Interactive Technology Impact on Quality Distance Education

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Abstract: This paper reports on a study to determine if existing technology is adequate for the delivery of quality distance education. The survey sample was 392 respondents from a non-traditional graduate level. The study included 15 descriptive questions on course assessment and satisfaction. The three hypotheses used Chi-square to find relationships between interactivity and three other variables: progress, communication mode, and the desire to take another course. Responses showed that taking a distance education course was worthwhile. Findings, recommendations and conclusion are included.

Keywords: Distance Education, Quality, Interactive, Technology Assessments, E-learning, Interactivity

1. Introduction: Stating the Problem

There are many problems associated with traditional education, including students' tardiness, schedule conflicts, unavailable courses, geographical isolation, changes in demographic and economic issues, and other obstructions that preclude students from attending traditional classes. This study points towards a need for an alternative education method to complement the traditional system.

Many definitions of distance education were uncovered, but most authors agree on the concept of student and instructor separation in time and place (Dalziel 1994; Moore & Kearsley 1996; Willis 1993).

In answering the question "Why teach at distance?," Gottschalk (1995) showed that distance education is a valid concept in which students could have access to education that they would not otherwise have available. Students could benefit from the participation of experts and skilled people available through distance education who might not be available locally. In addition, students could create a stronger bond with each other and share their distance education experiences.

2. Purpose of the Study

The research study attempted to evaluate the use of technology from the students perspective to deliver quality education over distance. The purpose of the study is to determine if technology has reached a level of adequacy to support the delivery of quality education regardless of time and place constraints of students and/or instructors. In addition, this study will endeavor to find which technological innovations provide students and instructors with a satisfactory degree of interactivity, which is the basis of traditional education.

3. Significance of the Study

This research may be important to those who are concerned about how technology should be included in the decision-making process of establishing distance-learning projects. Institutions exploring the myriad of technological innovations that could be used in distance education may also benefit from the study. Developing concrete insights on distance education may enable institutions to better balance their traditional on-sight programs with non-traditional distance education alternatives.

This study may or may not point out the importance of using technology to establish a distance education project. If it proves vital, then the results could be of value to institutional decision-makers.

4. Review of Literature

4.1 Definition of Distance Education

Distance learning has multiple definitions. The author of Distance Education Clearinghouse

(2002), which managed by the University of Wisconsin-Extension, compiled few definitions of distance learning. The author concluded that distance learning is a planned environment; involving the use of technology, and its design should provide the learners with interaction.

4.2 Link of Technology with Distance Education

This section deals with the issue of how technology has impacted distance education. Gates (1995) stated that people might fear that technology would "dehumanize" education. He added that if people could watch students living in different countries and exchanging information across the borders, they might rethink that technology would actually "humanize" education. Gates continued by stating "the same technological forces that will make learning so necessary will also make it practical and enjoyable. Corporations are reinventing themselves around the flexible opportunities afforded by information technology; classrooms will have to change as well." (p. 184)

4.3 Quality Distance Education

Since quality education is a concept that varies among individuals, it is hard to agree on a definition of quality in education. Aldag and Stearns (1991) suggest that quality is what a consumer wants from products and services and is willing to invest in. Moore and Kearsely (1996) discussed "quality assessment" as an important factor in the process of managing a distance education project. The authors stated that a distance education project should be assessed based on several factors. These include "quality of application and enrollment, student achievement, student satisfaction, faculty satisfaction, program or institutional reputation, and quality of course materials. Each of these factors reflect different aspects of quality" (p. 182).

4.4 Distance Education and Interactivity

De Vries (1996) stated that systems, which support interactivity between students and instructor, could generate a satisfactory learning environment. Schwier (1994) discussed the reasons for including the interactivity factor in distance education projects. These reasons include:

(a) finding different methods of accessing the materials;
(b) requiring interactive media analysis;
(c) producing stronger learning environments, since multiple media can be combined;
(d) increasing student retention rates;
(e) creating an independent study environment;
(f) providing instant access to information;
(g) ensuring a less hostile learning environment;
(h) improving record keeping and
(i) reducing costs.

4.5 Technology, Delivery Systems and Distance Education

This section discusses the electronic devices, and the delivery methods used in distance education. McLean (1996) stated that by using technological innovation, classrooms around the globe could be connected through satellite, computers, interactive TV, and the Internet. Brennan (1992) stated that telecommunication could provide new links between the learners and the instructor. The author added that the term "interactivity" is associated with the field of telecommunication.

Lucio Teles (2002) who surveyed 32 online instructors from United States, Mexico, Canada, Netherlands, Greece, Colombia, Australia, South Africa, the United Kingdom, and Spain stated that instructors preferred instructional tools that are intuitive and require less time to learn. Further, Morse (2002) stated that a variety of distance learning methods does exist. These approaches range from traditional correspondence courses to real time interactive videoconferencing. In delivering distance education, the varieties of modes include print (Bates 1995), e-mail and facsimile (Romiszowski 1993), video conferencing, interactive video technology (Buntzman 1996), audio graphics (Steiner 1997), teleconferencing and audio conferencing (Patton-Bennington 1997), and the Internet. (Glossbrenner & Glossbrenner 1996).

4.6 Interactive Technology, and Distance Education

Systems, which supported interactivity, and were expanded to allow the discussion of related issues, could generate a satisfactory learning environment (De Vries 1996). De Vries continued by stating that effective distance education could be achieved when the students have "personal involvement." This section deals with the reasons for providing an interactive environment in the distance

education setting and studies related to interactivity issues in graduate schools.

Salmon (2002) stated that "learners need to be led through a structured developmental cycle for online learning to be successful and happy." Jones (1995) researched the usage of interactive-intercampus telecommunication systems connected through a compressed-video network in Alabama that was used in distance education. Jones concluded his study by stating that technology seemed to be effective and adaptable in providing teachers with better approaches to instruction.

5. Hypotheses Pertaining to This Study

This study explored the following three hypotheses:

Null hypothesis 1:
Student-instructor interactivity and student comparative progress are statistically related.

Null hypothesis 2:
The student's belief about adequacy of the communication mode does not vary with its level of interactivity.

Null hypothesis 3:
There is no relation between the student-instructor interactivity and the student's desire to take another DE course.

6. Research Design

6.1 Subjects

The population of students for this study is pursuing a graduate degree education through non-traditional means. Target subjects are graduate students who undertake distance education classes, appear to have technological competence, and who attend the Troy State University System (TSU) at a variety of campuses. The TSU database shows that there are about 400 graduate students who may be eligible and available to participate in this survey, given that in non-traditional campuses, student mobility is high.

This sample may show some limitations that could be stated as follows:

1. Diverse Educational Background. The surveyed students attended different undergraduate colleges and universities. Their educational background was varied, as was their degree pursuits.
2. Age of the Students. Since non-traditional graduate students tend to be older than traditional graduate students, their exposure to technology may vary. Their appreciation and views of the existing technology to deliver quality distance education could be affected by the degree of their experience.
3. Different Occupations. Since the surveyed students acquired different skills and knowledge from their jobs and life experiences, their appreciation or the desire to take a course over distance could be affected by these factors.
4. Restricted Geographical Area. The surveyed students attended schools in three states: Florida, Louisiana, and Mississippi. For that reason, this study may not reflect the entire graduate student body in the United States.
5. Other. The inability to obtain information on other characteristics such as cultural, social, psychological testing, and drug testing results may also be delimiting factors.

6.2 Instrument

In order to attain the research objectives, it was decided to mail a self-administered questionnaire to the subjects. The questionnaire consists of 4 sections:

1) A demographic series of questions asking the students about their background, education and preferences.

Qualification question: The initial question in the distance education section of the survey asked if the student has taken a distance education course using technology. If the answer is yes, the student is asked to complete the rest of the survey. If the answer is no, the student is asked not to respond further.

2) The distance education section asked students to self-evaluate their experience with distance education courses (characteristics and worth) on a scale ranging from (1) = extremely inaccurate or disagree very much to (6) extremely accurate or strongly agree. This ordinal scale is well suited to measure the differences in levels of agreement. Further, it should be noted that the variable progress was recoded into CompProgress (Comparative

Progress) as: (1-2-3 = no more progress; 4-5-6= more progress).

3) The section of questions on courses assessments required yes/no answers.

4) Types of technological delivery system used for the distance education course were included in the survey. Respondents had to mark one or more of the delivery methods used in their distance education course. The methods from which they would choose included the Internet, other service providers (AOL, Prodigy, CompuServe, etc.), facsimile, voice mail, two-way-video-two-way-audio, one-way-video-two-way-audio, two-way audio, and printed material via mail.

6.3 Conducting a Pilot Study

A pilot study, using samples of the population base, was conducted to determine the validity of the questions posed in the survey. Upon completion of the pilot study, corrections were made, and the final survey was sent to the target sample of the population. The results of this pilot survey will not be included in the final results.

6.4 Procedure

Students who indicated a desire to participate received a survey package. The package included the survey questionnaire and a stamped, pre-addressed envelope to return the completed survey.

6.5 Data Analysis Remark

The following assumptions are made in the process of evaluating the data. Fink (1995) stated "when independent variables are measured on an ordinal scale, they are treated as if they were nominal….when dependent variables are measured on an ordinal scale, they are habitually treated as if they were numerical" (pp. 49-50).

7. Findings and Discussion

7.1 Returned Surveys and General Characteristics of the Subjects

Of the 396 surveys sent, 253 or 64% were completed and returned. Of the latter, 20% of the students who answered the survey have enrolled and finished a distance education course. The socio-demographics of respondents' shows that 26% of the enrolled were female and 74% were male. Further, while the ages range from 26 to 54 years of old, the mean for the ages was 38.04 years and the median was 37.0 years.

7.2 Use of Delivery Systems

There are large discrepancies among the different delivery systems as can be seen from Table 1.

Table 1: Delivery systems used

Method	Use the method (%)	Do not use the method (%)
Internet	22%	78 %
Other service provider (AOL, etc)	14%	86%
Fax	16%	84%
Voice mail	14%	86%
Two-way video and two-way audio	16%	84%
One-way video and two-way-audio	4%	96%
Printed material via mail	64%	36%

7.3 Assessment of Courses

As seen from Table 2, the distance education course was worthwhile to the majority (84%) of the respondents. Data showed that sufficient interactivity between the student and instructor (64%). A vast majority (92%) of students believed that the content of the distance education course was clear. Distance education courses did not include alternative activities such as a guest speakers, field trips, or live presentations, according to most respondents (88%). They believed that the communication mode used was adequate (74%). Most students (68%) believed that the distance education course was challenging. Most students (74%) were able to apply the knowledge acquired from the distance education course; these results could be influenced by age. Since the students are older, and gainfully employed, they could be using the knowledge gained in the distance education course to adapt it to the working environment. Finally, 82% of students would take another distance education course.

Table 2: Forced Assessment of course

	Yes (%)	**No (%)**
(Q1) Was the course worthwhile	84%	16 %
(Q2) Was there adequate interactivity provided between the student and the instructor?	64%	36%
(Q3) Did the course include other activities such as guest speaker, live presentation, or field trip?	12%	88%
(Q4) Were the course requirement and content clear?	92%	8%
(Q5) After finishing the course, were you able to apply the acquired knowledge, skills, and techniques?	74%	26%
(Q6) was the course challenging?	68%	32%
(Q7) Was the communication mode (internet, etc) the right mode?	74%	26%
(Q8) Would you take another distance education course?	82%	18%

As can be seen from Table 3, 40% of students believe that the distance education was not as rewarding as a traditional education course. Only 42% of students felt that the distance education did offer opportunities to learn more about issues that could not be easily learned in traditional education. The survey showed that 72% of students believed that distance education allowed them to progress faster and further than traditional education. 84% of students felt that the distance education was well planned and laid out. Furthermore, 82% of students believe that the distance education course met their educational expectation.

Table 3: Satisfaction intensity

	Disagree very much	Disagree moderately	Disagree slightly	Agree slightly	Agree moderately	Agree strongly
(Q9) Was DE More rewarding than traditional education?	6%	24%	28%	28%	10%	2%
(Q10) Did DE provide more opportunities to learn?	8%	14%	32%	30%	8%	4%
(Q11) Did DE allow for progress more than in a traditional course?	8%	4%	12%	30%	28%	14%
(Q12) Was DE planned and laid out, with easy to follow directions?	6%	2%	6%	32%	42%	8%
(Q13) Did DE meet your educational expectations?	0%	4%	8 %	30%	38%	16%

Tables 4, 5 and 6 show the results of the remaining sections of the questionnaire.

Table 4: subject distribution over interactivity and comparative progress variables

	Did progress More	**Did not progress More**	**Total**
Adequate interactivity	56.3 %	10.4 %	66.7 %
Inadequate interactivity	18.8 %	14.6 %	33.4 %
Total	75.1 %	25.0%	100.0%

Table 5: Interactivity and communication mode

	Right mode of communication	Wrong mode of communication	Total
Adequate interactivity	58.0 %	6.0 %	64.0 %
Inadequate interactivity	16.0 %	20.0 %	36.0 %
Total	74.0 %	26.0 %	100.0%

Table 6: Interactivity and desire to take another course in DE

	Desire not to take another one	Desire to take an another one	Total
Adequate interactivity	14.0 %	22.0 %	36.0 %
Inadequate interactivity	04.0 %	60.0 %	64.0 %
Total	18.0 %	82.0 %	100.0%

7.4 Summary of Findings

In terms of interactivity between the instructor and the students, there was an important factor in the evaluation of quality distance education, the conclusion from the results showed that:

- Three quarters of the students felt they progressed.
- Three quarters of the students think that the right mode of communication was used.
- Two-thirds reports that there was enough interactivity.

Finally, in terms of interactivity and the communication mode, 58% believed that adequate interactivity was sufficient and provided by the use of appropriate communication mode.

8. Hypothesis Verification

Inferential statistics were used to draw conclusions from three hypotheses. All the hypotheses used Fisher's Exact Test (a derivative of Pearson Chi-square) to infer the relationship between the examined variables.

8.1 Preliminary Remark

It should be noted that Fisher's Exact Test was used for the three hypotheses, since the Pearson's Chi-square might not be accurate (Norušis 1994). Fisher's Exact Test is generated automatically by SPSS as a form of the Chi-square test.

8.2 Hypothesis One: Interactivity and Comparative Progress

The purpose of this hypothesis was to determine whether or not a relationship exists between student-instructor interactivity in distance education courses and the students' progress in the distance education course, compared to progress and interactivity in traditional courses. The conclusion of this hypothesis was to reject the null hypothesis. This indicated that there was a relationship between the student-instructor interactivity and the student's progress in a distance education course at the level of Alpha = .05 (p = .041 < .05). The hypothesis could be retained if the Alpha was chosen to be .01. Finally, the two variables under investigation showed a degree of association since Phi, Cramer's V, and Contingency Coefficient had meaningful results by having close values: .306, .306, and .293, respectively.

Generated results showed that 20% or more of the cells have an expected count less than five. Since this is the case, "the observed significance level based on the Chi-square distribution may not be correct" (Norušis 1994, p. 208). In responding to the issue, the Fisher exact test was used to deal with this limitation. In the article "What is the Fisher's Test?," 1997, the author stated that Fisher's Test is used as a meaningful test to deal with limitations associated with Pearson's Chi-square. The author continued by noting that Chi-square is based on the expected value that is influenced directly by the sample observed. Further, Fisher's Exact Test is not susceptible to low frequency. The SPSS package contains this test, and it prints directly with Pearson's Chi-square. In the article "Fisher Exact Test Online," the author noted that the one side test is legitimate with Fisher's Exact Test. Finally, the exact significance for one side is equal to .041. This result is smaller than Alpha with the value .05. The conclusion is that the null hypothesis is rejected at Alpha

level of .05. Therefore, there is a relationship between the two variables: Interact and Progress. The association tests showed that Phi = .306, the Cramer's V = .306, and the Contingency Coefficient = .293. Even though the measurement of association is not equal, they are of "the same magnitude" (Norušis 1991).

8.3 Hypothesis Two: Adequacy of the Communication Mode and Interactivity

The purpose of this hypothesis is to determine the relationship and the strength of association between the students' belief about the adequacy of the communication mode and the level of interactivity between the instructor and the students. The conclusion drawn from this hypothesis would be to reject the null hypothesis. This indicated that there is a relationship between the student-instructor interactivity and the communication mode used in a distance education course at the level of Alpha = .05 (p = .001 < .05). The hypothesis would still be rejected if the Alpha level was selected to be .01. Finally, the two variables under investigation showed a degree of association since Phi, Cramer's V, and Contingency Coefficient had meaningful results by having close values: .505, .505, and .451 respectively.

It was shown that 20% or more of the cells have an expected count of less than five. Similar to the first hypothesis, Hypothesis 2 will use Fisher's Exact Test instead of Pearson Chi-square. The exact significance for one side = .001. This result is much smaller than Alpha with the value .05. The conclusion is that the null hypothesis is rejected at this level. Therefore, there is a relationship between the two variables "Interact" and "Rightmod," or the two variables are not independent. Further, the association tests showed that Phi = .505, the Cramer's V = .505, and the Contingency Coefficient = .451. Even though the measurement of association is not equal, they are of "the same magnitude" (Norušis 1991).

8.4 Hypothesis Three: Interactivity and the Desire to Take Another Course in DE

The purpose of this hypothesis is to determine if there is a relationship between the level of interactivity supported by using the technology in the distance education course and the desire to take another distance education. Results showed that 20% or more of the cells have an expected count of less than five. Therefore, Hypothesis 3 will use Fisher's Exact Test instead of Pearson Chi-square. The exact significance for one side = .007. This result is much smaller than Alpha with the value .05. The conclusion is that the null hypothesis is rejected at this level. Therefore, there is a relationship between the two variables: Interact and Again, or the two variables are not independent.

A symmetric Lambda coefficient is used. This will allow to "predict the first variable from the second and then the second variable from the first" (Norušis 1991, p. 311). Lambda value for the variable Again = 0. (Norušis 1991) asked the same question "Is it really possible for variables to be related and still have a Lambda of zero? That doesn't sound right. Actually, this can happen easily depending on the distribution of the dependent variable" (p. 312). The used Lambda is symmetric. Therefore, Again and Interact are considered as dependent variables. Further, "since knowing the independent variable doesn't help at all, lambda equals zero" (Norušis 1991, p. 312). This value of Lambda would help a person to conclude that the variable Again would occur whether or not the value of Interact is known (Norušis 1999).

8.5 Impact of these findings

1. Students could expand their educational experience by taking classes over distance.
2. Although more students agreed that the communication mode was adequate at the time of this study, in the future the situation might change drastically. This could be influenced by the proliferation of technology, which will contribute to the technological competence of the student. Thus, students may demand implementation of more sophisticated technological equipment in the educational environment.
3. Since the technological innovations are prolific, a new approach should be considered in purchasing and implementing technology, and in planning and adapting technology to meet institutional goals. This study did not gather data on these important issues that are of value to educational institutions.
4. A quality assessment of a distance education project should include all those who are involved in and concerned about the overall success of the project.

5. As stated earlier, the student body of today and tomorrow will become more technically oriented. The result of this orientation will affect educational institutions and corporations. They will need to understand the potential applications of technology and should include it in their strategic planning.
6. Managers and administrators should support initiatives that emphasize the use of technology to assure the success of the distance education projects.
7. The variety of technology available in the education setting can be applied to other settings to provide for student satisfaction.
8. Planning a distance education project should be flexible enough to accommodate rapid changes in technology.
9. Advances in telecommunication and the computing field will continue to be user friendly, which will allow for the deployment and accessibility of distance education.

9. Final Findings, Recommendation and Conclusion

9.1 Findings of the study

The following points summarize the highlights of the study. These include:

1. A distance education project is a valid and appropriate method for delivering quality distance education.
2. There exists a relationship between interactivity and students' progress in the distance education course.
3. There exists a relationship between the adequacy of the communication mode and the level of interactivity.
4. There exists a relationship between the level of interactivity and the desire to take another distance education course.

9.2 Limits and Recommendations for Further Studies

The following information may point to future research in the attempt to measure quality distance education.

1. Larger samples may eliminate some of the obstacles associated with running the statistics that are encountered in smaller samples.
2. Technological changes are prolific, and there is an ongoing need to create similar studies.
3. Future students will be more computer literate, and assessing their skills should be an ongoing process.
4. Future research on this subject should cover larger and more diverse student populations so generalization of the data can be applied more accurately.
5. Since the definition of quality distance education could vary from one institution to another, other studies could be made by using the statistical analysis of this research to test quality distance education in a specific location.
6. Should other researchers replicate this study, the additional testing would increase and enhance the validity of the questions used in this survey.
7. To obtain results that are similar to this study, an identical environment should be used. Further, because of the exponential growth in technology, it would be difficult to replicate these findings with future graduate student samples.
8. Based on the rate of technology proliferation, designing an effective method to measure quality distance education might include other variables that either were not included in this study or have not yet been introduced.

9.3 Conclusion

Distance education technology is evolving and exponential gains in technology continue to create increasing opportunities for innovation. Therefore, what is current today is obsolete tomorrow. To that end, there is a need for a conceptual model that withstands the changes in technology, economy, and the environment.

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