Longitudinal Analysis of Student Performance in an Allied Health Distance Education Program

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ABSTRACT

A 10 year, longitudinal examination considered student performance for an Allied Health Distance Education (DE) program. The purpose was determining if students face-to-face in a classroom with an instructor performed differently than their counterparts located at a distance, taking class through an alternative delivery system. The question often overlooked and not asked was: —Is learner performance impacted on standard benchmark assessments by using technology as a delivery system?" Three research questions were asked: a) Were there statistically significant differences in learner performance on a National Examination (NBDHE)?; b) When considering GPAs?; or c) When examining individual course grades? T-tests were used for data analysis. From a cumulative perspective, and year-by-year, no statistically significant differences were apparent for the NBDHE and GPAs. Cumulatively, similar results were also found for individual courses. The DL system examined was considered effective for delivering education to learners if similar performance outcomes were the evaluation criteria.

Keywords: Distance Education; Distance Learning; Outcomes; Benchmarks; Dental Hygiene; Assessment; Student Performance; Allied Health; Health Occupations

INTRODUCTION

Educational opportunities continue growing exponentially in colleges and universities across the United States due to the implementation of technologically based delivery systems (Wilson, 2001). Rapid advances in today's technology (Wahlstrom, C., Williams, B.K. & Shea, P., 2003) facilitate distance learning (DL) and distance education (DE). Technological changes, including computer use and fiber-optic cabling, interactive television systems (ITV), and other hybrid configurations, allow learning in other- than-typical, traditional —face-to-face" classrooms (O'Lawrence, H., 2006). In 2003, the number of online course enrollees was 1.97 million, succeeded by 2.33 million students online in 2004 (Allen, E., & Seaman, J., 2004; Allen, E., & Seaman, J., 2005). Online courses require technological platforms and computers for delivery (Rossman, M., & Rossman, M. Eds; 1995). Continued growth and expansion of online coursework is now an integral element of mainstream higher education. Sixty three percent of schools offering undergraduate face-to-face programs also offer undergraduate programs online (Allen, E. & Seaman, J., 2005). Even though a significant body of literature existed documenting participant satisfaction while using alternative mediums for delivering courses, there was a significant lack of quantitative research verifying how people actually *performed* while receiving education when using various alternative delivery systems. From a programmatic perspective, a quantitative analysis of performance benchmarks provided evidence of individual's performance in an Allied Health educational program that used an alternative delivery system. The alternative delivery system examined was Interactive Television (ITV).

Purpose

The purpose of the study was determining if learners located at a distance from each other performed differently on established benchmark assessments. The defined benchmarks include course grades, grade point averages (GPAs) and the National Board of Dental Hygiene Examination (NBDHE).

Research Questions

The research questions examined included:

1. Did significant statistical differences in performance on a National Examination (NBDHE) exist between face-to-face and distance college learners?
2. Did significant statistical differences in grade point averages (GPAs) exist?
3. Did significant statistical differences in individual course grades exist?

Significance of the Study

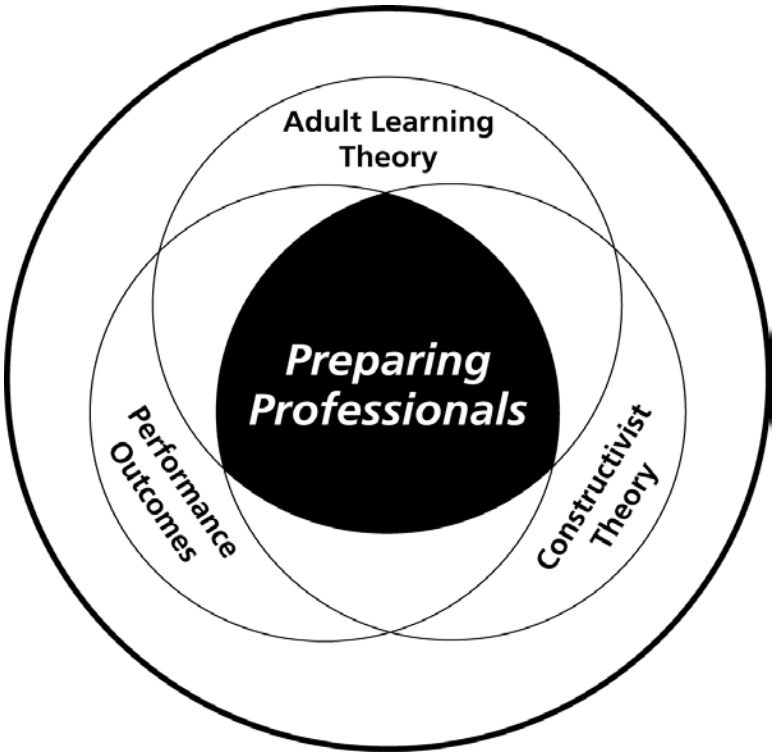
This study examined and documented institutional effectiveness from a program perspective while using DE for delivering didactic curricula. Results provided insights into the use of distance education as a viable delivery mechanism for health care education. Student performance on known academic benchmarks (course grades, GPAs and NBDHE) allowed for testing the relative effectiveness of using alternative systems for delivering allied health instruction. This study provided a longitudinal analysis of DE performance for an entire Allied Health educational program.

REVIEW OF LITERATURE

Preparing Professionals - A Conceptual Framework

Previous research has not offered conceptual frameworks justifying using distance education as a tool for preparing professionals. DL is used not only in education, but in business & industry throughout the world for various purposes (Simonson, M., Smaldino, S., Albright, M., & Zvacek, S., 2006). A conceptual framework considering myriad factors while remaining simple enough to be applied across disciplines is offered for consideration here. Three major areas of overlapping consideration for the conceptual framework included Adult Learning Theory, Constructivist Theory, and Program Outcomes. See Figure 1: Preparing Professionals

Figure 1: Preparing Professionals



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While preparing professionals for entering the workforce, consideration of several adult learning theories impacting the development of future workers was made. Adults are often self-motivated, needing to make sense of their own existence and purpose in life, and comparing their learning experiences against their own intrinsic needs and values (Knowles, M., 1998). Adults tend to learn more effectively from experiential techniques and wanting to gain skills that are immediately applicable in real-world circumstances (Cranton, P., 1992). Adult learners tend to be results-driven problem solvers, self-directed, responsible, and reflective about what is being learned in comparison to real life experience (Knowles, M., 1998). They desire timely to-the-point training directly related to their needs. Yang's (2003) holistic theory of knowledge acquisition for adult learners is multi-faceted, bridging various paradigms of learning while considering knowledge as a social construct, while applying philosophical views relating to humanism and radicalism (Elias, J. & Merriam, S., 1995).

Constructivist Theory-Building Community & Shared Meaning

Constructivist learning defined is meaningful action during the development of complex and unfolding knowledge (Mahoney, M. J., 2004). Several of the grounding assumptions for constructivist learning as identified by Brooks and Brooks (1999) include: 1) Knowledge is constructed; 2) multiple perspectives reflect the diversity of individually constructed worldviews; 3) knowledge is dependent on context; and 4) learning is social and based on dialogue.

DL is not for everyone. Adult, constructivist learners need to know in advance what is expected of them in the DL community (Bender, T., 2003). DL facilitators need to carefully

cultivate a positive environment supporting active participation and learner engagement (Bender, T., 2003). Expectations need to be clearly established in advance, and learners should have prior knowledge of their personal learning style(s) in order to succeed (Gardner, H., 1993; James, W.B., & Gardner, D.L., 1995; Kolb, D., 1984). The DL environment should allow socio-cultural opportunities for relationship construction so learners can build their own contextual meaning. Learning thus develops and is associated with authentic, real-world experiences. Sharing with peer colleagues strengthens the ability of learners to apply meaning. Content knowledge and advanced skills continue developing based on the framework of previous knowledge. Learning is not discovering more, it is re-interpreting concepts through different schemata. In DL environments, it is imperative that these principles are embedded in the context of the program and courses to maximize learner growth and development (Comeaux, P. (Ed). 2005).

Learner Outcomes

Numerous researchers have examined learners' performance in relation to DL. It is important to note that while many studies have shown no statistically significant differences in performance (Bergman, W.E., 1994; Parrott, S., 1995; Searcy, R.D., 1993), there has also been mixed results reported regarding learner performance (Cralley, D.L., 1996; Learn, C., 1994; Parkinson, C., & Parkinson, B., 1989) in DL environments. Another key consideration is the majority of studies reviewed assessed only one or two courses, or course section results, rather than entire academic programs, before drawing their conclusions (Bergman, W.E., 1994; Parrott, S., 1995; Searcy, R.D., 1993; Cralley, D.L., 1996; Parkinson, C., & Parkinson, B., 1989; Pucel, D., & Stertz, T., 2005). Additionally, none of these studies were conducted over significant periods (three years or longer) and the results identified might be spurious in nature. Reported results in studies undertaken within shorter periods (three years or less) might not provide enough statistically significant data for either making recommendations for change or laying the groundwork for further research (Bergman, W.E., 1994; Parrott, S., 1995; Searcy, R.D., 1993; Cralley, D.L., 1996; Parkinson, C., & Parkinson, B., 1989; Pucel, D., & Stertz, T., 2005).

Preparing Professionals for the Future

The paradoxes facing distance educators include learners reporting they do not want to learn at a distance but would rather engage with a learning group or with an instructor. Even so, evidence suggests increased demand for opportunities to learn at a distance. Learners report wanting supplementation or replacement of conventional learning with distance education because of the many roles they fill in a complicated global society (Allen, E., & Seaman, J., 2004; Allen, E. & Seaman, J., 2005; Rossman, M., & Rossman, M. (Eds), 1995; Wlodkowski, R., & Kasworm, C. (Eds), 2003). This model considers how the paradoxes facing educators in DL can be met, while maintaining high standards of expectation while developing future professionals for the workforce.

METHODS

This research was designed to address the question: To what extent was learner performance impacted on standard benchmark assessments using technology as a delivery system. The evaluation of benchmark data can ascertain program effectiveness while using distance education methodologies. Learners were assigned to one of two groups for statistical analysis based on location. The first group consisted of face-to-face learners with the instructor. The second group consisted of learners located at a distance from the didactic instructor. The study design determined if face-to-face and distance participants had statistically significance differences in performance from each other. Independent variables included location and time. Location was the determining factor in group assignment. Time as an independent variable

included examining graduate populations from 1997 through 2006. Dependent variables included course grade point averages, cumulative grade point average, and NBDHE scores.

Population

This study's research population included 266 persons from the graduating classes of 1997 through 2006. 189 learners graduated in 10 years. Through attrition, 77 persons did not complete coursework or graduate. 117 learners were face-to-face with the instructor over the 10-year period, 72 learners used the interactive television system to receive instruction. The graduating classes were composed of 186 females and 3 males. One hundred percent of data files for the learners who graduated were used for the study.

Data Analysis

For each research question, independent group statistical t-tests were used to determine if any statistically significant differences existed. The same testing methodology (statistical t-test) was also applied to the aggregated group's data. Data analysis was considered for documenting program effectiveness while using distance education as a program delivery method. The results of this study, while documenting learner performance for an entire program, also addressed two of the "gaps" noted in the scientific literature by Phipps and Merisotis (1999) --i.e., 1) to research learner outcomes not for individual courses, but for an entire academic program, and 2) proposes a conceptual framework for consideration and potential testing for further DL research.

Results and Discussion

Each of the study's research questions are addressed considering the results of the statistical analyses while looking at each individual supposition. Discussion highlights results from a program perspective, examining trends that might be of concern when considering Program Effectiveness.

Research Question One

The first research question asked, "Did significant statistical differences in performance on the National Examination (NBDHE) exist between face-to-face and distance learners?" T-test analyses were used. Data was examined both cumulatively and on a year-by-year basis.

Cumulatively, data demonstrated no statistically significant differences existed between host and cooperating college (distance) learners' performance related over a ten-year period.

Table 1 depicts a year-to-year analysis of NBHDE performance. Statistical difference was found for the class of 1998. No statistical significance was identified for the remaining nine graduating cohorts. During 1998, face-to-face learners outperformed the distance learners. What impacted performance that year? Were there pre existing educational differences between the groups? Did the face-to-face group undertake additional preparation, such as attending a NBDHE review session to better prepare them for the examination? On the other hand, as Major and Shane (1991) reported, are the cohorts forming cohesive groups in response to feelings of isolation from each other? Are these types of cohesive bonds a contributing factor to learner success? Even though there was a statistical performance difference noted for the host class of 1998, what was the cause? Clearly, during 1998 there was a statistically significant difference in performance noted in the year-to-year data on the NBDHE. However, it should be noted as a trend over time, we are not seeing major changes in performance on this national benchmark either cumulatively or year-by-year. The data supports the effectiveness of using distance

education to deliver classes as evidenced by performance on the NBDHE. This research provides exploratory data for this national benchmark.

Table 1

Table 1: Analysis of National Board of Dental Hygiene Examination (NBDHE) Scores by Host and Distance Learner						
Year	**Location**	**N**	**Mean**	**df**	**t-value**	**2-tailed prob.**
1997	Host	11	86.27	13	-.422	.680
	Distance	4	87.50			
1998	Host	10	88.00	16	2.749	.014 *
	Distance	8	82.63			
1999	Host	10	83.60	13	-.204	.841
	Distance	5	84.00			
2000	Host	9	83.22	15	-.280	.783
	Distance	8	83.75			
2001	Host	8	79.88	12	-.487	.636
	Distance	5	81.80			
2002	Host	15	83.07	22	-.554	.585
	Distance	9	84.22			
2003	Host	17	82.41	25	-1.169	.253
	Distance	10	85.20			
2004	Host	13	84.31	21	-.246	.808
	Distance	10	84.80			
2005	Host	10	84.60	12	-.195	.849
	Distance	4	85.00			
2006	Host	11	82.45	15	.981	.342
	Distance	8	80.63			
*p < .05						

Research Question Two

The second research question asked, "Did significant statistical differences in grade point averages (GPAs) exist between face-to-face versus distance education college-level learners?"

Data was examined cumulatively and year-by-year. Cumulatively, the researcher found no statistically significant differences existed between host and distance learners' performance

related to cumulative grade point averages for the 10 cohorts. Study results for this research question year-by-year are displayed in Table 2.

Table 2

Table 2: Analysis of Cumulative GPAs by Year and Host and Distance Learner						
Year	**Location**	**N**	**Mean**	**df**	**t-value**	**2-tailed prob.**
1997	Host	11	3.45	13	-.302	.767
	Distance	4	3.50			
1998	Host	10	3.44	16	1.38	.184
	Distance	8	3.18			
1999	Host	10	3.31	6	-4.25	.683
	Distance	5	3.38			
2000	Host	9	3.46	15	-.734	.475
	Distance	8	3.53			
2001	Host	8	3.11	12	-1.053	.315
	Distance	5	3.37			
2002	Host	15-	3.46	22	-.194	.848
	Distance	9	3.48			
2003	Host	18	3.29	26	-1.942	.063
	Distance	10	3.55			
2004	Host	13	3.52	21	-.116	.908
	Distance	10	3.53			
2005	Host	11	3.35	14	-.448	.661
	Distance	5	3.44			
2006	Host	12	3.29	17	.615	.546
	Distance	7	3.21			
*p< .05						

It was determined no statistical difference in performance existed for GPAs on a year-by-year basis.

Based on the evidence noted in Table 2, it was concluded that the data supports the effectiveness of using distance education for preparing professionals for careers as clearly evidenced by comparable GPAs for either face-to-face or distance learners.

Based on this data, it was also concluded distance education was a viable alternative methodology for allied health education and was as effective as traditional means. Where learners might not prefer the medium for educational delivery, their individual performance, as evidenced by grade point averages, was not impacted by its use. This data could be used as a national performance benchmark for DL programs. From a program perspective, this data also documents meeting standards relating to Program Effectiveness.

Research Question Three

The third research question asked, "Did significant statistical differences in individual course grades exist between face-to-face and distance college learners?"

The results of the cumulative analysis are addressed here:

Cumulative Analyses

Comparing learner performance as a cumulative for the core courses revealed no statistically significant differences. Results can be seen in Table 3. It was determined no statistically significant differences existed in learner performance for the program's entire academic curriculum over a 10-year period.

Table 3

Table 3: Ten-year Analysis of Core Dental Hygiene Courses						
Oral Anatomy (508-101) Course Averages by Host and Distance Learners						
Student Year	**Location**	**n**	**Mean**	**df**	**t-value**	**2-Tailed Prob.**
1997-2006	Host	107	2.96	134	1.223	.223
1997-2006	Distance	69	2.84			
Dental Hygiene Theory I (508-113) Course Averages by Host and Distance Learners						
Student Year	**Location**	**n**	**Mean**	**df**	**t-value**	**2-Tailed Prob.**
1997-2006	Host	114	3.73	184	1.445	.150
1997-2006	Distance	72	3.64			
Nutrition (508-114) Course Averages by Host and Distance Learners						
Student Year	**Location**	**n**	**Mean**	**df**	**t-value**	**2-Tailed Prob.**
1997-2006	Host	107	3.36	177	.001	.999
1997-2006	Distance	72	3.36			
Periodontology (508-115) Course Averages by Host and Distance Learners						
Student Year	**Location**	**n**	**Mean**	**df**	**t-value**	**2-Tailed Prob.**
1997-2006	Host	111	3.05	179	.853	.395
1997-2006	Distance	70	2.97			

Oral Pathology (508-122) Course Averages by Host and Distance Learners						
Student Year	**Location**	**n**	**Mean**	**df**	**t-value**	**2-Tailed Prob.**
1997-2006	Host	109	3.41	129	1.19	.233
1997-2006	Distance	72	3.30			
Dental Pharmacology (508-123) Course Averages by Host and Distance Learners						
Student Year	**Location**	**n**	**Mean**	**df**	**t-value**	**2-Tailed Prob.**
1997-2006	Host	116	3.35	185	.322	.748
1997-2006	Distance	71	3.32			
Dental Hygiene Theory II (508-124) Course Averages by Host and Distance Learners						
Student Year	**Location**	**n**	**Mean**	**df**	**t-value**	**2-Tailed Prob.**
1997-2006	Host	117	3.65	187	1.199	.232
1997-2006	Distance	72	3.57			
Community Dental Health (508-131) Course Averages by Host and Distance Learners						
Student Year	**Location**	**n**	**Mean**	**df**	**t-value**	**2-Tailed Prob.**
1997-2006	Host	116	3.70	186	-1.09	.913
1997-2006	Distance	72	3.71			
Five-year Analysis of Local Anesthetic (508-xxx) Course Averages by Host and Distance Learners						
Student Year	**Location**	**n**	**Mean**	**df**	**t-value**	**2-Tailed Prob.**
2001-2006	Host	70	3.77	109	-2.75	.784
*p < .05						

From a program perspective, the standard for Program Effectiveness was met. While examining the data for significant trends, it can be noted that these courses' cumulative averages over time remained consistent and stable. Based on this statistical evidence, it can be concluded that the use of distance education delivery mechanisms are viable for delivery of education if similar performance outcomes is the decision-making factor, and are as effective as traditional methods. This study demonstrated that accredited educational programs could exist successfully for the delivery of allied health education and specifically, dental hygiene education. It was determined through statistical analyses of performance outcomes the program was effective in delivering education and that Institutional Program Effectiveness was met.

CONCLUSIONS

The following conclusions were drawn related to the studies' conceptual framework and program need.

Conclusion 1. Institutional Effectiveness

It was determined through statistical analyses of benchmark outcomes Institutional Effectiveness was met.

The results identified while answering the research questions also addressed one of the "gaps" noted by Phipps and Merisotis (1999) --i.e., to research learner outcomes not for individual courses, but for an entire academic program. The data also helps answer the question, "Is it prudent for colleges and universities to continue expansion using distance education as a means of course and program delivery?" Based on the research findings, the answer is yes. The findings of this study also provide insights into the use of DL as a viable delivery mechanism for education. This study provides a foundational basis for benchmark comparison for future DL research for programs considering using DL for program delivery. Finally, this study provides an analysis of performance over time for an entire academic educational program using DL technologies. This data might assist colleges or universities in decision-making processes regarding the implementation of DL programming for general education, allied health or specifically, dental and dental hygiene programs.

Conclusion 2. Conceptual framework-Preparing Professionals

Overall, it was concluded that DL as a delivery mechanism was as effective as traditional means, and can be used as a tool for expanding the delivery of education to areas distant from established programs, as evidenced by learner performance on benchmark assessments. Have characteristics of adult learners and constructivist learning theories impacted learner performance? Learning is not just discovering more, but re-interpreting concepts through different schema. Consideration of the model offered as Figure 1: Preparing Professionals provides a conceptual framework for future research. It is not just applicable to health education, but has broader implications for use wherever DL is being considered as a delivery mechanism.

If reasons for using DL as a delivery medium still hold true today, then there is a need to continue examining the myriad, multi-dimensional, and complex factors associated with the persistence of the adult learner, constructivist perspectives of learning, and actual benchmark performance in outcomes assessments.

Recommendations

Based on the research conducted, the following recommendations were made:

1. Continue offering educational programming using DL as an alternative delivery mechanism. This research demonstrated learners at various locations performed equally well on standard benchmark assessments documenting program effectiveness. DL was considered an effective medium for delivering educational programming, and the use of DL should be continued.

2. A path analysis might be undertaken for inferring data back to larger populations for both GPAs and course grades.

3. Additional research could occur regarding preferred delivery and or learning styles of faculty and learners in DE programs. DL as a delivery modality is not for everyone (Bender, 2003). Additional research might identify persons for whom distance education is not a suitable delivery platform. Recommendations could be made for these individuals taking program courses with a face-to-face cohort to improve performance results, learner satisfaction, perseverance, and ultimately program completion and graduation.

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