

A Comparison of Asynchronous Online Text-Based Lectures and Synchronous Interactive Web Conferencing Lectures

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Introduction

Online learning environments are more prevalent in teacher education than ever before. In 2009, many instructors are attempting to emulate traditional instructional methods in the online learning environment as much as possible (Shi & Morrow, 2006). Fewer than ten years ago, the use of video-conferencing or instructional television to provide a seemingly traditional classroom for distant learners was common. However, this technology required the student and instructor to attend sessions in designated rooms and therefore lacked flexibility (Rowe, Ellis, & Bao, 2006). Today's technology has evolved so that a student can access instruction from a desktop computer via web conferencing tools that simulate the traditional classroom experience. The use of audio and video in synchronous learning environments to provide interactive learning experiences for learners who participate in a variety of online classes has increased because of these easy-access web tools (Stephens & Mottet, 2008).

Online courses may be separated into two categories, asynchronous and synchronous, depending on the nature of the online tool. Instructors use these types of online tools to create a hybrid course (combination

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of online and traditional) or to develop a stand-alone online course. Few studies compare asynchronous online learning (text-based, using discussion boards) with the newer web synchronous conferencing tools (e.g., *Illuminate Live*, *Wimba Live*, *Saba Centre*, and *Adobe Acrobat Connect*).

Asynchronous Online Courses

Asynchronous courses provide learners with a flexible environment that is self-paced with learners accessing course content using a variety of tools such as CD-ROMs, streamed prerecorded audio/video web recordings, and audio podcasts. Communication and collaboration are enhanced via asynchronous discussions. Learners are not restricted to a set day/time for communicating, and it allows students more time to prepare a response to a set of directions or questions. Examples include the use of discussion groups (e.g., through discussion boards via WebCT/Blackboard or other learning management system), wikis, blogs, and e-mail. Asynchronous class sessions can provide the primary delivery format, be used in an online course along with synchronous class sessions, or serve as a supplement to traditional classes (Knapczyk, Frey, & Wall-Marencik, 2005). Instruction for online courses is typically asynchronous. Among the institutions offering online courses during 2006-2007, 92 percent reported that they offered courses using an asynchronous format (National Center for Educational Statistics, 2008). Nineteen percent used one-way prerecorded video, while sixteen percent used correspondence only (e.g., e-mail), and twelve percent used one-way audio transmissions (e.g., podcasting).

In a study comparing asynchronous lecture notes on CD-ROMs with asynchronous lecture notes on *WebCT*, Skylar et al. (2005) found that both conditions were effective in delivering instruction. No significant differences between the groups for achievement and satisfaction were found. In another study, Chen, Klein, and Minor (2008) found the use of a hybrid design using asynchronous discussions (twice a week) to be effective in discussing modeling, communication needs, and interventions in online early childhood courses. Knapczyk, Frey, and Wall-Marencik (2005) evaluated the use of asynchronous discussions/forums in a behavioral disorder method course. Feedback from students indicated that this asynchronous format provided a sense of community and increased collaboration with classmates.

Synchronous Online Courses

Many instructors attempt to emulate traditional instructional methods in the online learning environment through the use of synchronous

web conferencing lectures. In real-time synchronous courses, the instructor leads the learning, and all learners are logged on simultaneously and communicate directly with each other (Shi & Morrow, 2006). In the past, classroom video-conferencing equipment could only be housed in designated classrooms, and students and the instructor had to travel to designated sites. Today, software can be accessed from a server, and an individual can join a synchronous interactive environment from a desktop or laptop computer. Examples of synchronous online formats include chat rooms, audio/video conferencing, and two-way live satellite broadcast lectures. Among the institutions offering online courses in 2006-2007, 31% percent reported that they offered the courses in a synchronous format; nineteen percent used two-way video and audio (NCES, 2008).

Synchronous courses provide online learning environments that are very interactive and use web conferencing products such as *Elluminate Live*, *Interwise*, *Wimba Live Classroom*, *Adobe Acrobat Connect Professional*, and *Saba Centra*. Advantages of using a synchronous learning environment include real time sharing of knowledge and learning and immediate access to the instructor to ask questions and receive answers. However, this type of environment requires a set date and time for meeting, and this contradicts the promise of “anytime, anywhere” learning that online courses have traditionally promoted. Synchronous online sessions are often called web-based training, Webinar, virtual meetings, and web conferencing (Stephens & Mottet, 2008). Usually, an audio broadcast and visual presentation, similar to slides, is accessed using an Internet browser pointed to a designated web address; sometimes web tours, break-out rooms, and application sharing are also provided (2008).

Through this format, students participate using the text chat function, voice communication using a microphone, whiteboard tools, and real time surveys called polling. In Shi and Morrow’s 2006 study, instructors described polling as an essential synchronous online component to gauge student comprehension and increase student involvement in a web conferencing environment. Recently, Offir, Lev, and Bezalel (2008) found the interaction level in a synchronous class to be a significant factor in the effectiveness of the class. Reushle & Loch (2008) suggest that staff training in the technical aspects of the synchronous tools, as well as pedagogical approaches to using them, is vital for successful use of web conferencing software for online learning.

The Problem

Despite the growth in the use of synchronous tools to facilitate online instruction, little is known about how people use synchronous web

conferencing technology. The role of interactivity in web conferencing is important, particularly as it relates to its effect on student learning and satisfaction (Stephens & Mottet, 2008). Research suggests that interaction in a synchronous environment should result in increased learning. However, these arguments are more theoretical than empirically supported (Allen et al., 2004). Therefore, this research was needed to compare asynchronous online environments and synchronous web conferencing environments and their effect on the achievement and satisfaction of students.

Purpose of the Study

The purpose of this study was to compare preservice general education and special education students' performance and satisfaction in a course that used two types of online instruction. Two courses were designed to use asynchronous text-based lectures and synchronous interactive web conferencing lectures; both groups received both types of online instruction. In setting up this study in this manner, all students were exposed to both conditions, and their preferences for one condition over another were felt to be an important aspect of the study. Additionally, with both groups participating in both conditions, it was felt that this would impact their perception of computer literacy skills over the duration of the semester.

The study asked the following questions:

1. Are there differences in performance between students accessing content presented in a synchronous interactive web conferencing lecture format compared to students that access content in an asynchronous text-based lecture format?
2. Would students prefer to take an online course that uses synchronous interactive web conferencing lectures or asynchronous text-based lectures?
3. Do students perceive an increased level of technology skills when taking an online course?

Method

Participants

Forty-four preservice general education and special education students enrolled in two sections of a special education course on inclusion participated in this study. The course was advertised as a hybrid course,

so students could expect to have online components with few face-to-face sessions. The course centered on an overview of disabilities, collaboration and inclusion models, and strategies for adapting and modifying general education curriculum/materials for students with special needs. The students enrolled in these course sections during the fall of 2006. All students received both conditions: synchronous interactive web conferencing lectures and asynchronous text-based lectures. Of the 44 students in this study, 36 (82%) were female and eight (18%) were male. All students had used computers for three years or more: six students 12 years or more, 14 students 9-11 years, 15 students 6-8 years, and seven students 3-5 years. All students except one had indicated that they had access to a computer outside of school and five students indicated that they did not like completing assignments that require them to access the computer/Internet. The average age of all the students was 27.4. The youngest student was 20 and the oldest student was 53. Most students enrolled in the class sections were graduate students working on their teaching credential. See Table 1 for a summary of the student demographics.

Setting

In the study, all students received both conditions. The same instructor taught both sections with each group alternating conditions for coverage of the content based on ten chapters in the textbook. Two settings conditions were used for this study:

Table 1:
Summary of Student Demographics

Characteristic	Fall 2006
Gender	
Male	36
Female	8
Age	
Mean	27.4
Range	20-53
Use of Computer in Years	
12 yrs or more	6
9-11 years	14
6-8 years	15
3-5 years	5

n=44

Asynchronous text-based lectures. The course presentation of content was asynchronous and used the course management system *WebCT*. A typical class week included the students downloading text-based lecture notes (e.g., PowerPoint, html, Word), reading a chapter in the textbook to correspond with the lecture notes, and taking a 10-item quiz at the end of the week. All content was available for students in an asynchronous format and organized by weeks 1-10 and by textbook chapter. See Figure 1 for a sample of how the asynchronous text-based lecture notes were organized on WebCT. Students were encouraged to download the lecture notes and read the corresponding chapter to prepare for weekly quizzes. In this environment, the students did not need to be present at a set day/time in order to access online lecture notes.

Students communicated with the instructor and peers in the class via e-mail and threaded discussions. This setting was a typical format for an online course. The students were required to adhere to due dates for completion of weekly quizzes which were only available Monday 8:00 a.m. through Sunday 11:00 p.m. Quiz time limits were constrained to 15 minutes for each 10-item quiz. This condition was used for five lecture sessions for each group of students. The instructor previously taught

Figure 1:
Sample of Text-Based Lecture Materials Organized on WebCT

Week 2

2.1. Chapter 1 Lecture Notes

2.2. Chapter 1 saved in HTML

2.3. Chapter 1 saved in PowerPoint

Week 3

3.1. Chapter 2 Lecture Notes

3.2. Chapter 2 saved in PowerPoint

3.3. Chapter 2 saved in HTML

3.4. IEP Questions

3.5. IEP Questions saved in Word

Week 4

4.1. Chapter 3 Lecture Notes

4.2. Chapter 3 saved in html

4.3. chapter 3 saved in PowerPoint

this course in this asynchronous format for the past six semesters; thus, she was very comfortable with the content of the course and conditions of this setting.

Synchronous web conferencing lectures via Elluminate Live. The second learning environment consisted of real time synchronous web conferencing lectures using *Elluminate Live*. Students accessed lecture note materials in the same manner as the other condition, and they were encouraged to print these out before a synchronous web conferencing lecture. Web conferencing lectures were structured to mirror a face-to-face classroom. Every other week the groups alternated this condition. The interactive nature of this environment provided a real time virtual classroom with a variety of tools such as: two-way audio, a webcam, break-out rooms, chat window, application sharing, web tours, and students' raising hands to be called upon in the chat window.

Included in the learning environment were polling features for questioning students similar to a "traditional classroom clicker." Students selected "yes/no, True/False, A-D" responses to questions posed by the instructor, and the instructor was able to view and compile the results, as well as use this tool to review content and cue students who weren't interactive and participating. Another tool available was a whiteboard similar to a chalkboard that was commonly used to load a PowerPoint presentation; this included interactive word processing tools for writing/drawing/highlighting, etc. on the whiteboard. Finally, post-session recordings of the lectures were provided; a URL for accessing the lecture at a later time was available for students who were absent or who wanted to review the lecture again.

Web conferences were scheduled early in the week (e.g., Monday @ 4:00 p.m.-5:50 p.m.). Students had the week to review the recorded *Elluminate Live* lectures before taking a quiz by the end of the week (e.g., Sunday @ 11:00 p.m.). See Figure 2 for a sample of the web conferencing environment with the interactive features: chat window, polling, participant window, and whiteboard.

Instruments

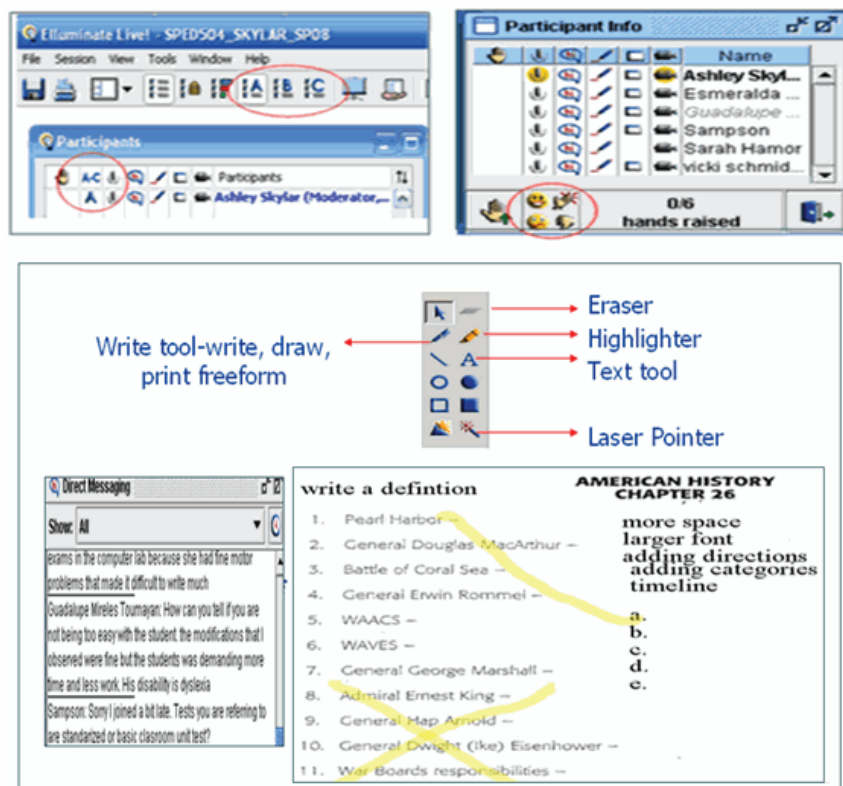
The instruments used in this study included a pretest, posttests, student satisfaction survey, and a pre/post computer literacy survey. These instruments were administered during the fall of 2006.

Student performance pretest. A 100-item pretest covering material contained in the course was administered to the students enrolled in the two sections of the course during the first class session. The 100-item

multiple-choice and true/false test was taken from the test bank that corresponds to the course textbook, *Including Students with Special Needs: A Practical Guide for Classroom Teachers* by Marilyn Friend and William Bursuck (2009), as well as from course lecture materials. Ten questions were identified per textbook chapter.

Student performance posttests. The students in both conditions were administered ten 10-item posttests/quizzes throughout the semester via WebCT with a time constraint of 15 minutes for each quiz. Each quiz corresponded to a chapter from the textbook and lecture notes. These same quiz questions were used for the pretest. The time frame of 15 minutes per quiz was tested in a previous study using ten 10-item quizzes (8 minutes, 10 minutes, 12 minutes, 15 minutes) to identify what time frame would give students sufficient time to answer all 10 questions,

Figure 2:
Sample of Web Conferencing Environment with Interactive Features



but not enough time to look up every answer if a student did not prepare for a quiz. Feedback from students indicated that they were able to review their lecture notes for 1-2 quiz items, but never the entire quiz. Due to taking the quiz in the online environment, the instructor could not control for the testing conditions of students using their notes and textbook, but could control for the time frame in accessing the quiz.

Student satisfaction survey. A student satisfaction survey was completed at the end of the semester. The survey consisted of 13 questions on a Likert scale of 1-5 with 1 “strongly disagree” and 5 “strongly agree.” Three questions asked students about their preferences with asynchronous and synchronous methods: (1) students’ preference in taking a class using synchronous web conferencing lectures or asynchronous text-based lectures, (2) whether students felt they performed better on weekly quizzes/posttests when synchronous web conferencing lectures were used, rather than asynchronous text-based lectures, and (3) whether students felt that using synchronous web conferencing lectures increased their understanding of the course material in addition to using the text-based materials. The other ten questions focused on student satisfaction with various features of the synchronous web conferencing environment (audio, chat window, polling questions for review of content, and whiteboard tools). These items are not reported here as these were meant to inform the researcher of the students’ perception of the functionality of the tools in the web conferencing environment.

Pre/post computer literacy survey. The survey consisted of 13 items accessing students’ perceptions of their computer literacy skills in the following areas: (a) level of technology, (b) use of word processing, (c) downloading information, (d) use of e-mail for communication, and (e) use of computer software. The questions used a Likert scale of 1-5 with 1 indicating “no experience” and 5 indicating “advanced.” There were also five additional open-ended questions inquiring whether students had access to computers outside of school, the number of years using a computer, and whether they like to use a computer/Internet to complete school assignments, etc. The survey was administered at the beginning of the semester and at the end of the semester.

Procedures

Forty-four students enrolled in two sections of an online special education course in the fall of 2006. The course catalog identified dates of synchronous online meetings and two on-campus meetings (first and last class session). All students were asked to participate in the study

during the first class session. During this session students signed an informed consent form, took a 100-item pretest, and completed a computer literacy survey. They also learned how to access course content/quizzes online, turn in assignments electronically, communicate in a threaded discussion, viewed how to access and load the synchronous web conferencing lectures, and were made aware of the hardware requirements (speakers, microphone) needed to participate in the web conferences.

Throughout the online sessions in the semester, each group alternated conditions while covering the ten chapters in the textbook. For example, Group 1 had an asynchronous text-based lecture for Chapter 1, while Group 2 had a synchronous web conference lecture for Chapter 1. The following week Group 2 had an asynchronous text-based lecture for Chapter 2, while Group 1 had a synchronous web conference lecture for Chapter 2. Each student took five posttests under each condition. Regardless of the condition, students had a maximum of seven days for accessing each posttest/quiz.

The organization of the bi-weekly synchronous web conferencing lectures allowed for 15 minutes of organizational business that included previewing previously learned material, answering questions about assignments, and taking attendance. These are all common strategies that are commonly used in a traditional face-to-face lecture. New content was presented for approximately one hour and 35 minutes and recorded. The instructor logged into the web conference 15 minutes before the start of each session to test audio, load the PowerPoint presentation, and answer questions about assignments. It important to note that in the preparation of the PowerPoint slides for each web conference lecture, the instructor embedded M/C, Yes/No, or open-ended questions every 3-4 slides (every 10 minutes) in order to increase the interactivity/engage students in the session. Research has shown that increased interactivity enhances students' satisfaction with the learning environment (Stephens & Mottet, 2008). The interactivity of the students in a synchronous web conference lecture is critical to employ strategies that encourage interaction to allow students to feel socially present in the lecture (2008). In setting up this alternating treatment design study, each student had the experience of asynchronous text-based lectures and synchronous web conferencing lectures.

Results

In this study, 44 students enrolled in two sections of an online class in the fall of 2006. All students participated in both conditions in this alternating treatment design. Data were collected in the form of a pre-

test, posttests, a student satisfaction survey, and a computer literacy survey.

Student Performance Tests

Research question one examined differences in performance among students accessing content presented in a synchronous interactive web conferencing lecture format and an asynchronous text-based lecture format. A 100-item pretest was given to all students at the beginning of the study. Throughout the study all students took weekly 10-item quizzes covering the 10 chapters in the textbook. A Scantron machine scored the pretest, and the 10 posttests were scored in the *WebCT* environment. Twenty-five percent of the pretests and posttests were selected randomly and scored manually to ensure scoring reliability.

The overall mean for both groups who accessed synchronous web conferencing lectures was 40.19 (Group 1=39.95, Group 2=40.42), as compared to asynchronous text-based lectures which was 38.45 (Group 1=39.65, Group 2=37.25). The maximum points students could have received for each condition was 50 points (five 10-item quizzes). Results from the means for group 2 suggest that students' performance was slightly improved when provided with synchronous web conferencing lectures vs. only asynchronous text-based lectures by 3.17 points (See Table 2). Group 1 did not show improvement across both conditions (.3). However, neither condition showed significance to indicate that one condition was more effective than the other. The results of this analysis suggest that both types of lectures (asynchronous text-based and synchronous web conferencing) were effective in delivering online instruction.

Student Satisfaction Survey

Research question two focused on whether students would prefer to

Table 2:
Summary of Means and Standard Deviations for the Posttest Items for Both Conditions

	<i>Synchronous</i>			<i>Asynchronous</i>		
	<i>Web Conferencing</i>			<i>Text-Based</i>		
Group	n	SD	Mean	n	SD	Mean
Group 1	20	3.634	39.95	20	6.226	39.65
Group 2	24	5.602	40.42	24	6.002	37.25
Total	44	4.618	40.19	44	6.114	38.45

take an online course that uses synchronous interactive web conferencing lectures or asynchronous text-based lectures. Descriptive statistics were calculated for each survey item (13) on a 5-point Likert scale with 1 indicating “strongly disagree” to 5 indicating “strongly agree.” Forty-one of the 44 students completed the survey. Of the 13 survey items, three items were used to answer this research question.

Results for these three items were: (a) 73.2% (30) of the students would prefer to take an online course which uses synchronous web conferencing lectures rather than an online course which uses asynchronous text-based lectures, (b) 87.8% (36) of the students felt that participating in synchronous web conferencing lectures increased their understanding of the course material, in addition to using the text-based lecture materials, and (c) 80.5% (33) of the students felt that they performed better on weekly quizzes when synchronous web conferencing lectures were used to present the material rather than using asynchronous text-based materials only to prepare for quizzes (See Table 3). Some additional insight into their satisfaction was provided by qualitative comments on the survey: for example, “I enjoyed the web conferences; the web conferences helped me tremendously for both understanding of the text and taking the tests”; “WebCT lectures were very flexible, and it was my first time in an online class, it showed me that I can still effectively learn materials outside of a traditional lecture.”

Table 3:
Detailed Analysis of Three Satisfaction Survey Items
on a 5-Point Likert Scale

Satisfaction survey items involving web conferencing (WC)	1-SD	2-D	3-N	4-A	5-SA	Mean
1. Preference to take a class using synchronous WC lectures rather than text-based lectures	7.3 %	4.9 %	14.6 %	17.1%	56.1 %	4.10
2. Use of WC lectures increased understanding of the material	0%	2.4%	9.8%	58.5%	29.3%	4.15
3. Performed better on quizzes when WC lectures were used	2.4%	4.9%	12.2%	26.8%	53.7%	4.24

Note: The 5-point Likert scale was used. 1-SD (Strongly Disagree), 2-D (Disagree), 3-N (Neutral), 4-A (Agree), 5-(Strongly Agree). Percentages of students are reported on the scale.

Computer Literacy Survey

Research question three examined students' perceptions on whether they felt an increased level of technology skills over the semester (16 weeks) while enrolled in the online course. Throughout the author's seven years of experience in teaching classes using a variety of online formats, students have articulated an improvement in their technology skills while enrolled in the online classes. To answer this question, survey items were developed on a 5-point Likert scale with 1 indicating "no experience" to 5 indicating "advanced." Of the 13 survey items, one item asked students to rate their level of technology skills at the beginning and at the end of the semester. Thirty-nine of the 44 students filled out the pre/post literacy survey. A paired samples analysis of the test item indicated that there was a significant difference in the students' perception of their technology skills over the course of the semester ($p=.000$). The pretest mean score of the students in both groups was 3.14 and the posttest mean score of the students in both groups was 3.69 (See Table 4). Twelve survey items addressed specific technology skills (e.g., downloading materials, use of word processing, use of e-mail, use of computer software, etc.). The overall pre/post means for these twelve items showed an improvement in students' perception of these specific technology skills over the course of the semester (Pre=3.29, Post=3.75).

Discussion

The purpose of this study was to investigate whether asynchronous and synchronous online instruction resulted in differences in student performance, student satisfaction, or student perception of their technology skills. Forty-four preservice general education and special education

Table 4:
Summary of Means and Standard Deviations for the Pre/Post
Item for Both Conditions Measuring Students' Perception
of their Level of Technology Skills

Item	<i>Pre</i>			<i>Post</i>		
	n	SD	Mean	n	SD	Mean
Perception of level of technology skills over the course of the semester	39	.644	3.14	39	.655	3.69

Note: A 5-point Likert scale was used. 1-"No Experience" to 5-"Advanced"

students received instruction in two different types of online learning environments (asynchronous text-based lectures using WebCT and synchronous web conferencing lectures using *Elluminate Live*). The results of this analysis suggested that both types of lectures are effective in delivering online instruction. In addition, almost three-fourths (30 of the 41 students) of the students indicated that they would rather take an online course that uses synchronous web conferencing lectures than an online asynchronous text-based lecture course. This finding suggests the importance of interactivity on student satisfaction in a course. Lastly, the research study supports the finding that students participating in an online course perceive an increased level of their technology skills.

Limitations

Several limitations to this study should be noted. First, the study only assessed a limited sample size (44 students) across two instructional environments. Second, students in the online sections were required to attend class on-campus at the beginning and end of the semester; therefore, the courses were not completely online and this may have influenced the results. Third, while every effort was made to ensure that both course sections received the same quality of instruction, they did not participate in identical sections, and this may have inadvertently influenced the data. Fourth, instrumentation in this study relied heavily on self-reported data, a measure which has been shown to have inherent flaws of participant bias and within-group variability. Finally, between group differences were not analyzed as both groups were exposed to both conditions. Nonetheless, the data indicated a comparison between two types of online instruction (asynchronous text-based materials and synchronous web conferencing lectures) and provides research to support educating students using online instruction with newer multimedia technologies that are interactive using an array of tools and conducting more exacting research on its effectiveness.

Implications for Further Research

Research concerning online instruction has focused on areas taught via instructional television, CD-ROMs, digital video, and online formats (*WebCT*, communication tools). However, research concerning the use of newer multimedia technologies, such as interactive synchronous web conferencing tools, is in its infancy and needs further and continued study.

Second Life, *Eluminate Live*, *Wimba Live*, *Saba Centre*, and *Adobe Acrobat Connect* are examples of synchronous online environments. Various research components of these environments might include mea-

asuring: (a) the performance and satisfaction of students in these newer environments; (b) the level of interactions and strategies used between the students and peers; (c) the variety of activities; (d) qualitative data in the form of interviewing students and instructors and chronicling their experiences over time; and (e) the level of technological support/barriers instructors and students encounter. As instructors use these newer online environments, it is important that research continues to explore the overall effectiveness of these environments as an instructional tool in education. The results from this study may indicate a paradigm shift in the way online courses should be taught and provide support in using synchronous web conferencing interactive lectures to emulate traditional face-to-face lectures.

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