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Facilitating Effective Online Learning: Findings from a Graduate Mathematics Education Course

Abstract: Online education at the graduate level has increased in recent years, offering students, instructors, and universities new challenges and opportunities for teaching and learning. The researchers in this study examine participant perceptions of a Master's degree program in Mathematics designed for secondary mathematic teachers. During one spring semester, survey data were collected to identify what participants believed to be successful aspects of the graduate level mathematics online course as well as areas for improvement. Using survey data, areas of strengths and weaknesses are categorized, and recommendations to instructors are made to help support teaching and learning in online graduate teacher-education courses.

Background

Distance education has allowed educators to provide new opportunities for students to pursue higher education. Educators are faced with challenges of selecting suitable learning tools to ensure students perceive positive learning outcomes and maintaining the same quality of distance learning as in traditional face-to-face settings. Synchronous and asynchronous communication tools have been in use for many years as optional forms of online communication in teaching and learning and as supplements to traditional teaching (Chen & Shaw, 2006). Students may participate, reflect, and compose ideas at a convenient time or at their own pace in an asynchronous communication environment (Zafeiriou et al., 2001). Students also have opportunities to influence the pace of instruction and to address their concerns immediately in a synchronous environment (Murphy & Collins, 1997). Both synchronous and asynchronous modes have unique features and values.

The National Science Foundation funded a grant to improve mathematics achievement in middle, secondary, and post-secondary education in the northern Rocky Mountain region to two state universities. In spring 2010, secondary mathematics teachers who were admitted to the virtual master's degree program were required to take the *Teaching Geometry* online course as indicated in the virtual master's degree program curriculum. This course was offered in an online environment. An online learning environment allows synchronous and asynchronous interactions and encounters with other participants in this study.

In order to assist instructors' teaching and students learning, the study was conducted with the purpose of to determine (a) the secondary mathematics teachers' identified aspects of the spring 2010 Mathematics Teacher Leadership Center (Math TLC) course that contributed to the course success or lack thereof, and (b) what suggestions were offered by the secondary mathematics teachers to improve this course. Recommendations to improve courses are provided after the study's results.

Method

Participants

Seventeen secondary mathematics teachers who took a graduate level mathematics course – *Teaching Geometry* – in an online setting at two universities in the Rocky Mountain region of the United States participated in this study in spring 2010.

Context: Online Course Format

The *Teaching Geometry* online course was offered at two universities in the spring 2010 semester. This course used Blackboard (a web-based course management system) and Elluminate (a suite of online audio-visual communication tools) to deliver the course. There were a total of 22 secondary teachers who took this course during a 15-week period. The instructor used Blackboard, an asynchronous platform, to post announcements, course materials, and grades, as well as to facilitate students' online interaction through discussion boards. In addition, the course relied on Elluminate, a synchronous platform, which includes text-based chat discussions and video conferencing, to facilitate real-time student interaction and communication. To meet the course requirements, students participated in weekly threaded discussions and submitted assignments by posted deadlines. Students'

participation was evaluated based on their weekly discussions in both synchronous whole group and small group sessions via Elluminate as well as asynchronous threaded discussions via Blackboard.

Instruments

The Secondary Teacher Technology Survey consisted of 35 questions. The first 29 survey items asked participants to indicate their level of satisfaction toward technology (e.g., Blackboard, Elluminate, Writing Tablets, Webcams, and headsets), asynchronous threaded discussion (Blackboard discussion board), synchronous-whole group class session (Elluminate), and synchronous-small group session (Elluminate) that they experienced in the course. These items were Likert-type items that ranged from 1 (strongly disagree) to 5 (strongly agree). In addition to the Likert scale items, six open-ended questions were asked:

1. Please describe your experience with the asynchronous threaded discussion or Blackboard Discussion Board.
2. Please describe your experience with the synchronous whole group course session or Elluminate whole class session
3. Please describe your experience with the synchronous small group session or Elluminate professional learning community session.
4. What do you like best about taking this course in the technology supported learning environment this semester?
5. What do you like least about taking this course in the technology supported learning environment this semester?
6. Any suggestions on how to improve the technology supported learning environment if the same course is offered next semester.

Procedure

Twenty two secondary teachers who took the *Teaching Geometry* course in an online setting were contacted by e-mail to indicate their willingness to share information about their online learning experiences. The Secondary Teacher Technology Survey was sent to all participants in Week 15, and 17 participants (77%) responded to the survey.

Data Analysis

From the Secondary Teacher Technology Survey, responses were calculated by using descriptive statistics and ranked for each survey item. From the six open-ended questions, a thematic analysis was conducted to identify emerging themes and patterns for responses to each question.

Results

Secondary Teacher Technology Survey

A total of 17 participants completed the Secondary Teacher Technology Survey designed for this study. The means and standard deviations for the 29 survey items were calculated and the overall mean score across the survey items was 3.90, a rating indicating a positive attitude towards online learning environments.

The three highest-rated and three lowest-rated statements on the Secondary Teacher Technology Survey are shown in a Table below. The three highest-rated statements on the survey were “My learning satisfaction is not undermined because I did possess adequate typing skills.” (M= 4.71), “I am satisfied with the quality of the online synchronous conferencing tool (Elluminate).” (M = 4.47), and “I am satisfied with the quality of the Logitech QuickCam Communicate STX Webcam that the Math TLC program purchased for me.” (M = 4.36). On the contrary, the three lowest-rated statements were “I wasted too much time sorting through my messages to find the few that are useful.” (M = 2.41), “I like the way the course is structured in terms of threaded discussions because we learn from each other.”(M= 2.53), and “Providing an orientation session would prepare me for the rigor of online learning.” (M= 2.65).

Open-Ended Questions

When participants were asked to describe their experiences with the asynchronous threaded discussion or Blackboard discussion board, three secondary teachers (18%) had positive experiences with the asynchronous threaded discussion, six of them (35%) had neutral opinions (both positive and negative), and eight (47%) had negative responses with this eCompanion discussion board.

When participants were asked to describe their experiences with the synchronous whole group course session or Elluminate whole class session, 12 secondary teachers (71%) had productive experiences with the synchronous whole group course session, 5 of them (29%) had neutral experiences, and none of secondary teachers had negative experiences with this Elluminate whole class session.

When asked, participants to describe their experiences with the synchronous small group session or Elluminate professional learning community session, 11 of secondary teachers (71%) had optimistic experiences with the synchronous small group session, five secondary teachers (29%) had neutral experiences, and none of the secondary teachers reported negative experiences with Elluminate professional learning community sessions.

When participants were asked what they liked best about this course, most of the secondary teachers appreciated the benefit of the Blackboard and Elluminate functions. Some benefits mentioned were convenience, Elluminate whole-class and small-group discussions, organized interface of Blackboard, and class interaction.

When participants were asked what they liked least about this course, some secondary teachers indicated that they lacked opportunities to interact with their instructor in this environment and felt uncomfortable with the classroom due to impersonality of this online environment. Some secondary teachers encountered technology issues such as unreliable connections and microphone problems.

When participants were asked whether they have suggestions on how to improve the technology supported learning environment if the same courses are offered next summer, secondary teachers recommended that the interface of Blackboard needed to be reorganized for easy navigating and better quality of headsets should be provided to students. Some secondary teachers suggested that having students to work in the same professional learning community groups during small group discussion was better than being randomly assigned. In addition, providing training in advance to learn how to upload file folders to Blackboard would be helpful to them.

Recommendations

According to the results reported in this study, we provide ten preliminary recommendations that instructors may need to consider as follows. Due to the limited space, more recommendations will be presented and discussed in the conference.

1. Offer more office hours per week. This might improve the instructor-student interaction to address isolation issues in learning, in making sense of material, and in working with technology. The virtual office hours can be offered via Elluminate chat, discussion group on Elluminate, or telephone.
2. Set up activities or have short quizzes available through eCompanion/Blackboard for students to test out their webcam and headsets prior to class (e.g., did your webcam work? Is your headset working?) The "quiz" answers allow the instructor/TA to identify particular people to contact to solve technical problems immediately.
3. Deemphasize the importance of participating in the online threaded discussion and ask students to participate in the threaded discussion actively. Offenholley (2006) stated that "Threaded discussions help build a sense of community, encourage higher-order thinking, and provide opportunities for peer collaboration" (p. 1).
4. Provide more activities which might increase communications among professional learning community groups during class in order to develop a sense of community.
5. Provide the course syllabus that outlines course content, objectives, timeline, clear expectations, and explicit assessment rubrics prior to course.
6. Create a "technical problem/issue board" for any students who have technical problems to report those issues on the board. For example, if students are having audio problems and reports those on the board, the teaching assistant might be able to provide students with new microphones.
7. Provide more activities to support student learning through Blackboard threaded discussion.
8. Provide a longer time scheduled of using Elluminate or switch to Skype when students need more time to continue their discussion.
9. Provide a short session of Blackboard training to students prior to classes.
10. Provide an orientation session (instructor's expectations, a Q&A session, etc.) to students at beginning of the class so students feel prepared for the rigor of online learning.

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