A CASE STUDY OF STUDENT SATISFACTION AND INTERACTION IN A DISTANCE EDUCATION COURSE[1]

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Abstract

The growth of distance education course offerings is an indication of its importance to students; however, criticisms have centered on its lack of ability to provide interaction among participants. This case study utilized a mixed methods approach to examine the assumption that an increase in interaction increases student satisfaction among distance learners in an applied animal genetics course delivered by interactive compressed video (ICV) technology to five far-end sites from a major land-grant university in the Northeast. A standardized questionnaire, interviews, and observations were utilized to assess interaction and student satisfaction among students. Students at all sites were satisfied with the course, although not overwhelming so due to technical limitations and failures. Students were very satisfied with the number and variety of opportunities for interaction provided in the course. The most frequent and enjoyable type of interaction was face-to-face communications with site facilitators. Recommendations for improving the course included providing advanced organizers to students, more time for questions and answers during the lecture, and resolving technology limitations and failures. Future research should examine social accountability as a factor for increasing interaction in ICV courses as well as a rationale for providing synchronous courses.

Introduction

Distance education, where the student and instructor are separated by place or time or both (Cyrs, 1996), has a long history in the United States tracing back to 1728 (Holmberg, 1983). With the advent of two-way audio and video technologies distance education course offerings have increased significantly in the United States over the past few years. Students can earn Bachelor's, Master's, and Doctor of Philosophy degrees without ever stepping foot on campus. An emerging use for distance education is resource sharing among campuses. As federal and state funding disappear in higher education many departments are exploring avenues for offering students a quality curriculum while reducing costs. Such is the situation in the Northeast where members of a regional consortium teamed up to offer a course in applied animal genetics to students at five campuses synchronously via interactive compressed video (ICV) technology and one campus asynchronously (videotaped).

As colleges and universities gear up to meet the needs of distance education students, faculty and administrators have questioned educational effectiveness of distance technologies. Can students learn when they are physically separated from their instructor? This question has been addressed by a plethora of literature that shows no significant difference between learning outcomes when grades are used to measure performance between near- and far-end students (Russell, 1992), therefore faculty are turning toward student satisfaction issues as measures of distance education success. Student satisfaction criterion can be used to judge the effectiveness of a course and is an important element for providing feedback to faculty for improving future distance education courses (Biner, 1993). Yet a research base for this significant variable has not been well established, particularly in animal science courses.

Theoretical Framework

Interpersonal interaction has been cited as the crux of significant learning for nearly a century, so much so that success in the educational environment is positively correlated to interaction (Garrison, 1993; Stanford & Roark, 1974). Learning theory indicates that students perform better and remember more when they interact within the learning environment (Oliver & McLoughlin, 1997; Wagner, 1993). With the advent of interactive compressed video (ICV) technology, which allows for two-way audio and video transmission, distance educators are able to incorporate fully interactive design techniques into the teaching and learning environment. Researchers have hypothesized that fully interactive classrooms will lead to increased learning outcomes in terms of quantity and quality of questions asked and answered (Bauer & Rezabek, 1992; Boverie, et al. 1997; Sholdt, Zhang, & Fulford, 1995).

Moore (1989) held that interaction is the key theoretical construct in distance education and distinguished between learner-content, learner-instructor, and learner-learner interactions. Reciprocity is necessarily built into Moore’s theory in that interaction is both unidirectional and bi-directional. Learner-content interaction occurs when a student reads a book, views pre-recorded videotape, or in some way interacts with inanimate learning resources. Learners engage in an internal didactic conversation (Holmberg, 1983) in order to master the content. Learner-instructor interaction is what differentiates self-study from distance education. The instructor provides learners with a curriculum for mastering content and communicates with learners throughout the course. Learner-learner interaction

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takes the form of group projects and Internet-based discussion boards.

Hillman, Willis, and Gunawardena (1994) added learner-interface interaction, the concept of interaction that occurs between the learner and technologies used to deliver instruction to Moore's (1989) framework. Hillman et al. (1994) argued that a student's skill with the communication medium necessary to participate in a distance education course is positively correlated with success in that course. In order to gain any meaning from the course content the student must be literate in the communication medium's rules of interaction. This study investigated interaction from Moore's (1989) and Hillman's et al. (1994) theoretical base.

Purpose and Research Questions

The major purpose of this study was to examine the assumption that an increase in interaction increases student satisfaction among distance learners. The study was guided by three research questions:

1. Were students satisfied with the distance education course?
2. How did the level and quality of interaction impact student satisfaction with the distance education course?
3. What was the relationship between student satisfaction and synchronous interaction in the distance education course?

Methods

Data Collection and Analyses Procedures

The study used a mixed methods approach, incorporating both qualitative and quantitative data collection and analyses methodologies. A standardized questionnaire, interviews, and observations were utilized to assess interaction and student satisfaction among students. Simply defined, a case study is "an empirical inquiry that: Investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (Yin, 1984, p. 23). Case studies are intended to catch the intricacies of a particular event, program, individual, or place. One of the most important uses of the case study is to "*explain* the casual links in real-life interventions that are too complex for the survey or experimental strategies". A second goal of the case study is to *describe* the context in which interventions occur (Yin, 1984, p. 25, emphasis in original).

Student satisfaction was measured with the Telecourse Evaluation Questionnaire (TEQ), a 43-item Likert-type sale (Biner, 1993). This instrument was developed with test construction standards consistent with test development in the field of educational and industrial psychology (Biner, 1993). The instrument was organized into three dimensions: 1) instruction/instructor characteristics, 2) technological characteristics, and 3) course management and coordination.

Qualitative and quantitative data collected for analyzing interaction were based on researcher-participant observations, in-depth semi-structured interviews with students (N=47) and faculty (N=5), and postings to the course discussion board. Videotaped recordings of all course sessions were captured and analyzed for quantity of interaction between students and instructors, and students and students. Measures for interaction between groups consisted of quantifying the number of questions posed by individuals during the live lecture and the number of times a student posted a comment to the discussion board.

All students were invited for interviews via e-mail. Students who responded to the invitation were interviewed between mid-October and mid-December, 1998. An interview schedule was developed and used during face-to-face interviews. Further questions evolved during the interview process as the researcher attempted to understand why students did not fully engage in the various types of interaction provided in the course. Interviews lasted no longer than one hour each and were audiotaped, transcribed, and coded following Miles and Huberman's (1994) suggestions for qualitative data analysis. Because of their focus on a particular situation case studies do not seek to make statistical generalizations, rather they rely on analytical techniques and are limited in their ability to generalize to a greater population (Yin, 1984).

Course Context

Applied Animal Genetics was designed as a capstone seminar for animal science majors. The purpose of the course was to expose students to the genetics industry through 12 seminars, which presented current research being conducted in the field. Seminar topics included genetic definition and control of qualitative and quantitative traits, genetic conservation, and new developments in molecular genetics. Speakers from across the United States and Canada were practicing geneticists who presented their research projects as compelling examples of science in action. Opportunities for interaction within the course context were provided in five forms. 1) Ten minutes were allotted at the end of each lecture to pose a question directly to the speaker from all sites. 2) A discussion board was linked to the course web site where students and guest speakers were invited to participate. 3) Most students had access to e-mail and were advised to communicate with site facilitators regarding content related questions. 4) Luncheons with guest speakers were provided at the near-end site. 5) Face-to-face interactions with site facilitators

occurred within the context of normal interactions between students and professors at traditional campus-based universities.

The course was also supported by an extensive Internet web site that contained links to a student photo gallery, course outline, course rules and abstract information, journal articles (accessed through Adobe Acrobat reader), contact information for all site facilitators, and a link to the discussion board. Near-end students could also access their current standing in the class through the web site.

The near-end class was held in a newly constructed building designed specifically for offering courses at a distance with ICV technology. Classrooms at far-end sites were equipped with ICV conferencing equipment that ran at 384 kilobytes per second (kbps). One site used ICV conferencing equipment at 128 kbps. Far-end sites employed some technical help in connecting to the bridging service each week, but site facilitators were primarily responsible for managing communications between sites.

Findings

Participants

Participants in this multi-site study included all students (N=81) and site facilitators (N=5) receiving the course fall 1998. Seventy-three students (90%) (of whom 20% were male and 80% were female) and five site facilitators agreed to participate in the study. The average age of the cohort was 21.7 years and the average number of years in college was 3.6 years. None of the students had participated in a distance education course prior to this one.

Interaction

Students were satisfied with the level and quality of interaction that they received in this course and found it to be consistent with other on-campus courses. Their expectations for interaction were generally met through four types of interaction offered in this course (live broadcast, discussion board, e-mail, and face-to-face interaction with site facilitators). Students were most satisfied with the time that they spent observing and participating in the broadcast. Students valued content experts' knowledge and responses to questions posed during the live broadcast as well as on the discussion board. Students sited the quality of interaction as excellent.

Participating in a synchronous (live) distance education environment was far superior in students' minds than receiving the same course videotaped. The effect of receiving the course synchronously served to heighten students' overall sensory awareness of their environment and motivated students to pay attention to the speaker. Students reported that the value of synchronous interaction with the guest speakers was high and that receiving the course live increased their satisfaction. Other students contributed to the learning environment by posing interesting questions for all to hear.

Several factors contributed to student dissatisfaction with interaction in the course. They included technology failures at far-end sites (which occurred during 36% of the broadcasts), the short amount of time allotted for questions and answers at the end of the period (a total of 10 minutes), lack of participation by other students, and the fact that the 40-minute presentation could not be interrupted for questions.

Student Satisfaction

Descriptive statistical analysis of the TEQ administered to students at the conclusion of the course provided quantitative data regarding students' level of satisfaction. Of the 81 students who completed the course 61 (75%) completed and returned the TEQ. The TEQ asked students to respond to each question using a 1-5 Likert-type scale, 1 being very poor and 5 being very good. Had the student rated each question as 5 (very good) the total score would be 175. For ease of interpreting results a letter grade was assigned for each dimension of the TEQ based on total points possible. Grades assigned followed the traditional format for a five point grading system using 90% and above as A, and so forth. The results of the data analysis for the TEQ are presented in Table 1.

The TEQ was broken down into three distinct facets: instruction/instructor characteristics, technological characteristics, and course/program management and coordination. Of these three facets, students were most satisfied with the instruction/instructor characteristics, followed by course/program management and coordination. Students were least satisfied with technological characteristics of the course. These findings were verified through face-to-face interviews. Students reported that the variety of guest speakers was what they liked most and technological failures were what they liked least about the course.

When asked to compare this course with a conventional non-distance course, students rated applied animal genetics as average to good (3.44 on a five-point Likert-type scale). Overall they reported that the course merited a C grade, or earned 75% of the total possible points for excellence with a standard deviation of 20.16 points. A strong measure of student satisfaction can be determined by asking students if they would enroll in another distance education course after having experienced the course under study (Biner, 1993; Leverenz, 1979; St. Pierre & Olsen, 1991; Tallman, 1994). Eighty-eight percent of students said that they would enroll in another distance learning course.

Table 1.
Total cohort data for student satisfaction as measured by the TEQ.

Facet of Telecourse Satisfaction	N	Score	St. Dev.	Possible Score	Grade %
Instruction/Instructor Characteristics	61	63.49	9.87	80	79-C
Technological Characteristics	61	22.67	5.28	35	65-D
Course/Program Mgt. and Coordination	61	37.29	7.72	50	75-C
Overall the course was: [1]	58	4.07	0.83	5	80-B
Compared to a conventional course this course was:[1]	61	3.44	0.80	5	70-C
Workload: [2]	61	3.23	0.64	3	100-A
Would you enroll in another DE course?	60	0.88	0.32	1	88-B
Total TEQ	61	130.75	20.16	175	75-C

[1] 1=Very Poor, 2=Poor, 3=Average, 4=Good, 5=Very Good
[2] Workload: 1=too light, 2=moderately light, 3=just right, 4=rigorous, 5=too great

According to data collected during student interviews (N=47) students at both near- and far-end sites were satisfied with the course, although not overwhelming so due to technical difficulties and failures. Students enjoyed the content of the course and were pleased with the opportunity to participate in a learning community that reached beyond their respective institutional boundaries. The most significant satisfier was the breadth and variety of topics presented by guest speakers followed by the opportunity to ask questions immediately following the broadcast. The most important dissatisfiers were ICV technology limitations and failures.

Offering the course simultaneously to near- and far-end sites did not reduce near-end student satisfaction, in fact, many near-end students reported that hearing other students' questions during the question and answer session was an added value to the course. Near-end students reported that they felt sympathetic toward far-end students because of the number of technical difficulties that were encountered during the semester. One area if dissatisfaction for near-end students was knowing that the far-end sites did not receive the same experience as they did in terms of quality or entirety of the broadcast when there were technology failures as well as time wasted during technology failures.

Students were very satisfied with the number and variety of opportunities for interactions provided in the course. The most important interactions occurred during the broadcast and the 10-minute question and answer session each week. The most frequent type of interaction was face-to-face communications with site facilitators at near- and far-end sites. The discussion board proved to be important for providing content to a minority of students and an obligation for the majority who did participate on it. E-mail was regularly used at the near-end site for submitting abstracts to site facilitators, who in turn provided meaningful feedback to students through this medium.

The student-professor relationship experienced by the majority of students was reported to be a critical factor in overall satisfaction with the course. As was expected and encouraged by course owners, each site functioned essentially as a mini-class, which was supported by an animal science professor. Course credit was awarded by each host institution, thus students were entirely accountable to local site facilitators for assignments, interaction, and evaluation.

Institutionalization of applied animal genetics at host universities resulted from site facilitators' taking ownership of the course where the course was utilized to suite a variety of institutional needs. The near-end site used the course as a capstone seminar in animal genetics, which required an introductory genetics course as a prerequisite. Plans are in place to adopt the seminars as a one-credit component of a three-credit introductory animal genetics course at two far-end sites. One far-end site will use the seminars as an enrichment experience for an honors section of a genetics course.

Recommendations For Improving Interaction

Recommendations for improving interaction in the course are categorized into six domains that relate to course design and technology improvements. They are:

1. Advanced organizers: Site facilitators should provide students with material that covers a base line understanding of concepts that will be presented during the course. Students should be given a glossary of terms so that they can become familiar with terminology prior to the course. Providing students with the journal articles and Power Point slide presentations at the beginning of the course is also recommended. This information can be delivered via the Internet course web site and downloaded by students and site facilitators at near- and far-end sites.
2. The discussion board: A minimum number of postings on the discussion board should be required for all students who enroll in the course. Site facilitators should work with students to ensure discussion board competency as a pre-requisite for enrolling in the course.

Students and site facilitators should engage in more didactic interactions by discussing issues that have no absolute answers. Students should be encouraged to take intellectual risks when posting questions and comments on the discussion board and to explore more creative dialogue with peers and site facilitators. Content experts should attempt to engage students in debates rather then providing direct answers to questions posed. Students should fill out the biographical information requested by the discussion board program when registering so peers can learn more about each other's interests. This may serve to stimulate student-to-student interaction.

3. More time for questions and answers during the live lecture: There should be more time provided for question and answers at the conclusion of the lecture. The 10 minutes for questions and answers provided fall 1998 was inadequate for all sites to pose meaningful questions. The time slot should be expanded to 60 minutes, where 40 minutes are dedicated to the presentation of new content and 20 minutes are dedicated to student questions and answers.

4. Speaking protocol: A time generous interaction protocol should be established and maintained for ICV tele-courses. Near-end site facilitators should give more time to each site for asking and answering questions due to the nature of ICV mediated interactions. More than one round of questions should be implemented to ensure that all students have an opportunity to pose questions. Often a student's question would stimulate another question from a site that had already been called on; thus the opportunity for asking that question was lost. Near-end site facilitators should require near-end students to use the microphone when posing questions so that all sites can hear the questions. The order of schools called on for questions should remain consistent each week versus a rotating order. The predictability of knowing that your site is always second may serve to increase the level of questions as students won't be caught by surprise when their site is called on.

5. Guest speakers: Near-end hosts should coach guest speakers in delivering pedagogically appropriate content at a distance. Many of the speakers were not university instructors; thus they have had little experience delivering lectures to undergraduate students. Some lectures were delivered at a content level that was above the comprehensible knowledge base of the audience. The Power Point presentation created by guest speakers should be reviewed in advance by hosts for clarity and comprehensibly of concepts presented. Guest speakers should also be coached on distance teaching techniques and etiquette, such as presenting graphical information that is clear and plainly displayed, as well as acknowledging far-end students as part of the learning community, not simply spectators. Guest speakers should be given a tip sheet for presenting over ICV systems.

6. Technology issues: Technology glitches should be resolved prior to offering courses at a distance. Fifty percent of the technology failures were caused by human error at the bridge site. A professional bridging service should be hired to facilitate ICV courses. Site facilitators and control room operators should master the ICV system to the extent necessary for smooth operations prior to the start of the course.

Implications and Discussion

Recent research in distance education has focused on the attributes of ICV technology that allows for synchronous two-way audio and visual interaction. However, the results of this study indicate that ICV technology is not fully interactive. This study showed that using ICV technology to deliver the course resulted in near-end site facilitators restricting interaction during the live broadcast because of inherent technology limitations. During successful broadcasts participants experienced delays in communications, visibility problems and a low quality image of graphical displays used by speakers. Technology failures caused by bad weather and human error at the bridging service accounted for loss of interaction 36% of the time. ICV technology advocates need to address these limitations, as results of this study clearly indicate that ICV technology served to inhibit interactions rather than promote them.

One of the purposes of this study was to examine the assumption that an increase in interaction increases student satisfaction among distance learners. The variety of opportunities for interaction provided in this course did serve to increase student satisfaction, if not actual interaction. Key constructs that surfaced in the present study for explaining the relationship between interaction and student satisfaction were *vicarious interaction* (Fulford & Zhang, 1993; Zhang & Fulford, 1994) and *anticipated interaction* (Yarkin-Levin, 1983). Students reported that listening to the lectures and other students ask questions increased their satisfaction with the course. Direct participation in the question and answer session and the discussion board was not necessary for learning, nor was it as satisfying as watching and listening to others participate. If students are satisfied by learning vicariously and through anticipated interactions (imagined), then who will ask questions during the question and answer session as well as post questions to the discussion board? Future research on interaction and student satisfaction should focus on the factors that motivate and stimulate students to openly participate in the learning environment.

Distance education students learn equally well using asynchronous learning modalities at a fraction of the cost of satellite or ICV technologies (Leverenz, 1979; St. Pierre & Olsen, 1991; Tallman, 1994). As course providers strive to increase interaction in the distance education classroom, consideration should be given to institutional costs as well as perceived student benefits when students are content to adopt a voyeuristic posture in the course. Colleges and universities must determine if they are investing wisely in synchronous, fully interactive technologies (satellite and ICV) to the extent that students are willing to participate in real-time interaction. The perceived educative value

of receiving the course synchronously was high for far-end students, as were the real costs to participating institutions in this study. Students who received the course live at far-end sites speculated that they would not have enjoyed the course had they received it videotaped. However, students who did receive the course videotaped were as satisfied with the content and the level of interaction as were synchronous sites. More empirical evidence should be gathered to demonstrate the superiority of synchronous delivery over asynchronous delivery in terms of quality of interaction and student satisfaction in the classroom, especially those courses that are supported with site facilitators who are also content experts.

In this study far-end students reported feeling socially accountable to guest speakers, knowing that they could be seen through the ICV system. Students reported that receiving the course live heightened their sensory awareness and they were more apt to pay attention and model appropriate behavior during the live lecture than if the course was provided videotaped. The social accountability phenomenon has not been reported in the distance education literature as a factor for student satisfaction or as a rationale for providing live, interactive courses. This factor alone may justify the costs of providing live, fully interactive courses to students who are able to participate in them (i.e. students who are not time- or place-bound). As a rationale for providing synchronous courses future research should examine empirical evidence that social accountability is indeed a factor for increasing interaction in the distance education environment.

Another rationale for provided live, interactive courses is resource sharing among partnering institutions. This particular course served to expand the animal genetics curriculum that was not available to the five far-end sites and served over 80 students in the Northeast region, with plans in place to expand offerings to the western United States. In time, the number of students served will increase as participating universities continue to adopt modules of the course as additional curriculum material in introductory genetics courses. Although ICV technology failures and limitations limited interaction, this modality of course delivery should be considered successful for providing an invaluable resource to students who would not have access to this material otherwise.

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