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Interactivity in Distance Learning: The Digital Divide and Student Satisfaction

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ABSTRACT

Like any other complex communications infrastructure, the network connecting different locations of virtual classes in university systems has developed over time with differing combinations of synchronous and asynchronous communication technologies at the various university locations. This research focuses on graduate nursing students' satisfaction with the learning experience in seven distinct virtual classes during the 1998-99 academic year of a midwestern state university system. Each virtual class included course offerings from multiple campuses at eight locations, two urban and six non-urban. Differences between student perceptions of satisfaction for host and remote sites are analyzed, as well as differences between students at urban sites and non-urban sites whether remote or host. When geographic location is controlled, separating the data into urban and non-urban settings, students attending classes with a web requirement in urban settings were more likely to express positive degrees of satisfaction than students attending classes with a web requirement in non-urban settings. The relationship holds for both host and remote classes.

Keywords

Distance learning, Student satisfaction, Digital divide, Web-based learning, Interactive video

Introduction

A distinction is traditionally made between education studies and distance education studies based on co-present teaching with face-to-face interaction between participants. The constraints of time and space have determined the boundaries of approaches to the study of distance learning, i.e. issues of access. Today, traditional courses are increasingly offered as *virtual* classes, and traditional distance learning students now often have the ability to communicate with other sites utilizing such media channels as satellite networks, email, telephone, fax, mail, Internet, world wide web and collaborative network applications, as well as both broadcast and interactive video in both its desktop and studio forms (Heldman 1993; Holmberg 1977). We follow Tiffin and Rajasingham's (1995) definition of the virtual class. They note: "A classroom is a room where classes are held. A class is a group of people joined for some course of instruction. A meeting of such a group is also called a 'class'. It is in this latter sense that we use the term 'virtual class', signifying that two or more people can come together as telepresences for instruction" (1995, 10). Even in the recent past, the number of communication channels available tended to favor the host site, yet today it is common for remote sites to also have a multitude of channels available (Barker, Frisbie and Patrick 1989). These changes have more than technological implications.

Virtual classes are increasingly a part of the traditional course curriculum, rather than limited to on-going or *adult* education. Stanford's approach to on-line education (http://scpd.stanford.edu/scpd/students/onlineClass.htm) is just one of many universities offering multimedia courses via the Internet. Indeed, the University of Chicago, Columbia University, Stanford University, the London School of Economics and Political Science, and Carnegie Mellon University are all members of the Cardean Academic Consortium. Cardean members work to develop high quality online business education (http://www.cardean.edu/cgi-bin/cardean1/view/public_home.jsp). These developments in the institutional bases

of virtual classes make it important to study distance learning classes not only from an *access* perspective, but also from an *interactivity* perspective, while maintaining concern for the quality of the learning process. The challenge for a virtual class is in measuring up to the interactive richness, albeit in different ways, of even a lecture hall course characterized by co-presence (Valenta, Therriault, Dieter, and Mrtek (2001). Yet, questions of access remain important. The FCC's 706 series of reports on the deployment of broadband networks notes that urban and rural differences persist in the availability of high-speed network services for each (August 2000; February 2002).

Drawing on the lead of Phipps and Merisotis (1999), our study focuses on the impact of multiple technologies and uses an explicit conceptual framework, Steuer's (1992) model of telepresence, to study the way **synchronous** and **asynchronous** communication technologies relate to the satisfaction of students with the learning experience in virtual classes. Studying the use of synchronous communication technologies such as interactive, network video alone is as limited as only studying the use of asynchronous communication technologies such as web-based courses or other computer-mediated learning resources (Tiffin and Rajasingham 1995, 123). The former overlooks well-known disparities between students at remote sites and those at host sites with the instructor. The latter position, while justifiably focusing on the pluses of streaming video and rich multimedia learning experiences, risks overlooking the relevant differences in rates of connection, such as home dial-up, cable modem, digital subscriber line (DSL) services, for students, as well as the possibility of no home connectivity. We follow Steuer (1992) in contending that neither of these two positions, taken in isolation, accounts for the importance of vividness and interactivity to the learning experience in virtual classes. These approaches also fail to speak to the practicalities of access to asynchronous technologies such as the world wide web.

We focus on *both* access and interactivity to assess the virtual class in distance learning. The technologies used in a virtual class provide a space for communication and interactivity made available to learners by the network interface. Following White (1999) we contend that the measure of quality for distance learning "is a matter for individual students to decide" (1999). We offer a conceptual model, a research strategy and a survey instrument to assess students' perceived satisfaction with distance learning classes.

Conceptual Model

The technological ideal of virtual classes involves building learning environments that immerse students in the same learning situation across several network locations. A key to recognizing such futuristic conceptions of the virtual class lies in making networks *transparent* to the learning situation. But, what does it mean to describe a network as "transparent"? Fulkerth summarizes this point noting that, "Our ongoing Distance Education development challenge will be to continue to work toward creating student-centered, technology-mediated learning communities in which the technology tools are so seamlessly integrated as to be transparent," (1998, 71). In its ideal configuration, the goal of transparency leads to a learning experience with similar features to the holodeck, made famous in the science fiction series "Star Trek: The Next Generation" in which people are virtually present one to the other (Tiffin 1997, 1).

Indeed, projects such as the CAVE Research Network already provide working models of network interfaces that approach the telepresence ideal of transparency in which vividness and interactivity are enhanced with the aid of goggles and other peripheral technologies (see http://www.evl.uic.edu/cavern/vrserver.html). Although this ideal network interface has only been approximated in limited domains in research and development labs, it does provide a benchmark for how well current technological configurations support transparency in network interfaces. McCullough's summary of the human-computer interface problem applies in general terms to that of network interfaces. He notes, "Better human-computer interfaces improve our sense of participation…They let us know we are in charge, and they let us focus on our work. Like good traditional tools, they go unnoticed. We may say that they become transparent" (1996, 139).

We draw on Steuer (1992) to conceptualize the relationships between the transparent ideal and the expedient combination of technologies that currently exist to support virtual classes. Steuer conceptualizes the degree to which a network interface achieves transparency as telepresence, or *" the extent to which one feels present in the mediated environment, rather than in the immediate physical environment"* (1992, 75). In his formulation, telepresence and, by implication transparency, requires a high degree of vividness and interactivity in the technology interface (Steuer 1992). "*Vividness*, refers to the ability of a technology to produce a sensorially rich mediated environment…*interactivity*, refers to the degree to which users of a medium can influence the form or

content of the mediated environment" (Steuer 1992, 80). As Borgmann recently observed, "Transparency seems to be the perfection of information about reality," (1999, 168).

While truly immersive technology may or may not develop, it is many times presented as inevitable (Leyshon and Thrift 1997, 326). In the near term, to the extent that faculty and students in virtual classes are constrained by a network interface that fails to achieve transparency, they are forced to orient to it and manage it as an obtrusive technology.

Instead of a transparent interface rich in vividness and interactivity, learning situations today consist largely of *expedient* mixes of synchronous communication technologies (interactive video networks) and asynchronous communication technologies (web sites with streaming media, graphic presentations, discussion lists, etc.). Telepresence, with transparency of the network interface as its ideal, provides a conceptual model for explaining the relation of participant immersion in the learning situation of virtual classes to proximate perceptions of co-presence. We use Steuer's model to operationalize the degree of interactivity embedded in the design of classes using synchronous and asynchronous communication technologies. We do not operationalize the variable of vividness in this study largely because doing so would require access to two or more separate distance learning network architectures that the constraints on this study did not afford. Studying vividness requires comparing an immersive learning environment, such as the CAVE mentioned above, and the increasingly common expedient learning environments cobbled together from existing network resources in today's learning institutions. Our focus is limited to an analysis of interactivity.

The Study

Our study analyzes the relative success of virtual classes (seven graduate nursing classes) in producing positive student perceptions of co-presence in learning situations mediated by technologies of telepresence. A previous research study (Jung, Keel, and Irons 1998) found that the mere fact that a web site existed for the virtual classes increased student satisfaction even when no requirement existed for students to use the web for specific communication purposes. The current study compares student satisfaction within classes with no required web component (specifically, virtual classes that use the web solely to publish course materials for students to access via the web) to virtual classes that publish course materials on the web, integrating new forms of virtual interactivity (e.g. chat rooms, self-paced or knowledge-based navigational instruction) and also require students to engage these resources and influence discussions in the virtual class as a course requirement. In laying out the model this way we are attempting to give analytic clarification to the third way outlined by Rossman (1992) for going beyond situations where virtual classes use interactive video or computer-mediated communication resources alone. Our analysis does not focus solely on virtual classes using interactive video or on virtual classes that are web based. Rather, *our analysis takes into account design issues and interactivity as they relate to student satisfaction with virtual classes*. Table 1 outlines six possible data relationships a study of virtual classes can cover.

	Virtual Class Type A	Virtual Class Type B	Virtual Class Type C
	Interactive video or Web-based Learning	**Interactive video + web publishing**	**Interactive video + web publishing/virtual interaction**
Synchronous	*	+	+
Asynchronous	*	+	+

Table 1: Data Relationships of Virtual Classes
* We do not examine classes that use either synchronous (interactive video) or asynchronous (web-based learning) resources alone.

Our research hypothesis for testing relations between the independent variable *level of design* and the dependent variable *interactivity* predicts that,

> The level of interactivity produced by the design of a virtual class increases student satisfaction with the learning experience.

The variable of interactivity is operationalized according to the level of design included in the class as distinguished by Table 1. Thus, our conceptual model predicts a higher student satisfaction for classes as additional channels of interactivity are designed into the class (i.e. classes in Virtual Class Type A compared to

classes in Virtual Class Type B or Type C). *The current study only compares student satisfaction with virtual classes from Types B and C.*

Methods

We use two methods: 1) a survey on student satisfaction with the learning situation (see Appendix A), and 2) field research that includes observations in the virtual classroom. The questionnaire was developed to gather data measuring the dependent variable of *interactivity* in relation to the independent variable of *level of design*. So, we measured student satisfaction with the learning experience by examining classes with varying levels of design. Specifically, we measured student satisfaction with the learning experience for virtual classes that required students to use the web as a channel of interactivity compared to those where the web is simply used to publish course materials, i.e., online brochures.

Questionnaires

Questionnaires were distributed to the professors for distribution at each class location. A cover sheet asked the students to volunteer an anonymous assessment of the virtual class. Each student's questionnaire, completed or not, was returned during class in a sealed envelope. Each professor then forwarded the questionnaires to the researchers.

The questionnaire for the current study consisted of 23 items, with 18 on a seven point Likert scale, four "*yes/no*" items, and one item to determine gender. The Likert items asked students to indicate their agreement on a seven-point scale ranging from **(1)** *strongly agree* to **(7)** *strongly disagree*. A general *Comments* section was provided at the end of the questionnaire with a specific *Comments* section provided for Question 18 which read: "It was difficult to get the professor's attention during class when it was needed."

Observations

Each of the three researchers observed at least two classes in the Instructional Technology Center at one of the two urban campus sites. Observations were supplemented with a pre-class informal interview with the professor.

Virtual Class Locations

The research focused on perceived satisfaction of students with the learning experience in 7 distinct virtual classes. Each virtual class was a course offered at multiple university sites, networked with interactive video in a studio type setting, to graduate level nursing students. Data was collected from students enrolled in 19 accredited courses at eight locations, two urban and 6 non-urban. A majority of the students (144) were located near one of the two urban campuses and the remaining students (51) accessed the courses from other, non-urban campuses.

Response Rate

197 out of 273 surveys distributed for this study were returned. The response rate of this anonymous questionnaire approximated 72.16, a more than adequate response rate (Moser 1972; Alreck and Settle 1995) for data analysis.

Data Analysis

The survey instrument was designed to measure student perceptions of satisfaction with the learning situation in virtual classes. We did not generate data to compare Virtual Class Type A to Types B or C, largely because all the classes we studied used some form of web site. Our hypothesis predicts that satisfaction increases with interactivity. To test this hypothesis we operationalized **interactivity** as the presence of a required web component (Table 2). We used independent sample t-tests to analyze the independent variable (i.e. required web component) in relationship to the items of satisfaction from Questions 6 through 23 of the survey (see Appendix A). Additionally, we performed the same measurements using **location** (host/remote) as an independent variable.

Distance learning research consistently points to the importance of learning location (host/remote) to differences in student experience, making location a key independent variable to test. Our analysis found responses to questions 11, 15, 18, and 22 displayed statistical significance ($p < .05$) in relation to the independent variable of interactivity (Table 2).

		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Q11	Access to this class was more convenient than access to the same class would usually be for me.	4.524	218	.000	1.22	.27
Q15	I would not choose to take another class that uses interactive video.	-4.150	215	.000	-1.22	.30
Q22	I would not recommend any interactive video class to other students.	-3.756	214	.000	-1.04	.28
Q18	It was difficult to get the professor's attention during class when it was needed.	4.190	214	.000	1.21	.29

Table 2: Independent Samples Test (Interactivity -- Web Requirement)

Moreover, responses to questions 11, 15, 22, and 18 also indicated statistically significant relations to the independent variable of location (Table 3).

		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Q11	Access to this class was more convenient than access to the same class would usually be for me.	2.555	218	.011	.71	.28
Q15	I would not choose to take another class that uses interactive video.	-2.877	215	.004	-.86	.30
Q22	I would not recommend any interactive video class to other students.	-2.860	214	.005	-.80	.28
Q18	It was difficult to get the professor's attention during class when it was needed.	2.773	214	.006	.82	.29

Table 3: Independent Samples Test (Location -- Host/Remote)

For question 11, a web requirement in the class decreases student satisfaction with access to the class. In other words, access to classes that require students to use the web is perceived as less convenient in general. Nevertheless, respondents to question 11 who were students at remote sites found these classes to be more convenient and were more likely to agree with the statement when their responses are compared to students at host sites. Questions 15 and 22 deal with student willingness either to take an interactive video class again (question 15), or recommend that others take one (question 22). The scores on these questions indicate that students in classes with a web required component are less likely to take another such class and less likely to recommend one than students in classes without a web requirement. Students at remote sites are more likely to take another such class and more likely to recommend one than are students at host sites.

The findings noted above do not permit us to reject our null hypothesis. Our hypothesis predicts that higher degrees of interactivity produce increased satisfaction with distance learning. Yet, when we look at question 11, the opposite appears to be the case since a web requirement decreases student satisfaction with access to the class. Traditional assumptions about students at remote sites support the expectation that interactivity is diminished by the remote location. Yet, the responses to questions 15 and 22 indicate the opposite since students at remote sites were more likely to say they would take an interactive video class again and recommend them to other students. ***We think the traditional host/remote distinction does not encompass all the relevant dimensions of access when a web component is a required feature of a distance learning course.*** Yet, we need to know more about how response patterns at the remote sites differ from those at the host sites in order to better understand the bearing of our independent variables, interactivity and location, on student satisfaction. The subtleties of these patterns are clearer when we consider the responses to question 18 ("It was difficult to get the professor's attention during class when it was needed."). We used ANOVA to do additional analysis of how interactivity and location influence student satisfaction.

We found that student responses to question 18 occurred in the direction predicted when both interactivity and location are taken into account. Students in classes with a web requirement were significantly more likely to disagree with the statement when compared to students in classes without the web requirement. Thus, students in classes with a web requirement perceived it easier to get the professor's attention. Nevertheless, students at remote sites indicate a lower degree of satisfaction with their ability to get the professor's attention, regardless of whether a web requirement is used in the course. Reasons for this relationship include problems with the technology itself, in addition to the familiar issue of the tendency of professors at host sites to train most of their attention to students at those sites rather than those at remote sites. **These findings point to the continuing relevance of issues of *access* to distance learning research, even when the focus is on interactivity.** The interactive video space produced by such synchronous communication technology as interactive video networking is equally accessible to host and remote students regardless of their use of the world wide web. Both have to travel to a class room to access their respective class locations for the virtual class. Yet, increasing the level of interactivity in a course by requiring web use as part of the course design (i.e. increasing interactivity through design) introduces another dimension to the access issue.

Our current data point to *access* as a multidimensional variable in that students not only require access to the media space opened by the interactive video network, but also require access to the web, or the internet, when a virtual class integrates use of the web with the course design. Thus, *this latter dimension of access affects student perceptions of interactivity and goes beyond the host/remote location distinction*. For example, when we use ANOVA to examine student responses to question 11 ("Access to this class was more convenient than access to the same class would usually be for me."), while controlling for web requirement and location, an interesting interaction occurs (Table 4). Students enrolled in classes that integrate the web into the course as a required component view the class as more accessible ($p = .006$) than do students enrolled in classes where they are not required to use web resources (Table 4).

Tests of Between-Subjects Effects Question 11: "Access to this class was more convenient than access to the same class would usually be for me."				
Source	**df**	**Mean Square**	**F**	**Sig.**
Web Requirement	1	30.825	7.799	.006
Host	1	1.186	.300	.585
Web Requirement * Host	1	5.635	1.426	.234
R Squared = .067 (Adjusted R Squared = .052)				

Table 4: Question 11

Descriptive Statistics Question 11: "Access to this class was more convenient than access to the same class would usually be for me."				
Web Requirement	**Location**	**Mean**	**Std. Deviation**	**N**
Yes	**Host**	4.28	2.11	25
	Remote	4.49	1.82	37
	Total	4.40	1.93	62
No	**Host**	3.77	2.07	39
	Remote	3.21	1.98	94
	Total	3.38	2.02	133

Table 5: Cell Means for Table 4

When we examine the likelihood that a student will choose to take a virtual class again, the data show that the web requirement and location are the most significant predictors of choosing to take another course. Student responses on question 15 ("I would not choose to take another class that uses interactive video.") are more likely to agree with the negative statement when they are in classes at remote sites with a web requirement designed into the course (Table 6). The probability of disagreeing with the negative statement posed by question 15 was greatest among students in virtual classes with a web requirement at a host location ($p = .02$). As we noted above, the finding is counter-intuitive given the patterns predicted by our model in Table 1. Thus, as previously noted, increased levels of interactivity in a course that result from increased levels of design do not predict the likelihood of a student agreeing with question 15. Rather, ***a web requirement combined with a remote location is the most predictive*** (Table 7).

While a required web component may increase interactivity, without equal technological access to the Internet the increased potential for interactivity does not result in the predicted relationship between interactivity and satisfaction. Why? Perhaps all remote sites are not created equal with respect to technology access. We suspect this anomalous finding means that distance learning researchers need to reconsider how access and location are conceptualized since technological access based on a host/remote distinction is insufficient. Access to synchronic communication technologies such as interactive video networks is different from access to asynchronous communication technologies such as discussion lists, email, etc. We need to know to what extent location modifies the effects of interactivity on student satisfaction.

Tests of Between-Subjects Effects Question 15: "I would not choose to take another class that uses interactive video."				
Source	**df**	**Mean Square**	**F**	**Sig.**
Web Requirement	1	22.195	5.048	.026
Host	1	2.132	.485	.487
Web Requirement * Host	1	24.198	5.504	.020
R Squared = .086 (Adjusted R Squared = .071)				

Table 6: Question 15

Descriptive Statistics Question 15: "I would not choose to take another class that uses interactive video."				
Web Requirement	**Location**	**Mean**	**Std. Deviation**	**N**
Yes	**Host**	4.56	2.35	25
	Remote	4.00	2.29	36
	Total	4.23	2.31	61
No	**Host**	4.53	2.41	38
	Remote	5.56	1.79	93
	Total	5.26	2.04	131

Table 7: Cell Means for Table 6

The Digital Divide Effect

Access is typically examined in terms of host/remote location. A host/remote distinction, though crucial, is not enough when we consider access to the world wide web because issues of geographical location, especially urban/non-urban, become salient to the consideration. In particular, it appears the digital divide must be considered by any comprehensive analysis of student satisfaction with distance learning classes. To explore these issues we broke location down into those sites in urban areas and those sites outside these two urban campus locations. This breaks down in general terms into urban sites and non-urban sites. We assume that access to the Internet is more readily available in these urban campuses and residences than in the non-urban settings, as a recent FCC study reports in relation to the general population (Deployment of advanced telecommunications capability: Second report, August 2000).

Tests of Between-Subjects Effects Question 11: "Access to this class was more convenient than access to the same class would usually be for me."					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	154.659(a)	3	51.553	15.054	.000
Intercept	1076.681	1	1076.681	314.401	.000
Web Requirement	42.836	1	42.836	12.509	.001
Urban	9.447	1	9.447	2.759	.098
Web Requirement * Urban	26.141	1	26.141	7.633	.006
Error	654.089	191	3.425		
Total	3482.000	195			
Corrected Total	808.749	194			
a R Squared = .191 (Adjusted R Squared = .179)					

Table 8: Question 11

Descriptive Statistics Question 11: "Access to this class was more convenient than access to the same class would usually be for me."				
Web Requirement	**Location**	**Mean**	**Std. Deviation**	**N**
Yes	**Urban**	4.36	1.90	56
	Rural	4.83	2.32	6
	Total	4.40	1.93	62
No	**Urban**	4.02	1.91	88
	Rural	2.11	1.60	45
	Total	3.38	2.02	133

Table 9: Cell Means for Table 8

Responses to question 11 indicate that although the web requirement or design is the most predictive variable relating to the question of access, the combination of the urban variable with the web requirement is predictive at the .05 level of significance (Table 8).

The relationships between design and geographical location are further highlighted in the responses to question 22. Students in classes with the web requirement are significantly ($p = .001$) more likely to agree with the statement when compared to students without a web requirement as part of the course (Table 10). Students attending at locations other than urban sites whose course requires them to use the web are statistically more likely to agree with the statement in question 22 ("I would not recommend any interactive video class to other students."). So, students with these attributes are less likely to recommend such courses (Table 10).

Tests of Between-Subjects Effects Question 22: "I would not recommend any interactive video class to other students."					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	79.793(a)	3	26.598	7.358	.000
Intercept	1312.101	1	1312.101	362.998	.000
Web Requirement	42.027	1	42.027	11.627	.001
Urban	1.387E-03	1	1.387E-03	.000	.984
Web Requirement * Urban	17.770	1	17.770	4.916	.028
Error	675.935	187	3.615		
Total	5284.000	191			
Corrected Total	755.728	190			
a R Squared = .106 (Adjusted R Squared = .091)					

Table 10: Question 22

Descriptive Statistics Question 22: "I would not recommend any interactive video class to other students."				
Web Requirement	**Location**	**Mean**	**Std. Deviation**	**N**
Yes	**Urban**	4.27	2.25	56
Yes	**Rural**	3.20	2.68	5
	Total	4.18	2.28	61
No	**Urban**	4.84	1.83	86
No	**Rural**	5.89	1.38	44
	Total	5.19	1.76	130

Table 11: Cell means for Table 10

From these findings we tentatively conclude that students at locations other than urban sites appreciate access to the class per se. Their positive assessment of the learning experience is diminished when a requirement to use the web is added to the course. We speculate that this pattern holds because access to the web in those non-urban locations is not as readily available. So, it is not surprising that students in urban locations with ready access to

the web in courses with a web requirement are more likely to disagree with the negative statement in question 22 regardless of whether they are host or remote students.

Student responses to question 7 ("The web site and electronic discussion group contributed significantly to my learning the course content.") indicate that students enrolled in courses with a web requirement are more likely ($p = .057$) to agree than students enrolled in courses without a web requirement (Table 12). The relationship holds regardless of location.

Tests of Between-Subjects Effects Question 7: "The web site and electronic discussion group contributed significantly to my learning the course content."					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	27.964(a)	5	5.593	.965	.440
Intercept	646.824	1	646.824	111.635	.000
Web Requirement	21.301	1	21.301	3.676	.057
Host	4.089	1	4.089	.706	.402
Urban	2.989	1	2.989	.516	.473
Web Requirement*Host	1.686	1	1.686	.291	.590
Web Requirement*Urban	12.524	1	12.524	2.162	.143
Error	1095.082	189	5.794		
Total	2737.000	195			
Corrected Total	1123.046	194			
R Squared = .025 (Adjusted R Squared = -.001)					

Table 12: Question 7

Thus, students who are required to use the web, regardless of location, are statistically more likely to agree with Question 7. Students, who are not required to use the web, but have course content available from the web on a voluntary basis, are statistically less likely to agree with Question 7. **These relationships hold regardless of host/remote location.**

Students who indicate an unwillingness to recommend the class to others (see question 22 discussion) nevertheless recognize the importance to learning that the web requirement holds (see question 7 discussion). We speculate that their appreciation for the contribution of a web requirement to learning the class content points to the salience of design for positive perceptions of the learning experience rather than the learning situation per se. Even students in urban sites, where access to the web is less problematic, express less willingness to take another interactive video course but agree that using the web contributes to learning course content.

Conclusions

Overall, students in courses with a web requirement expressed lower degrees of satisfaction with the learning experience when compared to those in courses without a web requirement. However, when we control for geographic location, separating the data into urban and non-urban settings, these findings tell us more. Specifically, students attending classes with a web requirement in urban settings were more likely to express positive degrees of satisfaction than students attending classes with a web requirement in non-urban settings.

Our findings are also relevant to a more general discussion. Because this study: (1) takes into account differences among students, in particular differences among urban and non-urban students, (2) focuses on the interaction of multiple technologies, and (3) is guided by the conceptual framework of telepresence, we have begun to fill in what Phipps and Merisotis (1999) identify as significant gaps in the research and important flaws in the methodology of technology-based distance education research.

Students appreciate the interactivity of virtual classes that include a web component. But, to the degree that use of the web component is a part of the course requirements, their satisfaction with the class decreases. This is particularly the case for non-urban students. A number of possible explanations for this pattern come to mind, none of which is sufficient without more detailed data on individual access to network resources. Students at urban locations are advantaged in virtual classes in their individual access to network resources, specifically dial-

up access as well as residential broadband access to the internet is more widely distributed in urban areas. Furthermore, for dial-up Internet users, urban students are less likely to face as many telephony costs such as long distance charges when compared to students in non-urban areas. Thus, it makes sense that urban students would not find access to web resources needed in a course as burdensome as non-urban students. We conclude that our data point to at least one basic research need in the design and delivery of virtual classes. The degree of variation of access to asynchronous communication resources such as the web, e-mail, etc. between urban and non-urban students needs to be assessed by a focused research effort.

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References

Alreck, P. L., & Settle, R. B. (1995). *The survey research handbook*, NY: Irwin Professional Publishing.

Barker, B. O., Frisbie, A. G., & Patrick, K. R. (1989). Broadening the definition of distance education in light of the new telecommunications technologies. *The American Journal of Distance Education*, 3, 20-29.

Beller, M., & Or, E. (1998). The crossroads between lifelong learning and information technology: A challenge facing leading universities. *Journal of computer mediated communication*, 4 (2), http://www.ascusc.org/jcmc/vol4/issue2/beller.html.

Borgmann, A. (1999). *Holding on to reality: The nature of information at the turn of the millennium*, Chicago: The University of Chicago Press.

FCC (2000). *Deployment of advanced telecommunications capability: Second report*, http://www.fcc.gov/Bureaus/Common_Carrier/Orders/2000/fcc00290.pdf.

FCC (2002). *Report on the availability of high speed and advanced telecommunications capability: Third Report*, http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-02-33A1.pdf.

Fulkerth, B. (1998). A bridge for distance education: Planning for the information- age student. *Syllabus*, 12 (4), 28-30, 71.

Heldman, R. K. (1993). *Future telecommunications*, Washington, DC: McGraw-Hill, Inc.

Holmberg, B. (1977). *Distance education*, NY: Nichols Publishing Co.

Holmberg, B. (1981). *Status and trends of distance education*, NY: Nichols Publishing Co.

Johnstone, S. M. (1991). Research on telecommunicated learning: Past, present, and future. *ANNALS of the American academy of political and social science*, 51(4), 49-57.

Jung, D. J., & Irons, L. R. (1995). Analysis of interactivity in distance education: The Missouri IVPTF experiment. *Report submitted to the Interactive Video Programming Task Force of the Missouri Public Service Commission and State of Missouri Department of Elementary and Secondary Education*.

Jung, D. J., Keel, R. O., & Irons, L. R. (1998). Interactivity in distance education: A study of telepresence in university virtual classes. *Paper presented at International Conference on the Social Impact of Information Technologies*, October, St. Louis, Missouri.

Leyshon, A., & Thrift, N. (1997). *MoneySpace: Geographies of monetary transformation*, London: Routledge.

McCullough, M. (1996). *Abstracting Craft: The Practiced Digital Hand*, Cambridge, MA: The MIT Press.

Moser, C.A. (1972). *Survey methods in social investigation*, NY: Basic Books.

Phipps, R., & Merisotis, J. (1999). What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education. *The Institute for Higher Education Policy*, http://www.ihep.com/Org.php?parm=Staff/Phipps.html .

Rossman, P. (1992). *The Emerging Worldwide Electronic University*, Westport, CT: Greenwood Press.

Roussos, M., Johnson, A., Moher, T., Leigh, J., Vasilakis, C., & Barnes, C. (1998). Learning and Building Together in an Immersive Virtual World. *Presence*, 8 (3), 247-263.

Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of communication*, 42 (4), 73-93.

Tiffin, J., & Rajasingham, L. (1995). *In search of the virtual class: Education in an information society*, London and New York: Routledge.

Tiffin, J. (1997). The virtual class: Enhancing learning in an information society. *Keynote Address at the OTFE/OTS Conference*, 8 May, Moorabbin, Victoria, Australia.

Verduin, J. R., & Clark, T. A. (1991). *Distance education*, San Francisco: Jossey-Bass Publishers.

Valenta, A., Therriault, D., Dieter, M., & Mrtek, R. (2001). Identifying student attitudes and learning styles in distance education. *Journal of asynchronous learning networks*, 5 (2), 111-127, http://www.aln.org/alnweb/journal/jaln-vol5issue2v2.htm.

White, F. (1999). Digital diploma mills: A dissenting voice. *First Monday*, 4 (7), http://firstmonday.org/issues/issue4_7/white/index.html.

Appendix

Class Survey

Check the appropriate response to the following items.

1. ( ) Female ( ) Male

2. Have you taken other college classes that used interactive video?

   ( ) Yes ( ) No

3. Have you taken college classes that used electronic discussion groups?

   ( ) Yes ( ) No

4. If yes to Question 3, were you adequately prepared for using those electronic discussion groups?

   ( ) Yes ( ) No

   Comments: _____

   a.) If yes, how often did you participate in the electronic discussion group? (please circle)

   Not at all 1-3 messages 4-7 messages 8-12 messages more than 12 messages

   b.) Was participation in the electronic discussion group a class requirement?

   ( ) Yes ( ) No

5. a.) Does your instructor have an e-mail address for students to use in order to ask her/him questions, or discuss class-related problems and concerns?

   ( ) Yes ( ) No

   b.) If yes, how often have you contacted the instructor through this private e-mail address? (please circle)

   Not at all 1-3 messages 4-7 messages 8-12 messages more than 12 messages

Circle a number between 1 (Strongly Agree) and 7 (Strongly Disagree) on each scale. Circle N/A if the question does not apply to the particular class you took.

6. The web site for our class increased my communication with other students.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree N/A

7. The web site and electronic discussion group contributed significantly to my learning the course content.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree N/A

8. The web site and electronic discussion group allowed me to work effectively with students at other locations.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree N/A

9. I communicated more with the professor because we used a web site. N/A

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree N/A

Please compare your experience as a student in this class to your previous experiences with "face-to-face" classes you have taken.

10. Access to the teacher was increased by interactive video.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

11. Access to this class was more convenient than access to the same class would usually be for me.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

12. I communicated more with other students in this class because it was an interactive video class.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

13. Taking this class was more boring than if it were a face-to-face class.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

14. I felt less "involved" in this class than in other classes where everyone is face-to-face.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

15. I would not choose to take another class that uses interactive video.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

16. I learned a great deal more because of my participation in this class.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

17. Attending this class increased the quality of my education.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

18. It was difficult to get the professor’s attention during class when it was needed.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

If applicable, describe the way(s) you were able to get the professor's attention:

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19. Presentation materials used in class (text, graphics, slide shows, etc.) were easy to read.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

20. I would recommend this class to other students.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

21. It was easier to communicate to students in this class.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

22. I would not recommend any interactive video class to other students.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

23. It was easier to communicate to the professor as I became accustomed to the interactive video environment.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

General Comments:
