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Student Use and Perceptions of Distance Education Technologies

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Abstract

We use a Sophomore-level wildlife conservation course to evaluate the effectiveness of distance education technologies. We examine student preferences for and the cost efficiency of videotape versus live broadcast technologies. Based on responses from in-class surveys we find that some technologies, such as a live phone bridge, were costly and ineffective forms of communication. Students preferred to spend extra time outside of lecture for discussion groups with an on-site faculty or other students.

Introduction

Jackson (1995) presented an overview of the expanding technologies used in distance education. Educators have experienced a rapid transition from resident classroom teaching, to correspondence study, to audio and video teleconferencing and Internet courses (Jackson, 1995; Kelly, 1990). This transition requires instructors to develop new skills for curriculum development and delivery and to keep up-to-date on the quickening pace of technology adoption and change in the telecommunications and Internet areas.

Educators have the same basic issues of effective teaching when using new technology. How do we encourage interaction and questions? How do we evaluate our effectiveness? How do we select and promote those areas where our effectiveness joins with student preference and enthusiasm? Distance learning gives us more choices to address these issues using various technologies, and more difficulty in being selective and efficient with our choices. The purpose of this paper is to evaluate effectiveness of technologies used in distance education courses.

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Methods

The Course

Oregon State University (OSU) is the only institution in Oregon offering degrees in Wildlife Science. Fish and wildlife have become increasingly important elements of natural resource management (Kellart, 1987). There is substantial need and demand for wildlife and conservation education at the undergraduate level (Hodgdon, 1990). The OSU enrollment in fisheries and wildlife courses has increased 86%, from 140 students in 1987 to 260 in 1994.

In 1995, personnel from the Department of Fisheries and Wildlife at OSU initiated a three-year distance learning program using innovative technologies to present an existing on-campus, Sophomore-level course entitled *Principles of Wildlife Conservation* (FW 251) to college audiences nationwide. Specific objectives were to: (1) design a course and materials that provide a critical core component of undergraduate degrees in wildlife, natural resources, and agricultural sciences; (2) use alternative and innovative teaching methods to reach and motivate large audiences efficiently; and (3) identify effective components of distance education and distribute findings to natural resource and agricultural sciences educators nationwide.

The program is being implemented in three phases. Phase I presented the course via satellite throughout Oregon during Spring Term, 1996. Notebooks, computer discussion groups, two-way audio, and toll-free phone access were used to aid students in comprehending the material. Lectures used computer-graphic screen shows, slides and locally-and nationally-produced video segments to enhance student interest in course material. Phase I used Oregon's ED-NET I, an existing satellite technology providing one-way video and two-way audio to over 235 sites. Course evaluation, redesign of course materials, and professionally- produced video distribution will occur in Phases II and III.

Principles of Wildlife Conservation attracted 143 registered students at 15 sites throughout Oregon. The course consisted of 27, 50-minute lectures presented by 14 instructors covering 21 topic areas and originating from the OSU campus. Students on the OSU campus viewed lectures live from the broadcast studio ("on-campus" students). Students at remote sites ("off-campus" students) could view live broadcasts of lectures in classroom settings or at home in those areas where lectures were available on cable television. Additionally, all students had access to video tapes of each lecture. A course notebook consisting of extended outlines of each lecture, discussion questions and supplemental readings was available to each student. While the notebook was intended as the primary teaching supplement for the course, two optional textbooks were recommended (Primack, 1993; Shaw, 1985). Grades were based on two midterms and a final exam. Each test consisted of 50-75 multiple-choice questions and was electronically-graded at OSU. Several services were available to students including a course facilitator at each site, an internet discussion group, a toll-free telephone "helpline" to on-campus teaching assistants, and a phone bridge linking students viewing live broadcasts to the instructor for answering questions on-the-air.

Evaluation

Students were requested to complete evaluations three times during the 10-week course. Each evaluation was distributed with exams and included questions regarding each topic and presenter during that section of the class. The third and final evaluation included additional questions regarding the use of different technologies for intercommunication and student preferences for technologies. We designed an evaluation rather than using a standard OSU survey instrument because we were interested in student's perceptions and use of different technologies, components unavailable in the OSU instrument. However, our questions regarding individual lectures/lecturers were taken verbatim from the OSU survey. Validity and reliability of the additional questions were not previously tested.

Results and Discussion

Demographics

We collected 103 student evaluations for this study for a 72% response rate. Non-responses to questions were not included in statistics, therefore, we present the number of responses with percentages. We present responses for the entire class (Total), and for students physically present at OSU during satellite transmission of lectures (On-Campus; 62 registered, 50 responses) and students located at distance sites (Off-Campus; 81 registered, 53 responses) subpopulations. The largest group of Off-Campus students, 67% (n=54), were located at Eastern Oregon State College in LaGrande, Oregon.

Gender of the Off-Campus population was evenly split, while the On-Campus population was predominantly male (70%). The primary academic level was college (94%, n=48). The Off-Campus responses were 94% college and 10% high school (n=32). The distribution of all college respondents was 28% freshman, 43% sophomores, 22% juniors and only 7% seniors or post-graduate (n=97). Of those On-Campus responses (n=50), 22% were in a forestry-related major and 32% were wildlife or fisheries majors. The remaining On-Campus majors included biology/zoology, engineering, history, English and geography. The Off-Campus responses (n=48), 38% were rangeland resource majors, 12% biology, and 10% agricultural economics/ business. The remaining majors were similarly dispersed.

Students evaluated overall course content and their perception of the usefulness of the class. Responses were

ranked on a scale of 1 to 5, with 1 being "Strongly Disagree," 3 being "Neutral", and 5 being "Strongly Agree." Responses to all class content questions were favorable, with ranking between 3 and 4 (Table 1). The lowest mean score, 3.41, reflected some disagreement that enough time was spent on each topic. Fewer respondents "Strongly Agreed" with this question than any other question, but 42% of the respondents ranked it as 4. The highest mean score (3.96) was for the statement that useful information had been gained from this course. Although mean scores were all below 4, in general, students were satisfied with the premiere presentation of this course.

Responses regarding testing procedures were almost unanimously positive for all three questions with no major difference between On-Campus and Off-Campus responses. Students were generally satisfied, with the manner in which tests were distributed (96%, n = 99) and the amount of time allowed for testing (100%, n = 99). Approximately one-fourth of the respondents (23%, n = 99) felt tests could have more fairly covered lecture material. General comments revealed that exams were more detailed than students expected and that the notebook did not always follow the lectures, hindering students' ability to prepare for tests.

We asked several questions evaluating student perceptions of the technologies used in Phase I (Table 2). Several questions determined student attendance of live lectures versus broadcasts or use of cable TV and video-tape options. Attendance was fair regardless of media. Of the respondents, 19% saw less than three-fourths of all lectures; 65% saw over three-fourths but not all the lectures; only 16% saw every lecture. Attendance patterns were similar for both On-Campus and Off-Campus sites.

Students were then asked to give the percentage of lectures seen via live broadcast at designated ED-NET site ("Live Ed-Net"), live broadcast using cable television at home ("Cable TV"), and videotape as the only method of seeing a lecture ("Only video"). Note that most students

Table 1. Overall Evaluation of Distance Education Course: Number and Percent of Responses.

	Strongly Disagree		Neutral		Strongly Agree	
	1	2	3	4	5	Mean
As a result of this course, I have learned useful information. (n=103)	1 1%	9 9%	15 15%	42 41%	36 35%	3.96
This course increased my interest in Wildlife Conservation and Management. (n=101)	2 2%	8 8%	17 17%	36 36%	38 38%	3.87
I knew what was expected of me in this course. (n=101)	3 3%	8 8%	29 29%	32 32%	29 29%	3.64
I would recommend this class to other students. (n=96)	2 2%	5 5%	29 30%	31 33%	29 30%	3.53
Overall, enough time was spent on each topic. (n=101)	5 5%	16 16%	20 20%	42 42%	18 18%	3.41

Table 2. Student Attendance and Preference of Technology.

Question	Site					
		---- *Number and Percent of Responses* ----				
		Percent of Lectures Attended				
		<50	*50-75*	*75-90*	*90-99*	*100*
All together, how many lectures did you see? (n=98)	On-campus	3 6%	5 10%	10 21%	22 45%	9 18%
	Off-campus	4 8%	7 14%	15 31%	16 33%	7 14%
	Total	7 7%	12 12%	25 26%	38 39%	16 16%
		---- *Mean Percent Value and Number of Responses*[z] ----				
		Live Ed-net		*Cable TV*		*Video Only*
What was the approximate percentage of the lectures you saw at each of the following sites ? (n=97)	On-campus	81.8% 33		35.3% 20		24.9% 7
	Off-campus	69.9% 38		42.9% 16		72.1% 11
	Total	75.4%		38.7%		53.7%
		---- *Number and Percent of Responses* ----				
		Never	*Rare*	*Occasional*	*Frequent*	*Often*
Did you use a video tape to watch a lecture more than once ? (n=93)	On-campus	37 82%	5 12%	2 4%	1 2%	0
	Off-campus	27 56%	7 15%	7 15%	3 6%	4 4%
	Total	64 82%	12 10%	9 4%	4 4%	4 4%

[z] Multiple responses for each student were possible for this question, therefore responses are greater than 100%.

used multiple media forms and therefore percentages may be greater than 100%. Respondents watched an average of 75.4% (n=71) of all lectures live at designated Ed-Net sites (Table 2). At least one lecture was seen using cable television by 37% of respondents (n=97), and cable television was used to view an average of 38.7% of all lectures. Those who used the videotapes only, that is not for review, saw nearly half of lectures (53.7%) this way. Video was more popular with Off-Campus students. Seventeen percent of Off-Campus respondents watched videotapes only. On-Campus students overwhelmingly attended live broadcasts; 55% of respondents saw an average of 82% of their lectures live. Off-Campus attendance was slightly different; 58% of respondents saw 70% of their lectures live.

The previous question excluded using videotapes for reviewing lectures. When asked the frequency of using videotapes for viewing lectures more than once, 82% of respondents said they never used videotapes to review lectures. While 56% of Off-Campus students never used videotapes for reviewing lectures, 21% used them "Occasionally" or "Frequently;" 8% used them "Often."

When asked to summarize preference for taped versus live-broadcast lectures, respondents overwhelmingly preferred live-broadcast lectures (89%). The On-Campus group had a higher preference (92%), while only 86% of the Off-Campus group preferred live-broadcast lectures. When asked to comment as to why they did not attend live-broadcasts more, two predominant reasons were given: comfort and convenience of watching cable television at home, and class conflicts with live lectures/broadcasts.

We asked several questions pertaining to student's ability to interact with the instructors or obtain additional information. Most respondents (85%, n=98) felt that they had sufficient opportunity to ask questions during the lectures (Table 3), responses were similar across the two subgroups. Students' primary source of additional information (55%) was the topic instructors. Questions either went unanswered or another source of information was used by 35% of respondents. The primary "Other" source of information listed by respondents was other students. Some students always went back to the course organizer no matter who the instructor was for a topic. No one used the phone bridge and only 10% used the toll-free phone number for additional assistance (Table 3). The percentages differ between the subgroups. The On-Campus group used the instructors more (74%) as a primary source of information. Only 34% of the Off-Campus respondents said they used the instructors. A majority (51%) of Off-Campus students either did not have questions answered or sought another source of information; 15% used the toll-free phone number.

A majority (81%, n=93) felt the facilities were adequate for asking live questions (Table 3). The Off-Campus level of satisfaction was slightly less (76%, n=49). When those viewing from an Off-Campus site were asked how often they used the phone bridge, 91% (n=73) replied "Never," no respondent used it more than 2-3 times during the course. When asked why they did not use the phone bridge, most respondents said it was "too much trouble" (39%), or "too embarrassing" (21%) to use. Of the 40% that indicated an "Other" reason for not using the phone bridge the most frequent reasons were: used videotapes to answer questions, waited to ask questions after class, and questions were not important.

Finally, we asked students about their use and access to Internet facilities (Table 4). The majority of students (81%, n=99) said they had Internet access; access was only slightly less for Off-Campus (78%, n=49) than for those On-Campus (84%, n=50). Only 11% of respondents said their access had changed from the previous evaluation given at mid-term. However, only 11% (n=84) of respondents had ever visited the Web page for the course and only 7% (n=85) had signed up for the mailing list/discussion group. The Web page contains the course notebook and lecturer information. No assignments were required or posted on the Web site.

Economic Evaluation of Course

Although distance learning may attract new and larger audiences, costs of providing such a course can be high. Provider institutions have production costs and sites linking to a class have downloading costs. Technological costs vary among institutions and courses depending on facilities available to potential students and the tuition and fee arrangements.

First, we provide a short summary of the costs involved in this specific course. More importantly, we look at the costs of specific technologies and their economic "efficiency" measured by students' use of the technology compared to its cost.

It is important to note that the costs of this course were in part subsidized by a USDA grant for $24,572 and $14,649 during the first and second year of the project, respectively. We estimated the direct costs of Phase I of this course at $61,570, or the equivalent of $153 per student-credit-hour. The OSU business office estimates an equivalent on-campus course costs $224 per student-credit-hour. Most off-campus students paid a $150 fee for this course, which included the course notebook.

In the second phase of this project, the course will be offered internationally on videotape. The fee structure arranged for Phase II includes a $100 fee and $200 registration per student, and $225 for the set of videotapes. The estimated costs for 100 students, including faculty salary, is $66,324.

Costs of this course were comparable to an on-

Table 3. Student Satisfaction with Instructor/Student Interaction.

Question	Site	Number and Percent of Responses				
		Yes	*No*			
Do you feel you had sufficient opportunity to ask questions ? (n=98)	On-campus	44 88%	6 12%			
	Off-campus	39 81%	9 19%			
	Total	83 85%	15 15%			
		Unanswered	*Instructor*	*1-800 Phone*	*Phone Bridge*	*Other*
What was the principal source of answers to your questions ? (n=68)	On-campus	4 11%	26 74%	2 6%	0 –	3 19%
	Off-campus	7 21%	11 34%	5 15%	0 –	10 9%
	Total	11 16%	37 55%	7 10%	0 –	13 30%
		Yes	*No*			
Are the facilities at your site sufficient for asking live questions ? (n=93)	On-campus	38 86%	6 14%			
	Off-campus	37 76%	12 24%			
	Total	75 81%	18 19%			
		Never	*Once*	*2-3*	*>4*	
If you viewed from an Ed-Net site, how often did you use the phone bridge ? (n=73)	Off-campus	66 91%	6 8%	1 1%	0 –	
		Too much Trouble	*Too Embarrassing*	*Other*		
If you did not use the phone bridge, why not ? (n=57)		22 39%	12 21%	23 40%		

Table 4. Student Concerns Using the Internet.

Question	Site	Number and Percent of Responses		
		Yes	No	N/A
Do you have access to the Internet ? (n=99)	On-campus	42 84%	8 16%	0 –
	Off-campus	38 78%	11 22%	0 –
	Total	80 81%	19 19%	0 –
Has your access changed since the previous evaluation ? (n=83)	Total	10 11%	73 79%	0 –
Have you viewed the Web page ? (n=84)	Total	9 11%	69 82%	6 7%
Did you sign up for the mail list ? (n=85)	Total	6 7%	72 85%	7 8%

campus class. However, based on student evaluations of the different types of technologies, some costs could have been eliminated, such as the phone bridge. Even less efficient may be live broadcast of the course. Given the low use of the phone bridge there may be no compelling reason to spend $180 per hour, $5400 for a 10 week course, for a live broadcast. Additional charges include, downlink charges of $10 per hour ($300 for 10 weeks), Ed-Net production and room charge $20 per hour ($300 for 10 weeks), and phone charges for a 1-800 number.

We estimate that production cost of the videotape version of this course (Phase II) will be $25,000, including re-taping some sessions, providing some sessions with field-trip footage, and packaging the tapes in a commercial fashion. Internet access, via a homepage on the world wide web, was not heavily used by students. However, this is one of the least expensive technologies. Salary costs are the primary cost of production and maintenance of a homepage. Currently, the homepage contains the course notebook and a link for sending messages to the instructors. As Internet access and student familiarity with the Internet grow this may be a critical technology for this type of distance course. Improvements in the current homepage for this course are planned, such as interactive simulations, links to additional references, and quick-time supplements, and course assignments. Eventually, the notebook and other material provided for this course will only be available through a homepage, eliminating the need for a notebook fee.

Without a grant, the live broadcast phase of this course (a total cost of $61,570) may have been economically impracticable. Phase II, videotape distribution, seems to be an economically more attractive version of the course. The live broadcast allows immediate interaction between instructor and students. Students in this course, however, viewed use of the phone bridge as embarrassing and unattractive. The cost of live broadcast may not be unreasonable if the students use and obtain some additional learning advantage from the technology. Discussion of ways to enhance the use of these technologies should be considered before they are eliminated.

Summary and Recommendations

Student and economic evaluations must be considered within the context of several other variables, including the learning environment and instructional contact with distant audiences. There is a learning curve that provides us with a roller coaster ride of setbacks and improvements.

Perhaps one of the most overlooked but critical influences on student learning is the environment in which

they sit during the course. There are really two settings to be concerned with in this case. One, the room from which the course is televised. Frequently these classrooms are new, air conditioned, and comfortable. In most, a microphone, which must be turned on and off for asking questions, is located in front of students. Open microphones pick up background noise and not enough of direct questions. However, like the phone bridge, students are leery of freely using the microphones. This leads to two possible problems – lack of dialogue from the students or dialogue that isn't picked up on the videotape because the microphone was turned off. The first is detrimental to a class in which discussions should be prominent and the second diminishes the learning experience of the students using the videotape.

Downlink site classroom are often not ideal and choice may be limited by classroom availability. One downlink site for this course was provided in a small auditorium with a television screen no larger than found in most homes. Seats more than 5 or 6 rows away had reduced visibility. In addition, the only sound was provided by the same television, so that the volume was loud in the first couple rows and weak in the last rows. At most sites a single phone bridge was located in the front of the room, requiring students to get up from their seat, proceed to the front of the room, and ask their question – an act of bravery for most students. Thus, an unfortunate setting for the class may preclude the use of many of the advantages of a live broadcast.

Teaching methods, as always, greatly impact the effectiveness of any course. In particular, distance education technologies require instructors to be aware of an audience that is not physically present. Based on student evaluations of this course, two recommendations arise. One, both students and faculty see a need for discussion sessions with on-site facilitators and other "live action", such as field trips. that enhances the student learning experience. The second recommendation is for instructors to find ways to encourage the use of interactive technology, including the phone bridge, Internet or phone. The most basic method may be for each site linked to a telecast to "check in," thereby establishing an identity for the other audiences. Other suggestions are to rotate the phone bridge link to different sites, thereby providing an incentive to use it on given days, or to offer extra points during the first week or two to students who call in or sign-up on the list-serve. The initial contact between instructor and distant audience is best placed on the instructor not the students.

Technologies available for linking campuses together are expanding quickly. There is tremendous momentum and, perhaps, pressure for institutions to take advantage of these technologies by establishing large off-campus audiences for courses. However, we must consider the effectiveness of our choice of technologies for each course individually. Student learning and economics can be used together to evaluate distance education technology. The final caveat is that through experimentation, instructors may be able to enhance the effectiveness of a technology by enhancing the learning experience and thus, justifying the cost.

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