Investigating the Relationship Between Cost, Reach, and Richness in Distance Education

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Abstract

Is the money allocated to institutional distance education getting the results on the back end in terms of student achievement? A literature review of cost analysis studies on distance education is presented with three themes factored out from those studies: Costs (Institutional and student costs), Reach, and Richness (cost to the student). A synopsis of a study that produced evidence regarding the relative effectiveness of three distance educations strategies (*live* , *video* , and *web*) for enhancing the science learning of 94 midwestern elementary school teachers who were participating in a five-year professional development project is referred to throughout this piece. The results of this analysis suggest there is a sliding scale when looking at cost, reach, and richness in distance education.

Introduction

D'Ignazio (1993) compares distance learning in education with that of the corporate world, “Businesses have been building electronic superhighways while education has been creating electronic dirt roads. And sometimes on a dirt road, it's just as easy to get out and walk.” If we are to convert dirt roads to superhighways, we must continue to ask questions and seek answers through study of both dirt roads and superhighways. For the third time in fifty years distance education has been touted as the elixir that will cure all the ills in education and training. However, what is different is that never before has this much attention, money, publicity, and hope been invested in its practice in business and education (Saba, 2001) .

"IT Funding challenges have become the number-one IT-related issue in terms of its strategic importance to the institution, its potential to become even more significant, and its capture of IT leaders' time” (Crawford, 2003) . Higher education institutions are feeling increased pressure to integrate distance courses. The justification for this pressure is primarily due to the possibility of higher student enrollment and the resulting increased revenue for the institution and for the departments from which the teaching originates. As the economy in the United States continues to slump, the demand to increase institutional revenue continues to increase exponentially. Many state governments are making up for their budget deficit by extracting the allocated funding for education. Institutions seeking innovative ways to combat costs are moving to more flexible ways of delivering teaching and learning (Archer, 1999) . Combined with the competition from for-profit institutions, the difficulty to produce quality distance courses with minimal funding, and attracting quality students is almost incomprehensible.

There have been numerous cost analysis studies (Alaluusua, 1992; Archer, 1999; Branigan, 2003; Crawford, 2003; Cukier, 1997; Foreman, 2003; Hawkes, 2000; Jones, 2003; Katz, 1999; Marrett,

2002; Osguthorpe, 2003; Rumble, 1997; Spangehl, 1987; Taylor, 2001; United States General Accounting Office, 2004; Weigel, 2000; Zemsky, 2004) , but there is no clearly identifiable evidence to suggest that one avenue of distance delivery is more cost effective than another. The rapid expansion of the use of electronic teletraining (by corporations) is being driven, as always, not so much by effectiveness, but rather by economic factors (Romiszowski, 1996) . What is lacking in the literature on distance education is a substantive study that reports student achievement in each of the various delivery modes. Student achievement is arguably the biggest price educators' and students pay regardless of the teaching strategy or delivery mode. The reasons for investing in online learning varies from increasing access to the improvement to the quality of learning (Katz, 1999) . What follows is a rationale for this investigation, a review of costs analysis studies on distance education, and an argument for what variables should be considered when designing distance programs.

Purpose

The purpose of this investigation is to review various cost analyses on distance education, and to find common knowledge that would answer the question: Is money allocated to institutional distance education getting the results on the back end in terms of student achievement regardless of the capital put forth on the front end. The rationale for this inquiry is two-fold:

- A report by The United States General Accounting Office (GAO) report (United States General Accounting Office, 2004) , and
- The results of a comparative study of three modes of distance delivery (Annetta, 2003) . The study will be referred to as DEEP (Developing Elementary Educators Pedagogy) throughout this piece.

The GAO Report

The GAO reported in 2000, 1 out of every 13 postsecondary students took at least one telecommunications course, and by the end of the 2000-2001 school year, nearly 90% of the public 4 year institutions offered distance courses. These statistics emphasize the importance of distance courses in the current field of education. Undoubtedly, these numbers are only going to increase as time passes. One might ask what is the single most importance for offering distance courses? The answer depends on whom you ask and where you are when you ask them.

Purist educators might answer, “acceptable student learning outcomes” to this question. That is student learning is similar to that of traditional classrooms. The “No Significance Difference” results from numerous distance education comparative studies of traditional versus distance courses would suggest there are no learning differences between the two (Cooper, 2001; Coppola, 2000; Faux, 2000; Keefe, 2003; Meyer, 2002; Russell, 1999) .

Some administrators might answer the question with the same response as the purist educators. However, if the question was asked to these same administrators off the record, the answer might become one of a fiscal nature.

Certainly distance education brings with it the possibility of high student enrollments, and therefore greater revenue, but the question of student outcomes in various modes of distance education is a critical piece missing from the puzzle. The GAO report gave details on the importance of student learning citing agencies such as the Council for Higher Education Accreditation and the congressionally appointed Web-based Education Commission calling for accountability for institutions in student learning outcomes.

This is due in part to the fact that there are 7 different agencies that are accrediting institutions that offer distance courses. All have varying standards and benchmarks for accreditation. “Development of strategies for achieving the goals of reliable accreditation involves determining how human, financial, and other resources will be applied to achieve the goals (U.S. GAO, p. 21).” Finally, this report stated the results of their study recommended outcomes from 4 questions that formulated guidelines for accreditation. The goal was for all accrediting agencies to follow the same standards and benchmarks when evaluating distance education programs. Arguably the most important of the 4 questions asked specifically for evaluation of student learning outcomes in distance education programs.

DEEP

Annetta (2003) investigated the comparison of 3 modes of distance delivery (referred to as DEEP) in terms of the science content participants learned and in terms of participant perceptions of and attitudes toward the delivery modes -- (1) interactive television with real-time presentations by science experts facilitated by a host (*live*); (2) interactive television with videotapes of presentations by science experts supported by real-time, wrap-around discussions conducted by a host (*video*); and (3) asynchronous, web-based sessions with streamed video presentations by science experts supported by discussion board interactions among participants and the science experts (*web*).

Participant's science learning was determined with a set of multiple choice, constructed response, and classroom application (vignette) items designed specifically for each of the 6 science topics presented. Participant attitudes were collected with a set of items embedded from the *Flashlight Current Student Inventory*™ in *CTLSilhouette* ™. *Flashlight*™ has been developed in collaboration with the Western Cooperative for Educational Telecommunication and Indiana University Purdue University at Indianapolis with support from a variety of sources including the Fund for the Improvement of Post Secondary Education FIPSE) of the US Department of Education for planning, and from the Annenberg/CPB Projects of the Corporation for Public Broadcasting. *Flashlight*™ provides a particularly valuable and flexible array of survey questions for probing the relationship between new technologies and students' experience learning with them (Brown, 1998).

The research hypotheses on learning were tested using factor analytic and analysis of variance procedures on mean scores from the science learning posttests. Teacher background in science was used as a blocking factor in the ANOVA's. The reason for this blocking factor was to eliminate possible skewing of data due to the variability in science background of the participants. Some participants had as little as 3 credit hours in science while others had advanced degrees in a science content area. The results of DEEP suggested that students found a negative correlation toward their attitude of interaction in the *web* mode and *video* mode and a positive correlation for interaction in the *live* mode. More importantly, the results implied that the *live* mode was more effective than the *web* and *video* modes for science learning.

Cost of Distance Education

The focus of distance education has been toward *web* instruction due to its perceived financial benefit. Because it is exclusively Internet driven, web-based instruction is viewed as cost effective for institutions and time effective for the learner since the information can be accessed at any time from any location that has an Internet connection. This is the essence of asynchronous instruction. Cost is arguably a major factor associated with distance education. However, the analyses in the current literature can be misleading. Studies that examine the comparative costs

of distance education to traditional education have been done worldwide. However, there is considerable variability in these studies. Some studies examined per student costs, some studies looked at costs per learning hour, and some studies have explored the net costs of setting up a distance education experience (Perraton, 1997) . This disparity might be explained in terms of the difficulty in making precise comparisons between cost of media, audiences, and geography. After reviewing many cost analysis studies on distance education, 3 themes can be derived:

1. Costs: Institutional and Student
2. Attracting students (Reach)
3. Cost to the students (Richness)

Institutional Costs

Institutional costs are defined as costs the institution incurs. University administrators are putting all of their eggs into the distance education basket to help control overall institutional costs (Dibiase, 2000) . They are operating under the untested, unproven assumption that the asynchronous, web-based mode of instruction is the most cost-effective approach to delivering content that would otherwise be delivered in a traditional classroom setting (Kozma, 1994) . Jackson (1998) suggested distance learning is neither less expensive nor easier than a traditional course. Distance education has a lower per student cost than traditional education but with high attrition rates, the cost per graduates in distance education are considerably higher than that of their traditional counterparts (Rumble, 1997) . Vicky Phillips, founder of Geteducated.com, a consulting agency for distance educators, estimates the online student dropout rate at around 35%. The average attrition rate for college freshman at U.S. universities enrolled in traditional courses is around 20%. Hawkes (2000) stated that cost effectiveness of distance education correlates highly with student satisfaction regardless of money spent. The fact is, much of what passes for online education today would put most of us to sleep (Svetcov, 2000) . If the student is bored and the overall course satisfaction suffers, the attrition rates and cost effectiveness of that course will have a direct relationship. Moreover, administrators think that distance courses are cheaper than resident courses because they don't factor in the cost of time, expertise, and technology required (Taylor, 2001) . A study of the Colorado Department of Education reported that "the cost per student of a high-quality online learning program is the same as or greater than the per-student cost of physical school (i.e., traditional) education" (Branigan, 2003) .

The start-up expense of a distance program is generally the most significant (Jones, 2003) . For example, in the mid-1990's a midwestern university decided to convert some of their traditional classes to distance classes using compressed video over a telecommunications network. The startup equipment was a static $80,000 and the leasing of an established T-1 line infrastructure was another $1200 per month (Weber, 1996) . Prior to the start of DEEP, the network administrators proposed to raise the cost of leasing the T-1 lines from $6,400 to $18,000 for thirty-two hours of live, teleconference usage. This immense figure was used to deter live instruction in favor of asynchronous instruction. The network administration justified this by saying they would not have to pay engineers with the technical expertise to circumvent problems with compressed audio and video and could use fewer people with less technical knowledge if the science content sessions were delivered asynchronously. Twenty-four hours of network time at a total expense of $480 was incurred for the *live* and *video* modes. These costs can appear to be static to the laymen, but upgrades were frequent and costly. To circumvent these costs, institutions are creating partnerships with other institutions and companies to share technology, and to produce and deliver courses (Dunn, 2000) .

Student Costs

The results of DEEP indicate that administrators must decide whether it is more important for the delivery strategy they choose to promote meaningful learning or to simply benefit the institution financially. The manner in which the *web* instruction was used in DEEP doesn't suggest that the *web* is necessarily more cost effective and certainly does not suggest that it is more learning effective.

Federal funding through the still existent e-rate initiative of 1996 and presently *No Child Left Behind* (NCLB) are contributing financially to the hope that information technologies as a whole will answer the call for a cost effective alternative to traditional, on-campus instruction. As e-rate has allowed for the establishment of networks in schools and libraries and NCLB is calling for teacher expertise to be considered “Highly Qualified”, the infrastructure and motivation seem to be in place for teacher professional development through distance education. Interestingly, it is the promise of lower per-student costs that are driving distance education technologies (Rahm, 1999) rather than the quality of instruction and the learning opportunities for the students. Many universities are aiming at cost control, improved quality of instruction, student satisfaction, and perseverence in a competitive distance education market.

Riley, Hollerman, and Roberts (1999) stated, “The quality of Internet access is critical. Broadband access will be the standard. Slow, unreliable connections that cannot support interactivity or complex multimedia content will no longer be efficient or acceptable.” Viewing streamed video, animations, and other graphics (i.e., PowerPoint presentations, digital images, etc.) through *web* instruction require a high-speed, reliable connection. High bandwidth is limited by cost and location. With the onset of improved multimedia, the cost of development and delivery impact student perceptions (Marett, 2002) because the cost of purchase and development is passed on to the student.

The use of streaming video is an added bonus for the visual learner in the asynchronous mode but the expense to produce digital video is significant. The DEEP researcher streamed the video and uploaded it to a streaming server. If this were not the case then yet another person with expertise in digital video would have to be hired to create a streamed video. A cursory Internet search for cost of streaming video offered thousands of companies who provide this service. The average cost of digitizing video taken from standard VHS videotape was $150 for the first 5 minutes of video and $22.50 for each additional 30-minute block. The catch to these costs is that it doesn't factor in additional costs for editing or adding sequences such as titles or transitions. If the aforementioned expenses were accrued in the DEEP study it would have cost $240 per session and $1,440 over the course of 6 sessions.

Hidden Costs

Hidden costs are seemingly symbiotic with the increase of technology and the commitment to distance education. There are monetary costs that are prevalent in distance education. However, there are unseen time and human costs that are generally not budgeted and these deduct from the effectiveness of the distance education course design.

Human capital is an expense that can be easily underestimated (Ng, 2000) . “Time is money” and that holds true in the realm of distance education as well. Training instructors on how to use distance education technologies costs the institution money for the time spent by both the instructor being trained and the trainer. Zemsky (2004) cited Carol Twigg, the executive director of the Center for Academic Transformation at the University of Pennsylvania, who said faculty members involved in e-learning use the course management tools and supplemental technologies with a "hope for the best strategy." A class that has multiple instructors or a single instructor with

multiple support personnel requires time for virtual office hours and circumventing unseen or unpredicted technical difficulties. This is most apparent in the asynchronous mode of communication since the class is effectively open 24 hours a day, seven days a week. Often times professors want extra incentives to teach an e-learning course (Zemsky, 2004) . This makes the courses too expensive over the long haul. The technicians who need to be in place in case the inevitable technical difficulties occur cost money as well. During the *live* sessions of DEEP, a technician was on hand for the entire two-hour session. Although his salary is not known, it is known that he is paid on an hourly basis. The DEEP researcher trained the instructors on the equipment and provided support for constructing their presentations. Technical difficulties also occurred during the *web* sessions. A person would almost have to be paid as "on-call" to clean up the mess technical residue can leave behind. Again the researcher of DEEP was the technical assistance resource person for the *web* sessions. Emails and phone calls were received as late as 1:00 a.m. and as early as 4:30 a.m.

A major economic advantage for institutions that offer distance education is that it doesn't require lengthy full time student residence on campus. This might explain why established institutions have barely broken even financially when implementing distance education courses. The startup costs and the human capital are added expenses to the day-to-day operating costs at most institutions. The success of such accredited institutions that are exclusively Internet driven lies in the fact that they have zero expenses for housing, food service, utilities, etc. As Cairncross (1995) suggested, "The death of distance as a determinant of the cost of communications will probably be the most important economic factor shaping society in the first half of the new century." Certainly distance may have lost its enchantment, and information technologies can be argued as solely responsible for this loss.

Reach: The Cost of Attracting Students

A study reported by eBrain (2001) suggested that more than 65% of U.S. adults in online households are interested in continuing their education via distance learning. Moreover, fifty-five percent of adults are interested in classes delivered via the Internet. Weigel (2000) defined "reach" as the number of people involved in the exchange of information. As more universities are creating distance courses, the notion of reach is at the forefront of many curricular designs. Web-based distance learning is forcing institutions of higher education into competition with for-profit organizations to reach those who are looking for quick, efficient, and accredited degrees (Armstrong, 2000) .

The idea of larger numbers of students generates further ideas of increased tuition, value driven benefits, and value added benefits. Cukier (1997) defines value driven benefits as increased access, flexibility, and ease of use of institutional courses and technology. Value added benefits are such things as reduced traffic and parking on campus and the potential for new markets. While value driven benefits are important to a university's community, value added benefits are what is driving many of the current integrations of web-based courses.

Richness: Cost to the Student

"Richness" is the overall quality of information provided (Weigel, 2000) . If there is high quality in the delivery of information, than meaningful learning should be occurring. Learning is arguably the most important cost to students. This is not a monetary cost, but rather a cost of an intrinsic nature. Results of DEEP implied that more effective learning of science occurred in the *live* mode, over and above the *web* and *video* modes respectively. However, many administrators see *web* (asynchronous) instruction as more cost effective and therefore there is a need to find the

best way to deliver *web* instruction so the *web* student outcomes equal or outperform *live* instruction.

A Case for Synchronous Instruction

An argument needs to be made for *live* (synchronous) instruction. There has been much research that states that “Rich” distance education needs to contain two-way communication where instructors can provide immediate feedback to their students, but maybe more importantly has embedded instructional immediacy (humor, using student name, encouragement, gestures, smiles, etc.) (Gorham, 1988; Hackman, 1990; Muirhead, 2000; Romiszowski, 1996; Sproull, 1986; Tresman, 1998) . However, Chizmar (1999) proposed the use of technology can in fact provide immediate feedback through chat rooms, webcasts, and online quizzes.

The most successful math and science reforms of the 1960's were not just those that emphasized the active nature of the learner through manipulatives and hands-on inquiry, but instead those that provided opportunities for the students to talk and to question while they were engaged in the process of learning (Parker, 1999) . Learning theory has not changed much, if at all, since the 1960's. We still know that students learn most effectively when there is 2-way communication with the instructor and their peers, and are actively engaged in the content.

There is a problem with both students and teachers of distance courses not being prepared for teaching and learning through distance education formats. Cornell (1999) suggested students felt isolated due to lack of teacher feedback, technical difficulties, and time management. Teachers felt the same as students but also felt a sense of diminished control over the course. We can surmise that this is a reality because synchronous instruction is what students and teachers are used to. It is how students have learned and teachers have taught throughout their academic lives. Until asynchronous instruction is incorporated into the primary and secondary grades, the reality of students changing their attitudes toward asynchronous instruction is unlikely.

Meaningful Learning

Garrison (1990) stated, "Passive access to information is not sufficient; there must be active participation in the educational experience for information to become meaningful knowledge." It is critical that institutions and instructors of distance courses take the approach that it is more important what the students learn as opposed to an emphasis on reaching the masses. This approach has failed in the traditional large lecture classrooms, so why would we suspect it would succeed in the distance-learning environment? Foreman (2003) stated, "Even though it contradicts most of the tenets of high-yield instructional technique, the large lecture persists-mainly because it is cheap and pragmatically useful: the economics of scale generate a surplus that supports low teacher-student ratios in major classes."

Meaningful learning, which anchors new learning matter in cognitive structures, not rote learning, has to be the center of interest. Teaching is taken to mean facilitation of learning. Individualization of teaching and learning, encouragement of critical thinking, and far-reaching student autonomy are integrated with this view of learning and teaching (Holmberg, 1989) . These intangibles to the teaching and learning process are closely related to the affective domain of the learner. Designing distance courses requires what Cukier (1997) calls performance driven benefits. Examples of these benefits are student/teacher satisfaction, learning outcomes, active discussions, and a perceived return on investment by the student (Swan, 2001) .

Conclusion

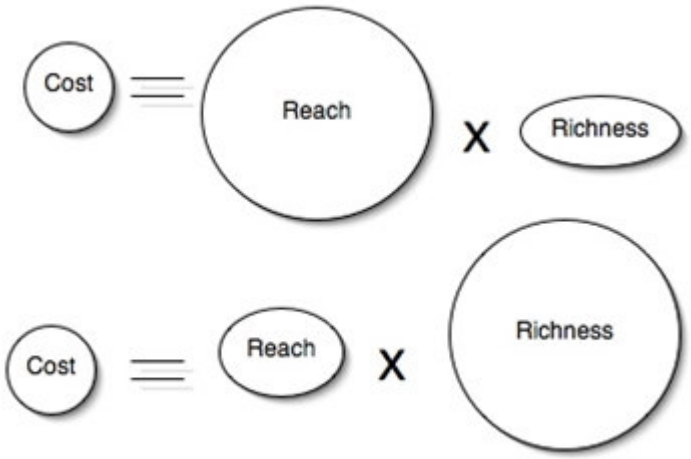
What we can glean from these studies is that distance education can be expensive to deliver and costly for students. Moreover, we can surmise that administrators of distance education need to thoroughly analyze the design process because there are many hidden variables that can quickly increase costs to the institution and the students alike. Money may make the world go ‘round but we shouldn't squeeze the dollar at the expense of meaningful learning.

Cheap products always conceal their true cost (Foreman, 2003) . Richness needs to be paramount in course design regardless of delivery strategy. Lopez (2003) suggests there are three critical issues that should be examined when designing an online course: 1. Learning occurs in communities; 2. Learning requires greater participation in communities; 3. Participation ensures the survival and growth of communities. Emerging technologies are providing possibilities for *Reach* to meet *Richness* . An alternative to videoconferencing is live webcasting (King, 2002) . This is the use of streamed or compressed video with a text chat integrated into the technology that allows all students and the instructor to interact synchronously. In the King study, one student was reported as saying, " the ability to participate in this course via the Internet (using live webcasting) was valuable to me. To be able to see the instructor and hear other people's ideas and comments made me feel I was a part of the class as opposed to a conference call.”

Conversely, the search for *richness* should not impact upon the search to improve *reach* (Marchese, 2000) . In traditional education, the tradeoff between *richness* and *reach* is equal to cost (Weigel, 2000) . There is a sliding scale between *richness* and *reach* .

As *richness* increases, *reach* decreases (and vice-versa) to keep *cost* equivalent. See **figure 1.**

Fig. 1: Proportion of reach and richness and its effect on cost.



Suggestions for Practice

There are arguably 5 components to a rich, cost effective distance learning delivery. The acronym **PUPIL** is used here as a guide for distance education administrators to follow as they design courses and a subtle reminder that the pupil is the most important aspect of any educational setting. **PUPIL** can be deciphered in the following manner:

P -Production

U -Upkeep

P -Personnel

I -Infrastructure

L -Learning

Production is comprised of the teaching and technical support staff. These people develop and implement the learning tools for a distance course. They are the critical cogs in a perfectly delivered program. The instructor(s) deliver the content while the technical support staff guides the students through the technology.

Upkeep is the cost related to maintenance, repair, and upgrades to the delivery systems. In the digital age, upgrades are prolific and the price of upgrades can increase drastically.

Personnel are the office administration. When *reach* increases, the traditional office staff cannot usually handle the volume of enrollments, billing, general questions, etc. There needs to be extra assistance for distance courses. This is yet another cost that is commonly not accounted for.

Infrastructure deals with the network over which the course is delivered. In a synchronous learning environment, by today's technology standards, it is critical there be broadband connection from delivery point to learner. Whether it is over a telecommunications network or through telephone lines, the design needs to take the student's geographic location into account. In the DEEP study, the students lived in very remote, isolated communities where broadband was not offered. The class sessions had to be restructured to accommodate those who were in these locations.

Finally, the most important aspect of any course design has to be learning. Learning is the compilation of the aforementioned 4 components of a rich, cost effective course design. All of the benefits an increased *reach* provides means nothing if the students involved in a distance learning environment aren't learning. We need to ask what students want and how new electronic media can motivate students (Zemsky, 2004) .

In conclusion, there needs to be further comparative research to distinguish the financial cost differentials between the various modes of distance delivery. The DEEP study did not set out to compare *cost* , *reach* and *richness* , but rather it strived to find answers to the questions of costs to the students (*Richness*) in distance education. Cuts in funding toward education have put administrators in a difficult situation. The unfortunate outcome is that administrators are forced to be thrifty. If we are to be honorable educators, then we cannot be thrifty when it comes to the experiences, and most importantly the learning, of our students. Saba (2001) suggested, if we believe if we follow the road where technology is used to reduce the cost of education, and speed-up time-to-degree for students, while making education more personal, it might succeed. As Schank (as cited in Svetcov, 2000) stated, " Education will be measured by what you know rather than by whose name appears on your diploma. If the Internet can facilitate this kind of change, we can only say, Amen."

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