0.016.

FINDINGS

Table 1 presents the COLLES items found to be significant through ANOVA. The ANOVA results, along with the post-hoc comparisons are presented in this section.

Professional Relevance

The purpose of Items 1-4 was to address how relevant online learning is to the students' professional practice. ANOVA results indicated a significant difference among the groups on Item 4 (what I learn connects with my professional practice). Post-hoc analyses revealed significant differences between the TC and DB groups ($p = 0.001$) for this item. No differences were found on other items assessing professional relevance, such as "my learning focuses on issues that interest me" and "I learn how to improve my professional practice."

Reflective Thinking

Items 5-8 assessed whether the online learning stimulated critical reflective thinking. ANOVA results indicated significant differences among the groups on Item 6 (I think critically about my own ideas), Item 7 (I think

TABLE 1
Means, Standard Deviations, and Results of ANOVA Analyses Among Audio Conference (AC), Text Chat (TC), and Discussion Board (DB) Groups

COLLES Question (I found that…)	*AC Mean (SD)*	*TC Mean (SD)*	*DB Mean (SD)*	*F Statistic*	*p Value*
Professional Relevance					
4. what I learn connects well with my professional practice.n	4.00 (0.67)	4.40 (0.52)	3.50 (0.54)	5.367	0.012
Reflective Thinking					
6. I think critically about my own ideas.	3.80 (0.79)	4.30 (0.48)	3.50 (0.54)	3.838	0.035
7. I think critically about other students' ideas.	3.60 (0.52)	4.70 (0.48)	3.25 (0.46)	22.25	<0.0001
8. I think critically about the ideas in the readings.	4.00 (0.67)	3.70 (0.48)	3.00 (0.76)	5.667	0.009
Interactivity					
9. I explain my ideas to other students.	3.80 (0.42)	4.10 (0.88)	3.00 (1.31)	3.419	0.049
11. other students ask me to explain my ideas.	3.00 (0.67)	4.40 (0.52)	2.50 (0.54)	26.83	<0.0001
12. other students respond to my ideas.	3.60 (0.52)	4.10 (0.88)	2.67 (0.52)	8.341	0.002
Interpretation of Meaning					
14. other students make good sense of my messages.	4.20 (0.42)	3.70 (0.48)	4.00 (0.00)	4.271	0.025
Tutor Support					
17. the tutor stimulates my thinking.	3.80 (0.42)	4.30 (0.48)	3.50 (0.93)	3.838	0.035
19. the tutor models good discourse.	4.40 (0.84)	4.30 (0.48)	3.50 (0.93)	3.602	0.042
Peer Support					
21. other students encourage my participation.	3.80 (0.42)	3.60 (0.97)	2.75 (0.46)	5.823	0.008
22. other students praise my contribution.	3.50 (0.54)	4.00 (0.82)	2.75 (0.46)	8.427	0.002
23. other students value my contribution.	3.80 (0.79)	4.30 (0.48)	3.00 (0.76)	8.066	0.002
24. other students empathize with my struggle to learn.	3.60 (0.52)	4.30 (0.48)	3.50 (0.54)	6.937	0.004

critically about other students' ideas) and Item 8 (I think critically about the ideas in the readings). When considering one's own ideas (Item 6), post-hoc comparisons found the difference between the means of the TC and DB groups to be significant ($p = 0.002$). On Item 7, significant differences were found between the TC and DB groups ($p = 4.1 \times 10^{-6}$) and between the AC and TC groups ($p = 5.5 \times 10^{-5}$). On Item 8, significant differences were found in critical thinking between the TC and DB groups ($p = 0.015$) and between the AC and DB groups ($p = 0.004$). No differences were found among the groups on Item 5 (I think critically about how I learn).

Interactivity

Items 9-12 measured the extent to which students and instructors engaged in rich dialogue online. ANOVA results reveal significant differences among the groups on Item 9 (I explain my ideas to other students), Item 11 (other students ask me to explain my ideas), and Item 12 (other students respond to my ideas). With the Bonferroni-corrected alpha set

at 0.016, no significant differences were found between the groups on Item 9. On Item 11, significant differences were found between the TC and DB groups ($p = 5.0 \times 10^{-7}$) and between the AC and TC groups ($p = 2.7 \times 10^{-5}$). On Item 12, significant differences were found between the TC and DB groups ($p = 0.001$) and between the AC and DB groups ($p = 0.002$).

Interpretation of Meaning

Items 13-16 assessed whether students and instructors were able to coconstruct meaning in a congruent and connected manner. ANOVA results revealed significant differences among the groups on Item 14 (other students make good sense of my messages). Post-hoc analyses revealed significant differences between the means of the AC and TC groups ($p = 0.011$). No differences were found among the groups on Items 13 (I make good sense of other students' messages), 15 (I make good sense of the tutor's messages), and 16 (the tutor makes good sense of my messages).

Tutor Support

The purpose of Items 17-20 was to address how well the instructors engaged students in online learning. ANOVA results indicated significant differences among the groups on Item 17 (the tutor stimulates my thinking) and Item 19 (the tutor models good discourse). Significant differences were found between the TC and DB groups ($p = 0.015$), as well as between the AC and TC groups ($p = 0.011$) on Item 17. On Item 19, significant differences were found between the TC and DB groups ($p = 0.015$). No differences were found among the groups for "the tutor encourages me to participate" (Item 18) and "the tutor models critical self-reflection" (Item 20).

Peer Support

Items 21-24 addressed how well fellow students provided support during the online learning experience. ANOVA analyses revealed significant differences among the groups on all of the items in the peer support scale. On Item 21 (other students encourage my participation), significant differences were found between the AC and DB groups ($p = 6.2 \times 10^{-5}$). On Item 22 (other students praise my contribution), significant differences were found between the TC and DB groups ($p < 0.001$) and between the AC and DB groups ($p = 0.004$). On Item 23 (other students value my contribution), significant differences were found between the TC and DB groups ($p < 0.001$). And finally, on Item 24 (other students empathize with my struggle to learn), significant differences were found between the TC and DB groups ($p = 0.002$) and between the AC and TC groups ($p = 0.003$).

DISCUSSION

On most of the Items included in the COLLES, the TC group had the highest mean. This finding was unexpected for our subjects (adult learners) and learning tasks, since much of the research on audio conferencing and video conferencing suggest that these forms of computer-mediated communication are more effective than text chatting (Knipe & Lee, 2002). For example, it was expected that participants in the AC group would perceive their online learning environment to be of higher quality than the TC group on almost all Items included in the six scales: professional relevance, reflective thinking, interactivity, interpretation of meaning, tutor support, and peer support. However, the AC group had the highest mean on only four Items—Item 8 (I think critically about the ideas in the readings), Item 14 (students make good sense of my messages), Item 19 (the tutor models good discourse), and Item 21 (other students encourage my participation). Perhaps these results differ from the literature because students were exposed to a blended learning environment (a combination of face-to-face meetings and distance learning).

On the other hand, the DB group had the lowest mean on all but one item. This finding

is similar to other research suggesting that asynchronous discussion is not as collaborative or reflective (Dietz-Uhler & Bishop-Clark, 2001). On Item 14 (other students make good sense of my messages), DB students had a higher mean than TC students. Perhaps this result has to do with the inability to type complete thoughts in text chats. To keep up with the pace of the chat and to interject ideas at appropriate times, many students type abbreviated versions of their ideas. In that case, sometimes other students may misunderstand what the presenter is trying to convey.

The students in the TC group were not very different from the AC and DB groups on the professional relevance or the interpretation of meaning scales. On three of the four items in each of these scales, significant differences were not found among the groups. In terms of professional relevance, this result is expected since the three groups were discussing the same topics intended on improving professional practice. If anything, it was expected that students in the discussion group would have higher means on these items than found in this study. Previous research has suggested that asynchronous communication modes may give students more time to reflect and provide insight based on their professional experiences (Branon & Essex, 2001). On the interpretation of meaning scale, the one item found to have significant differences among the groups was "other students make good sense of my messages" (Item 14). Students in the AC and DB groups had a higher mean on this item than students in the TC group, presumably because of the difficulties that arise with text chats such as typing quickly, having trouble jumping into a discussion, and the slow pace of discussions.

The TC group did perceive their learning environment to be more interactive and supportive. In congruence with the literature, students in the synchronous groups found their environment to be more interactive than the DB group. However, it is unclear as to why students in the TC group rated their learning environment to be more interactive than students in the AC group. Some research has shown that text chats better foster participation among all group members; in contrast, one or two students may more easily dominate audio conferences. Or perhaps students in the TC felt less inhibited and better able to contribute their ideas than students in the AC group who may be more worried about their self-presentation. It is suspected that students in the TC group found their environment to be more supported for the same reasons. It is difficult to draw a conclusion from the items on the tutor support scale, since two different instructors were facilitating discussion. However, the TC group perceived more support from their peers on all but one item.

Finally, the TC group reported that they were thinking critically about their own as well as other students' ideas. It is possible that the slower pace of the text chat gave these students more time to reflect on the ideas presented before responding. Previous research has suggested that asynchronous discussions may be better at encouraging critical reflection; however, this study did not support that conclusion.

Implications

Distance learning can be a valuable tool in teacher education. It is becoming more and more necessary for universities to infuse online education into their teacher education programs. However, more research is necessary to learn how to best implement computer-mediated communication to prevent passive learning on the part of students. In this study of a blended learning environment, text chats were perceived to be better than audio conferences and discussion boards on the most of the items assessed by the COLLES. Comparative studies between text chats and discussion boards have corroborated many of the findings of this study (Branon & Essex, 2001; Dietz-Uhler & Bishop-Clark, 2001). With text chats, students perceive to receive more social interactions, more task support, increased convergence on meaning, and increased confidence that someone would respond to ideas. Discus-

sion boards may have their benefits when discussion is about complex ideas; however, in this study, the use of this form of communication did not appear to encourage critical reflection more so than the other environments. While the use of asynchronous discussion may be beneficial in online courses (Lou, Bernard, & Abrami, 2006), it may not be necessary in blended learning courses where online discussions are not the only means for student-to-student interactions. The same conclusion might apply to audio chats as well; the expected benefits in terms of interactivity, support, and understanding meaning may be reduced in blended learning environments with face-to face interactions. More research addressing how face-to-face interactions influence distance learning, how other technology (video conferencing and virtual worlds) influence perceptions of the online learning environment, and how understandings are socially constructed in computer-mediated communication is necessary.

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