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Distance education: relationship between academic performance and technology-adept adult students

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Advances in technology assisted education are revolutionizing the educational process as most know it today. What impact, if any, does technology-assisted education have on the future of higher education? In this study, we examine data from an ongoing evaluation of the distance education program for graduate level business students in a private university. The study addresses the impact of technology-assisted learning on academic performance among distance learners and their on-campus counterparts. The study further explores the relationship between academic performance and students' technological adeptability. The findings indicate, when adjusted for gender (females out-performed males), there were no significant differences in academic performance between distance learners and their on-campus counterparts. Analysis also shows no significant differences in overall academic performance between technology-adept students and those without technological skills. These findings may remove at least some perceived barriers in the decision to initiate distance education programs.

Keywords: academic performance; distance learning; technology-adept; adult learners; distance education.

Introduction

The concept and application of distance education (DE) has been around for over two hundred years. References to the use of correspondence courses can be found as far back as the late 1770's (Wolfe, 1996). Over forty years ago Pennsylvania State University began offering televised college credit courses and became an early leader in what is now referred to as *technology-assisted education* (TAE), the use of technology to improve the education process (Richardson, 1996). TAE has had tremendous impact on education systems at both local and global levels. Today the use of personal computers and printers, fax machines, telephones, voice and electronic mail, and the Internet is common and even considered essential in many educational systems. On a broader scale, established and emerging technological advances in satellite transmission, the use of networked computer systems Intranets and Extranets, and compressed video, offer providers of education the means for distributing knowledge through methods unimagined as recently as ten years ago (Ashton, 1997).

Today, technology-assisted education is used as an enhancement in classroom teaching or as a substitute for instruction from professors. Its application may be in a distance

education program using television and satellite technology, or in distributive education using computer networks such as the Internet (Eddy and Spaulding, 1997). Distance education, as defined by the American Council on Education (1996), is a system and a process that connects learners with distributed learning resources. It is characterized by: 1) separation of place and/or time between instructor and learners, and/or between learners and learning resources; and 2) interaction between the learner and the instructor, among learners, and/or between learners and learning resources conducted through one or more media (Sullivan and Rocco, 1996).

The application potential of these new technologies appears to be far greater than actual implementation particularly in their productive use in the educational process (Geoghegan, 1994). While most agree that technology-assisted education has the potential for literally re-engineering systems of education, it is the users (students and professors) of these technologies that determine success or failure (Webster and Hackley, 1997), not the technologies. 'Essential to the success of distance education programs which use such technology is the training of both professors and students who will be involved in this emerging technology' (Garland and Loranger, 1996).

BACKGROUND

Distance learning frequently involves the separation of the teacher and the learners in space and often time, a shift in volitional control from the teacher to the learner, and noncontiguous interactive communication between teachers and students through the use of electronic media (Sherry, 1994). Wolfe (1996) defines distance learning as a structured or programmed learning process operating without the physical presence of an instructor. The terms distance education and distance learning are often used interchangeably; however, distance learning is the intended outcome of the distance education process (Wolfe, 1996).

In researching the literature, it appears that much research focuses on the actual use of technology in the classroom and its effect on student satisfaction and academic performance. These investigations are critical to understanding the impact of technology on the students' ability to learn. However, more practical considerations play in the minds of education administrators. Many educational institutions are faced with decisions of having to commit precious resources to distance education programs at the risk of such investments not being as successful as traditional approaches at least in their effectiveness, efficiency notwithstanding. As corporations are beginning to meet the needs of the non-traditional student through corporate universities and other corporate-based education, academic administrators see the necessity for adopting these new technologies to remain competitive and to attract new market segments (Walsh and Reese, 1995; Miller and Clouse, 1994).

Given the growing use of and confidence in distance education alternatives, the use of technology in the classroom is increasing rapidly; however, both the student and the professor must be at ease and comfortable with the use of technology to gain full benefit from technology-assisted education. 'The belief that one has the capability' to comfortably

interact with technology is a construct that does impact performance (Compeau and Higgins, 1995). Studies from Davis, Bagozzi and Warshaw (1989) and Zoltan and Chapanis (1982) also support this assertion. Furthermore, the concept of *self-efficacy* in social cognitive theory argues that one must *believe* in his or her own ability to successfully accomplish what one sets out to do (Bandura, 1986). One's belief in self-efficacy influences motivation. 'You may have many skills and talents, but if you believe you are incompetent, the skills may go to waste. *If you believe you are competent, you are likely to value your abilities and aspire to success*' (Harachiewicz, Sansone and Manderlink, 1985).

The Non-Traditional Student

There is a rapidly growing population of students currently referred to as *non-traditional students.* These students are unique in their definition of educational needs; however, referring to them as *non-traditional* may be short-lived due to the sheer increase in their numbers alone. Between 1970 and 1995, US non-traditional students more than doubled to over six million (Wayland and Swift, 1995; National Center for Education Statistics, 2000). This number, Internet and WEB based offerings notwithstanding, is expected to grow to almost 70 million in 2007 (National Center for Education Statistics, 2000). The dramatic historical, and continuing, increase has made a startling impression on university and college professors and administrative decision-makers. Many are asking 'How do we use advances in educational technology to better meet the needs of these students?' For the most part, these students are professionals with several years of work experience, and are returning to the universities for a number of reasons, both personal and professional (Stamps, 1998). A few of these reasons follow:

1. *Globalization*: Corporations are searching for employees who have business experience, an understanding of international business, and management skills that will give them the edge in technology-intensive firms.
2. *Downsizing*: With the loss of company loyalty and job security, American workers are recognizing the need to enhance their own marketability. Many of these workers are returning to school to enhance and update their knowledge, skills and abilities.
3. *Changing World Economy*: Success in today's business environment requires competencies for strategically managing innovation and creativity in dynamic national and international environments. Also required is the ability for assessing technological requirements essential for optimum competitive advantage.
4. *Changing Lifestyles*: With advances in technology across practically all industries, and the changing needs of American workers, the trend is to find a more even balance between work and personal life.

This study

Mercer University, a private university established in 1833, initiated a program in distance education for business students seeking a Master of Science in HealthCare or Technology

Management. There were several types of technologies being used in Mercer's distance education program. The primary delivery method was a two-way, interactive, compressed video system. The class sessions were transmitted from the campus site to a distant location in the State and the reverse.

This program of study was designed to provide the knowledge and skills required to manage successfully in complex, technology oriented organizations. The courses of study addressed the needs and interests of individuals already employed in those areas, who wished to pursue or enhance a management career. The courses evaluated in this study were core courses in the MS curriculum, mixing both HealthCare and Technology Management students. Analyses indicated no significant demographic differences between the healthcare and technology management students, so for the purposes of this study they were considered as part of the same sample.

The study addressed possible differences between distance learners and their on-campus counterparts in terms of overall academic performance. With an increasing use of technology-assisted learning, identifying and eliminating potential barriers to academic achievement is necessary for assuring learning success. Other factors considered as potential barriers were age, gender, access to computers and self-efficacy on the use of computers and other related technology. Student attitudes and opinions towards the use of technology-assisted education and those individuals who professed to be less adaptable to technology-assisted learning can also be barriers.

Measures of Academic Performance

The efficacy of the use of technology in higher education has not yet been demonstrated. 'Lookatch (1995) purported that all research that has been done in the area . . .is inherently flawed. . . .. Further, . . .Kobulicky (1999) stated that . . .conclusive evidence between technology and success in learning (as proxied by grades) is still lacking . . .(Johnson, 2000).' Others claim that there were no differences in academic performance between students who were in the physical presence of the professor and those who were at the distant location (Storck and Sproull, 1995). Thus the study of distance education and the nature of student performance in all locations continues to be necessary until such time as the 'evidence' is conclusive.

Grades are one of several methods for measuring academic performance. Notwithstanding issues surrounding the effectiveness of grades as a measure of learning (Cleveland and Bailey, 1994), final grades for the course served as proxies for learning.

Measures of Technological Adeptability in Adult Students

Not only could the distance education setting be a hindrance to learning, an individual's fear of using technology in the classroom may also affect academic performance. Thus, the study further explored the differences between individuals who were defined by the authors

as being technology-adept, or comfortable and confident with using technology, and those individuals who professed to be less adept with technology-assisted learning.

Researchers such as Davis, Bagozzi and Warshaw (1989), and Zoltan and Chapanis (1982) argued that the users' (students and professors) attitudes and opinions greatly impacted the successful implementation and utilization of any new technology. Webster and Hackley (1997) suggested that 'the attitudes toward a technology, the perceived usefulness of the technology, and attitudes toward distance learning should be included as important learning outcomes.'

The term *technology-adept* has been used as a measure of one's perceived competence and belief in self-efficacy. For the purposes of this study, *technology-adept* is the degree to which a person believes in his or her ability to learn with the assistance of technology; and the degree to which a person is comfortable and at ease with the use of technology for accomplishing desired learning outcomes.

Self-efficacy is acquired through one's experience, persuasion and encouragement from others, and the perception of one's own physiological state (Bandura, 1986). Likewise, the term *technological adeptability* is a measurement of the student's previous experience with technology, level of understanding, and comfort with the use of technology. According to Rozell and Gardner (2000), 'Computer efficacy' refers to 'a judgment of one's capability to use a computer' in the accomplishment of a task. . . . The construct has been found to be positively related to performance. Similarly, computer experience and ability have been shown to be directly related to achievement in a technology-assisted course as well. Thus study of technology adeptness of distance education students should be useful in further understanding their course performance. Based upon the literature, the dependent variable (technological adeptness) was defined in this study to be a combination of the following three variables (Table 1).

Methodology

Based upon the literature review, the following propositions were studied:

Proposition One: *There are no differences in overall academic performance between distance learners and their on-campus counterparts.*

Proposition Two: *There are no differences in overall academic performance between students who are technology-adept and students who are not.*

Table 1. Technology-adept variables

• I am an experienced Internet user.			Yes — *		No —
• I enjoy using and keeping up with technology					
Strongly Agree					Strongly Disagree
1*	2*	3	4	5	
• I have a [minimal] [general] [advanced *] understanding of how to use a computer					

* represents the variable options used to derive the measure of technological adeptability

Description of the Survey Instrument

The authors chose to use parts of existing survey instruments (Bozik, 1996; Compeau and Higgins, 1995; Emporia State Web Page, 1997; Engineering Outreach, University of Idaho Web Page, 1997; University of Wyoming Web Page, 1997; and Distance Learning Services, Georgia State Web Page, 1997) and developed additional questions used to customize the questionnaire. The instrument was designed to obtain information on demographics; educational background; professional experience; personal background; technology access, use and preferences; attitudes toward technology; and academic performance.

Student Profiles

Students participating in this study were both local and distance students in two core courses in the Master of Science program. Final grades were averaged to provide a mean GPA for the students. No significant differences were found among technology and healthcare students; thus, they were part of the total sample. Thirty-three students were involved in this study. Differences in student profiles are noted in Table 2. Statistically significant differences among the distance and local students were found to be gender, females outnumbered males in the local classroom 2 to 1; and in the distance classroom, the reverse, males outnumbered female students two to one. Second, the distance learners were older. GPA differences, which may have accounted for variations in performance results were not different for any of the groupings studied.

Procedures

Between August and December 1997, data was collected from the students. The courses involved in the study were Organizational Behavior, and Accounting and Financial Management. Each of the courses was offered at both the off-campus and on-campus locations.

To assure anonymity, an education facilitator administered the questionnaires. Questionnaires were distributed to students during the first session of the semester, who were requested by the facilitator to complete the questionnaire during the first 20 minutes of the first session. The professor was not present at any time during the process. Students were told by the education facilitator that all responses were voluntary and confidential, and would not affect the relationship with the professor or impact the grades in any way. The facilitator then collected the questionnaires.

Analysis of Data

In order to obtain an overall description of the student group, descriptive statistics were gathered on personal and professional background and general demographic data (Table

2). Student opinions on the process of distance education and their use of technology in the home and at work were also obtained from the questionnaires.

Respondents were divided into two groups based on the location of the classes. Because of the sample size, a student *t*-test was performed to determine if the final grade differences between distance learners and their on-campus counterparts were statistically significant. Regression analyses were also run to determine any relationships between any of the study variables and academic performance. Further, student *t*-tests were run to determine if there were differences relating to gender in the on-campus and off-campus classes.

The second proposition related to differences in academic performance between students who were defined as technology-adept and students who were not. To test this hypothesis, as stated, the student's previous experience with technology, level of understanding, and comfort with the use of technology measured the level of technological adeptability. Those individuals who reported being experienced Internet users who strongly agreed that they enjoyed using and keeping up with technology, and who reported an advanced understanding of how to use a computer were considered *technology-adept* in this study (Table 1).

A student *t*-test was performed to determine if final grade differences between the two groups were significant. Means testing was also performed to determine if marital status was a statistically significant factor between technology-adept students and non-technology-adept students relative to academic performance.

Table 2. Student population demographics

Variable	All Students n = 33	Distance Learners n = 14	On-Campus Learners n = 19	Technology-Adept n = 10	Non-Techn. Adept n = 23
Gender	Male	9*	7*	9	7
	Female	5*	12*	1	16
Average Age		35.79*	30.95*	33.4	32.8
Marital Status	Married	6	7	5*	8*
	Single	6	9	3*	12*
	Widowed	1	1	1	
	Divorced	1		1	1
Employment	Full time	12	17	9	20
	Part time		1		1
	Unemployed	1	1	1	1
Income Level	None	1	1	1	1
	< 25000	3	3		6
	25 − 50000	9	9	6	12
	50 − 75000	1	3	1	3
	> 75000		1		1
Final Grade		3.411*	3.776*	3.679	3.573
1st DE Course	Yes	11	18	1	3
	No	3	1	9	20

* significant at < .05 level

Results

Proposition One: There are no differences in overall academic performance between distance learners and their on-campus counterparts.

The student *t*-tests indicated that there were significant differences between academic performance by location. Therefore, Proposition One was initially rejected. Analysis of variance across means indicted that there were two significant differences among the two student groups, age and gender. Regression analyses indicated no significant relationship between age and final grade, but between gender and final grade (3.765 for the females versus 3.469 for the males, $p < .07$). Female results were the same in both locations. Given that females outnumbered males two-to-one in the on-campus classroom and that their final grades were significantly higher than males (3.8 versus 3.5), the difference in grades between the local and distance classrooms was attributed to the gender differences, not to distance learning differences. Thus when adjusted for gender differences, proposition one is not rejected.

Proposition Two: There are no differences in overall academic performance between students who are technology-adept and students who are not.

The results of the student *t*-test indicated that no differences were observed between technology-adept students and non-technology-adept students in their academic performance. There were also no significant differences found between these groups in age or gender. However, the marital status was different between the technology-adept and the non-technology-adept students, but an analysis of variance indicated no differences in academic performance by marital status, therefore Proposition Two was not rejected.

A regression analysis was also run with the final grade being the dependent variable and the three technology-adept variables being the independent variables. The results indicated that students who enjoyed technology had higher grades. The F value was 5.075, with $p < 0.05$, and an adjusted R^2 of 12%.

Discussion

The focus of this study was to look at the possible impact technology-assisted education had on adult learning as proxied by grades. Is distance education a convenient method to meet the needs of the non-traditional student while compromising the learning potential? Or does it remove barriers for students to acquire advanced education? Findings indicated that the instructional format did not significantly affect academic performance. These findings are supported by Storch and Sproull (1995).

Since the average student age was 33, it could be argued that this generation is inculturated with the uses of technology from an early age. Their exposure to video games, computers and other forms of recent technological advances has been a part of their lives since childhood; therefore the use of technology in a distance learning environment would

not significantly impact academic performance. Additional research is required to determine if age affects academic performance in an environment of technology-assisted learning.

While this study did not go into attitudinal responses, almost three quarters of the students indicated that clear guidelines of course expectations and the absence of technical problems during class-time had a significant impact on their learning experience. Quite possibly, a well designed and well-implemented distance education course does not affect the learning experience, but a distance education class with these distractions would have a negative impact on the learning experience (Webster and Hackley, 1997). A comparative analysis from a selection of distance education programs of varying sizes and 'degree of program success' may indicate specific critical areas for assuring learning success.

Use of grades as a measure of student learning is restrictive, especially in a distance education environment. These authors agree with Cleveland and Bailey (1994) that there needs to be found a more reliable method of measuring learning both in a class environment of distance education and/or in traditional classroom settings.

According to Collis (1995), it is not the technology alone, but rather the way in which the instructor implements the technology that determines its effect on academic performance. Webster and Hackley (1997) go on to state that it is the characteristics of the instructor (attitudes, control over the technology and teaching style) that affect academic performance. Studies on teaching effectiveness in both traditional and distance education classroom environments are recommended to develop more accurate measures of academic performance.

As the literature is relatively inconsistent on the subject of academic performance and distance learning, the findings add a study to the literature that demonstrated that lower academic performance for the distance learners compared to their on-campus counterparts was explainable when the gender differences in the two student samples were taken into account. Perhaps the overall body of knowledge on this subject would be more consistent if studies recognised the demographic differences in their subjects.

Further, while a useful tool to define student types, analysis showed no significant differences in overall academic performance between technology-adept students and those who were not. While the concept may ultimately be useful, it needs further refinement. However, one independent variable of the technology-adept criteria, *enjoying technology,* did result in a significant relationship to grades, explaining over 12% of the observed variance.

Summary

The findings indicated no significant differences in academic performance between distance learners and their on-campus counterparts. Analysis also showed no significant differences in overall academic performance between technology-adept students and those who were not. The results also indicated the importance of controlling for student differences in the analyses. These findings may remove at least some perceived barriers in the decision to initiate distance education programs.

Conclusions

The implication for Mercer's program: distance education did not seem to negatively impact the students' academic performance. For all distance programs, in these new technological times, perhaps selecting students who enjoy technology might be one key to the future of student academic performance in the millennia's new classrooms, real and virtual. Understanding the efficacy of the use of the technology is another.

References

Ashton, R. (1997) E-studies at cyberschool. *Home-Office Computing*, **15**(4), April, 13.

Bandura, A. (1986) *Social Foundations of Thought and Action: A Social Cognitive Theory.* Prentice Hall:Englewood Cliffs, NJ.

Bozik, M. (1996) Student perceptions of a two-way interactive video class. *T.H.E. Journal*, September, 99–100.

Cleveland, P. L. and Bailey, E. K. (1994) Organizing for distance education. In: *Proceedings of the Twenty-Seventh Annual Hawaii International Conference on System Sciences*, **4**, 134–141, IEEE Computer Society Press, Los Alamos, CA.

Collis, B. (1995) Anticipating the impact of multi-media in education: lessons from the literature. *Computers in Adult Education and Training*, **2**(2), 136–149.

Compeau, D. R. and Higgins, C. A. (1995) Computer self-efficacy: development of a measure and initial test. *MIS Quarterly*, **19**, 189–211.

Davis, F. D. Bagozzi, R. P. and Warshaw, P. R. (1989) User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, **35**, 982–1003.

Distance Education at a Glance, Guide #4, October, (1995). Engineering Outreach, University of Idaho. hhtp://www.uidaho.edu/evo/dist4.html.

Eddy, J. P. and Spaulding, D. (1996) Internet, computers, distance education and people failure: research on technology. *Education,* **116**(3), 391–392, Spring.

Garland, V. E. and Loranger, A. (1996) The medium and the message: interactive television and distance education programs for adult learners. *Journal of Educational Technology Systems*, **24**(3), 249–257.

Geoghegan, W. (1994) Stuck at the barricades: can information technology really enter the mainstream of teaching and learning? http://www.ilt.columbia.edu/k2/livetext/docs/projdev.html.

Harachiewicz, J. Sansone, C. and Manderlink, G. (1985) Competence, achievement orientation, and intrinsic motivation: a process analysis. *Journal of Personality and Social Psychology*, **48**, 493–508.

http://www.emporia.edu/n/www/hper/survey22.htm. Emporia State University (1998). 'Survey of Distance Learners.'

Ingram, A. L. (1996) Teaching with technology, *Association Management*, **48**(6), 31–38.

Johnson, D. (2000) Developing a seminar and workshops for new faculty members in graduate level higher education to increase their adoption of instructional technology methodologies. Masters, Practicum Report, Unpublished, Nova Southeastern University

Kobulicky, P. J. (1999) Critical factors in information technology planning for the academy, *Cause, Effect*, **22**(2). Retrieved September 1, 1999 from the World Wide Web: http://www.educause.edu/ir/library/html/cem9924.html.

Lookatch, R. P. (1995) Technology for teaching? The research is flawed. *Educational Digest,* **61**(3), 4–8.

Miller, C. D. and Clouse, W. (1994) Technology-based distance learning: present and future directions in business and education. *Journal of Educational Technology Systems*, **22**(3), 191–204.

National Center for Education Statistics, July 1, 2000, http://nces.ed.gov/pubs98/pj2008/p98c02.html.

Office of Off-Campus Credit Courses. 'Compressed Video Teleconferencing Instructor Survey.' University of Wyoming, 1997.

'On Campus Student Evaluation,' Distance Learning Services. (1997) Georgia State University.

Richardson, H. L. (1996) Logistics education: within your reach. *Transportation and Distribution*, **37**(2), 38–42.
Rozell, E. J. and Gardner, W. L., III. (2000) Cognitive, motivation, and affective processes associated with computer-related performance: a path analysis. *Computers in Human Behavior,* **16**(2000), 199–222.
Sherry, L. (1994) Issues in distance learning. http://www.cudenver.edu-isheny/issues.html.
Storck, J. and Sproull, L. (1995) Through a glass darkly: what do people learn in videoconferences? *Human Communications Research*, **22**, 97–219.
Sullivan, E. Rocco, T. (Task Force Co-Chairs) (1996) Guiding principles for distance learning in a learning society. American Council on Education, Center for Adult Learning and Educational Credentials.
Treagust, D. Waldrip, B. Horley, J. (1993) *Education*, **14**(2), 318–323.
Walsh, J. and Reese, B. (1995) Distance learning's growing reach. *Technological Horizons in Education (T.H.E.) Journal*, **22**(11), 58–62.
Wayland, W. P. and Swift. (1997) Issues and concerns for marketing educators. Advances in Marketing, 193–199, Southwestern Marketing Association, Houston, TX.
Webster, J. and Hackley, P. (1997) Teaching effectiveness in technology-mediated distance learning. *Academy of Management Journal*, **40**(6), 1282–1309.
Wetzel, C. D. Radtke, P. H. and Stern, H. W. (1994) Instructional effectiveness of video media, Erlbaum, Hillsdale, NJ.
Wolfe, T. E. (1996) Putting interaction into interactive television. In *Proceedings, 17th Annual Distance Learning Conference*, University of Wisconsin, Madison, WI.
Zoltan, E. and Chapanis, A. (1982) What do professional persons think about computers? *Behavior and Information Technology*, **1**, 55–68.