

A CASE STUDY OF BARRIERS TO INTERACTION IN DISTANCE EDUCATION²

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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 qualitatively examined barriers to interaction in an animal genetics course delivered through interactive compressed video (ICV) technology from a major land grant university to five universities in the Northeast. The purpose of the study was to analyze and describe student perceived barriers to interaction in a distance learning course. Qualitative data collection methodology included face-to-face interviews with students and site facilitators and participant observations to assess interaction among students at all sites. Barriers to interaction centered on social concerns, ICV technical limitations, lack of time, content related issues, camera shyness, site facilitators' behavior in facilitating interactions, needing more time for processing content, lack of non-verbal clues, distance, and having to press the microphone mute control knob. All ten barriers served as dissatisfiers for students. Recommendations for improving interaction within the course include resolving technical limitations and failures. Course providers should also consider delivering courses using low-cost options such as web-based courses in light of the limited interaction observed in this course. 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/Theoretical Framework

Distance education, where the student and instructor are separated by place, time or both has a long history in the United States tracing back to 1728 when Caleb Phillipps advertised a shorthand course in the March 20th edition of the Boston Gazette. Phillipps sent weekly lessons to adult students using U.S. mail services (Holmberg, 1995). With the advent of two-way audio and video technologies, distance education course offerings have increased significantly. Students can earn bachelor's, master's, and doctor of philosophy degrees without ever stepping foot on campus. The growth of this educational medium over the past 20 years is an indication of its importance in meeting the needs of students who either cannot or choose not to attend traditional campus-based courses. Yet we do not fully understand how interactions mediated through technology facilitate student learning outcomes. This evaluation study examined one aspect of the distance learning environment: student perceived barriers to interaction in a course that was offered simultaneously to five land-grant universities in the Northeast.

An emerging use for distance education is resource sharing among campuses. As federal and state funding sources disappear, many departments are exploring avenues for offering students a quality curriculum while reducing costs. One option has been to exchange course offerings between campuses using interactive compressed video (ICV) technology. With the advent of ICV technology, which allows for two-way audio and video communication between the teacher and student, distance educators are able to incorporate fully interactive design techniques into the teaching and learning environment. Researchers have hypothesized that increasing opportunities for interaction will lead to an increase in actual interaction because students will ask more questions (Bauer & Rezabek, 1992; Boverie, et al., 1997; Sholdt, Zhang & Fulford, 1995).

Interpersonal interaction has been cited as the crux of significant learning for nearly a century (Garrison, 1993; Stanford & Roark, 1974). Learning theory indicates that students perform better and remember more when they interact within the learning environment (Wagner, 1993). Moore (1989) held that interaction is the key theoretical construct in distance education and distinguished between learner-content, learner-instructor, and learner-learner interaction. Reciprocity is necessarily built into Moore's theory in that interaction is both unidirectional and bidirectional. Learner-content interaction occurs when a student reads a book, views a prerecorded 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 the learner with a curriculum for mastering content and communicates with the learner throughout the process. Learner-learner interactions take the form of group projects and Internet-based discussion board activities.

Learner-interface interaction, the concept of interaction that occurs between the learner and technologies used to deliver instruction (Hillman, Willis & Gunawardena, 1994), was also examined in this study. A student's skill with the communication medium necessary to participate in a distance education course is positively correlated with

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success in that course. Students must be literate in the communication medium's rules of interaction to gain meaning from the course content. This study used Moore's (1989) and Hillman's et al. (1994), framework for interaction by examining how students interacted with guest speakers, site facilitators, content, and each other through an electronic medium.

Purpose and Objectives

The purpose of this case study was to identify and describe student perceived barriers to interaction in an applied animal genetics course delivered through interactive compressed video technology from a major land-grant university (near-end site) to five distance sites (far-end).

Specific objectives for the study were:

1. To describe the context and setting of the course, including opportunities for interaction provided to students using the case study approach.
2. To describe student perceived barriers to interaction qualitatively through face-to-face interviews with students and observed interactions.
3. To analyze interview responses thematically that detail student perceived barriers to interaction.

Methods and Procedures

Data Collection and Analyses Procedures

Qualitative case study methodology (Merriam, 1998; Stake, 1995; Yin, 1984) was utilized to draw conclusions based on findings. 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).

Qualitative data were collected and analyzed based on participant observations of lectures at both far- and near-end sites and in-depth semi-structured interviews with students (N=47) and site facilitators (N=5). A structured interview schedule was adhered to for all 47 student interviews as well as for engaging students in probing questions, which evolved during the interview process. The researcher attempted to understand why students did not fully engage in the various types of interaction provided in the course. Site facilitators were interviewed for methodological triangulation.

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. Videotaped recordings of all lectures were analyzed for interaction context and content among participants. 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 11 guest speakers from across the United States and Canada who presented current research being conducted in the field. 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 had technical assistance in connecting to the bridge service each week, but site facilitators were primarily responsible for managing communications between sites.

Population

The population was self-selected by enrollment in an animal genetics course. 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.

Findings

Barriers to interactions were divided into 10 separate but not independent categories and served as dissatisfiers for students. Table 1 displays the categories along with the number of responses coded for each category from the interview transcripts and observation notes. Student responses are included in the findings.

The volume of codes indicates the density of the construct and their relative importance to the other categories. For example, social concerns were mentioned 67 times within the interview transcripts and classroom observation notes, whereas the microphone mute control knob was mentioned five times. Therefore, the relative importance of social concerns as a barrier to interaction is approximately 13 times greater than the mute control knob for students.

Table 1
Barriers to Interaction Category Titles and Number of Codes per Category

Barrier Category	Number of Codes
Social concerns	67
Technical failures	65
Time	48
Content related	38
Camera shyness	34
Site facilitator's role	28
Time for processing content	19
Non-verbal clues missing	9
Distance	6
Microphone mute control knob	5

Social Concerns

The majority of comments from students regarding barriers to interaction centered on social concerns. Students who were not inhibited by situational characteristics feared appearing insipid in front of peers and professors. Students were not only concerned about appearing unintelligent in front of the larger group, they also reported questions during the broadcast should be valuable to more than just themselves. Far-end students perceived that this class was more formal than other on-campus courses. The expert status of guest speakers and a broadcast site from a prestigious university served to inhibit questions from far-end students as well.

I don't want to ask something and (the others say), "go back to grade school". If I have a question that I feel isn't too embarrassing I'll ask it.

I'm afraid to be wrong, and feel stupid or something, or like that's a ridiculous question. I feel more comfortable just speaking to the teacher or professor afterwards. I don't feel uncomfortable asking them if no one else is around, like my fellow peers. Because I'm constantly thinking, what will my peers think of me, the whole society thing.

Technical Failures

The second most significant and effective barrier to interaction was ICV technical limitations and failures. Echoing and squealing noises as well as time delays and being cut-off inhibited interaction between guest speakers and students. Speech that was mediated through ICV technology lacked spontaneity and a lucid flow that is expected during face-to-face conversation, thus normal operations of the ICV system may have been interpreted by students as technical failures. ICV technology requires a highly structured and controlled learning environment. Because ICV technology has not reached the ideal paradigm for interactivity, near-end site facilitators implemented a speaking protocol by requesting that all questions and comments be held until the 10-minute question and answer session. Once students were asked not to interact for 40 minutes; some reported that when the question and answer session began they had to "get the motor running" again. Therefore, the ICV technology may not have failed technologically; however, it did fail to perform at a level that would facilitate human interaction rather than detract from it.

If right off the bat there's problems with the video or the sound, then you tune out because you either can't hear or you can't see it or it's not there at all. So then you start to drift away, well then it comes back and you have to kind of snap back so that really is the only thing for me that has kind of been a drawback. It's

very hard to get your attention centered on something when it keeps coming in, going out, coming in, and going out.

The last class with the echoes, I wouldn't want to talk. I don't think I could have said anything with that echo coming back at me.

Time

Time limited or prevented students from interacting both synchronously (occurring at the same time) and served as a significant barrier to interactions both in and out of the classroom. Students reported that the 10-minute question and answer session was an insufficient amount of time for adequate interaction. Students reported feeling rushed during the final 10 minutes of class to get their questions answered, especially when the speaker went over the 40 minutes allotted for the lecture.

I feel like the time is too limited for asking questions. Two weeks ago we had 4 visitors come in, and one was a professor, he hesitated to ask a question also, like he was ready to, but then we were cut off. It might be better to have more time for questions.

If they wanted it to be something where we interacted with students more, they definitely have to leave us time to interact, and give us more of a chance.

Time could be considered a compounding factor with the other barriers to interaction. In an over-dramatized example, once a student decided to ask a question, they would have to be confident that their question would be viewed positively and that it would make a contribution to the group as a whole, then reach to push the microphone mute control knob and overcome any level of camera shyness, ignore any technical difficulties present (squealing and echoing noises) and finally ask their question. Given the fact that each site had approximately 2 minutes for asking questions, it is phenomenal that any questions were posed at all.

Content Related

Each week a new guest speaker delivered an original lecture to the class, creating content related barriers to interaction. Students' lack of understanding of the new material presented prevented them from asking questions. Some students lacked confidence in asking questions publicly because they were not sure if they understood the concepts and did not want to appear ignorant. Site facilitators were present at each site during the lectures so that if students had questions they perceived as trite, they would ask site facilitators rather than the guest speaker. Ironically, students asked public questions that they already knew the answers to because they had confidence in presenting themselves to the larger animal science community.

Going in and listening to a lecture on poultry, I really didn't have any connection with that. I enjoyed the lecture but I couldn't think of any questions to ask.

The fact that I'm coming in ill-prepared is not a help. I mean I cannot ask questions when I don't know how to ask the question about the material.

I would just say that the biggest barrier would be me not feeling comfortable enough with the material.

Camera Shyness

Sixty-two percent of the students reported having anxiety about being seen on camera. When queried about camera shyness, students' answers ranged from the camera having no impact on their behavior to a strong desire to avoid being the focus of the camera. If the site facilitator did not display the picture-in-picture (PIP) feature on the ICV monitor (TV screen), students were more comfortable asking questions, as they could not see themselves doing so. Students at the near-end site reported that camera shyness was more of an issue for them than far-end site students because their larger-than-life size image was displayed on a screen in the front of the room.

In some way it is just because it's a Monday and you come in and you just drag yourself in after a long weekend of research or writing papers, so you are not exactly keen to have your face blown up on a huge screen.

In other classes, I'm like O.K., I'm thinking about more, do I have a question, like what did he just say, but in this class, I'm like, (gasp) the camera is coming.

As far as in the class, I had to ask a question last week and it was just very weird... this whole technology and lights and camera.

Site Facilitator's Role

Near-end site facilitators established the protocol for course interactions and served as moderators for asking and answering questions. They also coached guest speakers on the use of ICV technology and coping in the event of a technology failure prior to or during the broadcast. During the 10-minute question and answer session near-end site

facilitators called on each far-end site for questions. Often there were long pauses whereupon the site facilitator assumed that there were no questions from that site and would move on to the next site, effectively suppressing interaction from far-end sites. It was difficult to determine an appropriate time frame for students to respond to the call for questions.

The behavior of the guest speakers also suppressed interaction from far-end sites. For example one guest speaker indicated during an interview: "As soon as I started with the lecture, I ignored the fact that four other sites were sort-of peeking in on us." Treating the far-end sites as voyeurs was typical for guest speakers. In fact, speakers were coached to focus on near-end students as much as possible during the live broadcast and to ignore the activities on the screens that often depicted a site coming online, or dropping off-line when there were bridge failures. This behavior obviously contributed to the development of a mini-class structure at each far-end site, where students and site facilitators treated the live broadcasts as outside information being sent into their classrooms rather than as an interactive learning community.

Facilitator recognition of far-end students can enhance interaction. For example at the start of class on November 23, 1998 (13 weeks into the semester) a far-end site was projected on the screen at the near-end site. Students at the far-end were eating pizza. After the near-end site facilitator introduced the guest speaker he came online and said "first of all welcome to the foreign sites, the distance sites, it's nice to have you here. Although I'm quite upset that (far-end site) has pizza and is not passing it out to everyone else". Students at the site laughed, looking visibly surprised that they were noticed. Two of the four questions posed that day came from that particular site.

Time for Processing Content

Students needed more time for cognitively processing the content during the 10-minute question and answer session. A student likened the experience to making a sauce, in that it had to simmer for awhile before being good enough to eat. In traditional courses, students receive lectures from the same professor each session. In this course, students met a different speaker each Monday. Much of the content was new material for students.

They need to give it time to relax. You are boiling sauce, you need to give it time to simmer, then you need to give it time to sit. Then you can eat it. You can't eat it when it's still boiling, it's no good. You have to allow for time.

To compensate for this deficiency students were asked to write abstracts, which forced them to cognitively organize information that they had received and also served to illustrate where gaps in knowledge existed. Unfortunately, guest speakers were unavailable to students after the broadcast.

Do you feel that there are any barriers to asking questions during the live broadcast?

No, not really. I just haven't come up with any questions that I want to ask right there. Usually it comes about the time I start thinking about my abstract and go back and look through my notes. Then I'm like; I really didn't understand this part. Then that's when I need the question asked.

Non-Verbal Clues

Two students reported that a lack of non-verbal clues served to inhibit interaction. These students were not positive if their questions had reached the instructor when posing questions because of ICV technical delays. One student mentioned that she could not see the speaker because of the low quality transmission and because many speakers remained behind the podium while delivering lectures.

Distance

Three far-end students stated that they were dissatisfied with the distance education environment especially for asking questions. Asking questions was seen as a "production" by one student, and effectively served to keep her from doing so.

Microphone Mute Control Knob

Students at all sites were expected to press a knob that would activate a microphone on the desk in front of them. Students at far-end sites had to press the un-mute knob on the ICV keypad before speaking and then remember to re-mute their site after speaking to prevent feedback noise from interrupting other sites. Students spoke about the "button" as being a barrier to interaction in that if they didn't remember to activate the microphone no one could hear the question. The speaker rarely repeated questions so only near-end students could hear the them.

I think just the whole remembering to push the button and waiting for the camera. I know that you explained that at the beginning of class that you are supposed to raise your hand and push the button, or some order, and I have since forgotten exactly how to do that. You probably gave us a handout too, and I have just stashed that away. So I think it's just more of not knowing exactly how to ask the question.

Summary

There were 10 separate but not independent barrier categories that were discussed in this study. Barriers to interactions served as dissatisfiers for students. Camera shyness was an issue for students who did not want to see their image projected on a large screen or broadcast to the other sites. Content-related issues centered on students' lack of genetics knowledge. It was difficult for students to ask questions when they did not fully understand the content presented. The distance proved to be a dissatisfier for a minority of students who reported feeling disconnected from guest speakers.

Some students reported needing more time to cognitively process content covered in class before asking questions. A student likened the experience to making a sauce, in that it had to simmer for awhile before being good enough to eat. Few students reported that a lack of non-verbal clues, or body language was a barrier to interaction for them.

The site facilitators' behavior in facilitating interactions was a complicated issue to unravel. It was compounded with technical limitations and failures as well as by guest speaker behaviors and comfort levels in teaching to five sites at once.

A very important barrier to interaction for this youthful undergraduate population was social concerns. Not wanting to appear ignorant prevented many students from asking public questions. Some students commented on only wanting to ask questions that they perceived as intelligent and that would benefit many, not just themselves. They did not want to trivialize the learning environment with nit-picky or petty questions.

The most significant barriers to interactions were ICV technical limitations and failures. Echoing and squealing noises as well as time delays and being cut-off inhibited interaction between guest speakers and students. Having to press the microphone mute control knob could also be categorized as a technical limitation that inhibited interaction. Finally, time limited or prevented students from interacting both synchronously and asynchronously. The 10-minutes set aside at the end of the class was not enough to facilitate didactic interactions.

Implications, Recommendations, and Discussion

The results of this study have contributed to the distance education literature by identifying barriers to interaction, which centered on student situational and dispositional characteristics and technical limitations and failures. Student dispositional barriers such as camera shyness and a desire to appear intelligent when speaking in public naturally occur in all distance learning environments. However, there should be measures to curtail them by site facilitators. Some technological barriers can and should be overcome with improved bridging services, appropriate course design, and more practice with the technology. It is recommended that a professional bridging service be employed when delivering multiple-point ICV courses to improve technical connection quality and thus interactivity among participants.

Recent research in distance education has focused on the attributes of ICV technology for synchronous two-way audio and visual interaction. ICV technology in this study was not fully interactive. ICV technology used to deliver the course resulted in an interactive environment, but on a very limited basis. Near-end site facilitators restricted interaction during the live broadcast because of inherent technical limitations. There were 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. It is recommended that ICV technology advocates address technological limitations of this medium for delivering courses and that distance course providers consider providing asynchronous web-based courses due to ICV technical limitations.

Hillman, et al. (1994) discussed learner-interface interaction, the concept of interaction that occurs between the learner and the technologies used to deliver instruction. In this study one student complained about access to an on-campus computer in order to participate in the asynchronous elements of the course (e-mail and the discussion board). It is recommended that distance educators consider the burden placed on students when adding interaction features to the total course design. Course designers must balance media-rich and technology intensive learning environments along with student access to multi-media hardware to gains in learning achieved by using such options.

Distance education students learn equally well using asynchronous learning modalities (e-mail, discussion boards, videotapes) at a fraction of the cost of satellite and/or ICV technologies (Leverenz, 1979; St. Pierre & Olsen, 1991; Tallman, 1994). As course providers strive to increase interaction in the distance education classroom by simulating the face-to-face experience, consideration should be given to institutional costs as well as perceived student benefits. Colleges and universities must determine if they are investing wisely in synchronous technology (satellite and ICV) to the extent that learners are willing to participate in real-time interaction. In this study the perceived educative value of receiving the course synchronously was high for far-end students, as were the real costs to participating institutions. 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. It is recommended that more empirical evidence be gathered to demonstrate the superiority of synchronous delivery over asynchronous delivery in terms of

quality of interaction in the classroom, especially those courses that are supported with site facilitators who are also content experts as was the case in this study.

Finally, 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 were 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 synchronous 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.

References

- Bauer, J. W., & Rezabek, L. L. (1992). Interaction during face-to-face and teleconferenced instruction (ERIC, ED 363 299).
- Boverie, P., Murreil, W. G., Lowe, C. A., Zittle, R. H., Zittle, F., & Gunawardena, C. N. (1997). *Live vs. taped: New perspectives in satellite-based programming for primary grades* (ERIC, ED 407 939).
- Garrison, D. R. (1993). A cognitive constructivist view of distance education: An analysis of teaching-learning assumptions. *Distance Education, 14*(2), 199-211.
- Hillman, D. C. A., Willis, D. J., & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *The American Journal of Distance Education, 8*(2), 30-41.
- Holmberg, B. (1983). Guided didactic conversation in distance education. In D. Sewart, D. Keegan, & B. Holmberg (Eds.), *Distance Education: International Perspectives*. (p. 114-122). New York: St. Martin's Press.
- Holmberg, B. (1995). The evolution of the character and practice of distance education. *Open Learning 10*(2): 47-53.
- Leverenz, T. R. (1979). *Student perception of instructional quality of correspondence study courses: Report of a nine school comparative study* (ERIC, ED 202 267).
- Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco, Jossey-Bass Publishers.
- Miles, M. B., & Humberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. (2nd ed.). London: Sage Publications.
- Moore, M. G. (1989). Three types of interaction. *The American Journal of Distance Education, 3*(2), 1-6.
- Sholdt, G. P., Zhang, S., & Fulford, C. P. (1995). *Sharing across disciplines-Interaction strategies in distance education. Part I: Asking and answering questions* (ERIC, ED 383 337).
- St. Pierre, S., & Olsen, L. K. (1991). Student perspectives on the effectiveness of correspondence instruction. *The American Journal of Distance Education, 5*(3), 65-71.
- Stake, R. E. (1995). *The art of case study research*. London: Sage Publications.
- Stanford, G., & Roark, A. E. (1974). *Human interaction in education*. Boston: Allyn and Bacon, Inc.
- Tallman, F. D. (1994). Satisfaction and completion in correspondence study: The influence of instructional and student-support services. *The American Journal of Distance Education, 8*(2), 43-57.
- Wagner, E. D. (1993). Variables affecting distance educational program success. *Educational Technology, April*, 28-32.
- Yin, R. K. (1984). *Case study research: Design and methods*. (Vol. 5). London: Sage Publications.