Distance Learning: Identifying Conditions That Influence Web-Based Education Outcomes

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Abstract

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The transformation in higher education from classroom to web-based format continues to gain momentum. Students expect dynamic presentations in a format amenable to individual learning style; meanwhile, faculty attempts to reconcile with the appeal for a new teaching style and mode. The purpose of this longitudinal exploratory study was to identify factors that contribute to increased learning by students engaged in web-based study and to identify faculty factors that contribute to quality course development.

378 students and 142 faculty participated in the study. Student and faculty preferred learning channel influence development and utilization of web-based material, as well as appreciation for the online study. Faculty are diverse in relationship to computer proficiency and online course production; students are dissimilar in computer skills and application of web-based content.

Time and travel efficiency are positives related to online study, however access and quality continue to be issues. Faculty acknowledged that having options for learning is positive, but are uncertain about what constitutes effective online course management.

Analysis of web-based content reveals a predominance of print medium (workbooks, syllabi) and course content (lecture, support material); discussion groups are primarily limited to two academic programs (nursing and allied health).

I. Introduction

Health profession education is increasingly complex, with an expanding volume of essential structured information. The demand is for teaching methods that are efficient, flexible and user friendly. Like nearly all learners, prospective nurses, doctors, dentists, therapists, and scientists are more inclined to invest time absorbing material and understanding relationships when a source is novel and appeals to the preferred sensory channel or learning style.

Until recently, the primary teaching healthcare profession students occurred in the classroom, laboratory, or care setting. Faculty customarily lectured and used printed word, static illustrations, 35mm film or slides to present a topic or clinical scenario. With the advent of web-based distance learning, the faculty task is to convey the same body of knowledge via a dynamic communication medium instead of within the boundaries of an educational institution. Development of interactive healthcare profession education media and programs is proceeding rapidly, much of it created by existing faculty who recognize the power of computer-mediated learning.

Focus of Study: Research Question #1

Under what conditions do distance learning opportunities lead to increased learning as defined by traditional and non-traditional measures, with results of specific application to Ohio's higher education institutions?

Projects specific questions within this framework

1. Is there a relationship of gender, age, major, years of education, and student or faculty status to computer proficiency or technology utilization?
2. Is there a predominate preferred learning channel (PLC) for students and faculty?
3. Is there a relationship of student PLC to satisfaction with web-based learning?
4. Is there a relationship of student PLC to preference of delivery mode?
5. Is there a relationship of student GPA to perceived success in a web-based course?
6. Is there a relationship of student and faculty computer proficiency to degree of satisfaction with distance learning or online classes?
7. Is there a relationship of student and faculty PLC to level of satisfaction with online discussion groups?
8. Is there a relationship of student and faculty reported hours online to outcomes in a web-based course?
9. Is there a relationship of student ability to apply new knowledge and skills to quality of online course? To preferred learning channel? To learning activities?
10. Is there a relationship of student report of course quality to efficiency? To enablers? To barriers?
11. Is there a relationship of faculty years teaching to quality of materials and activities in online course?
12. Is there a relationship of faculty years teaching online to quality of online course?
13. What is the faculty perception of student participation during online course? What measures are used to evaluate student interaction online (quality, quantity)?

14. What measures are used to evaluate student progress in course (quiz, test, reports, projects, etc.)? Used to verify that student is doing own work and testing?
15. Which measures are more effective in evaluating student progress in course?
16. What strategies do faculty use to manage online time with students? What is most effective and why?
17. What strategies do faculty use to provide structure to a distance learning course? To assist students to progress through online material?
18. What is the course completion rate? Program completion rate?
19. Is there a relationship of faculty preparation for web-based teaching to quality of course or quality on material online from student perspective? Faculty perspective?
20. Is there a relationship of faculty preparation for web-based teaching to structure of course? Activities in course? Willingness to teach via distance learning?
21. Is there a relationship of faculty PLC to online course development? To preferred pedagogy style? To quality of distance learning material?
22. Is there a relationship of faculty primary role and teaching online? Pedagogy preference?
23. What factors motivate faculty to teach content online? Motivate students to take coursework online?
24. What measures do faculty use to assess the quality of online coursework? Are students asked to evaluate online coursework?
25. What types of pedagogy are evident online? What types of activities are used most frequently? What types of learning material is online?
25. Is online content aesthetically appealing? Interactive? Variety of activities?

Statement of Problem

Discrepancy between projected demand, actual utilization and satisfaction with web-based distance learning is poorly understood because there is limited inquiry into student preference and learning outcomes. Similarly, administrators and faculty who are planning, developing and implementing online classes may be thwarted by a paucity of institutional resources and clearly defined expectations. Worse yet, forced production imposed by overzealous administration may result in inappropriate dumping of pre-existing static course materials into the online environment. Insufficient experience with web-based learning and teaching, concurrent with limited insight into outcomes of distance learning, prompt inquiry about individual and institutional factors that influence or modify effectiveness.

Statement of the purpose

The purpose of this investigation is to identify factors that contribute to increased learning by healthcare profession students engaged in web-based study and relationship to demographic and online format variables. The second purpose of this study is to identify factors that contribute to quality course development and relationship to faculty and institutional variables. The third purpose is to discern for differences within sub-populations that will be relevant and generalizable to similar levels of learners in other disciplines throughout Ohio.

Background and significance of the problem

Healthcare profession education in Ohio is extensive, expensive and expected.

The extensiveness of professional level programs is widely distributed across the state. In nursing alone, there are nineteen baccalaureate and ten masters programs: seven medical and two dental schools are located within Ohio boundaries. Eight colleges offer a physical therapy curriculum, seven prepare occupational therapists, three train physician assistants, and four offer degrees in public or occupational health. Additionally, at least six institutions offer doctoral degrees in medical sciences. Eventual consolidation of quality web-based program resources may serve as a mechanism to strengthen programs statewide; however, such effort must be preceded by careful examination of what exists online and potential contribution to meaningful learning.

The expense of healthcare profession education is not retrieved by tuition, so institutions depend on subsidy to cover operating expenses and meet revenue needs. Web-based instruction is viewed as one mechanism to increase learner contact with subject matter without extending faculty numbers or workload. Professional schools are venturing into web-based instruction in order to attract students, but also to interest learners with diverse learning and lifestyle needs. The anytime-anywhere environment is appealing to self-directed students or learners who require increased time to master content. For example, time spent viewing slides during lab is usually not sufficient to become adept in identification of structure, much less pathology.

The expectation of lifelong ongoing education is mandatory for healthcare professionals. Advances in diagnosis, care and treatment emerge every day, and online education is already viewed as an unparalleled means for keeping abreast. Medical researchers can communicate lifesaving findings promptly. All levels of

providers can search for best evidence practice guidelines, potential therapy or undesirable treatment interactions. The general public is an additional beneficiary when individuals can easily access professional resources as a basis for judicious decisions in respect to lifestyle and healthcare.

Definition of terms

For the purpose of this study, the following terms are operationally defined:

Student: An individual enrolled in a healthcare profession program at the undergraduate or graduate level at Medical College of Ohio.

Gender: Student or faculty classification of self as male or female.

Age: Statement of time in years expressed as a positive whole integer.

Education attained: Highest number of years completed expressed as a positive whole integer, and denoted by degree received from an educational institution.

Preferred learning channel: Summative score on PLC-13 tool, classified as visual, auditory or kinesthetic

Student Demographic Data Form: Investigator developed instrument used to assess individual attributes and preferred learning channel.

Grade point average: total academic points earned divided by hours credit taken, expressed as a positive integer using one decimal point on a "0" to "4.0" scale.

Program: Specific major within one of the specified healthcare professions.

Geographic region: Location of student during web-based learning activities.

Technology utilization: Self-appraisal of current use of electronic devices and computer.

Computer proficiency: Self-appraisal of skills or tools that can be applied without referring to "Help" topics or asking for assistance.

Computer access: Usual mode of accessing distance learning.

Computer utilization: Self-appraisal of weekly number of hours online for web-based study, professional communication, research, and personal purposes.

Faculty: Full-time or part-time individual hired by the institution to teach a healthcare profession student in the classroom or online environment.

Faculty Demographic Data Form: Investigator developed instrument used to assess individual attributes and preferred learning channel.

Job classification: Statement of attained rank as faculty member.

Primary role: Teaching, research, or clinical.

Instructional experience: Years teaching expressed as a positive whole integer.

Preparation for web-based teaching: Formal course, degree program, workshop, seminar, conference, literature review, online exploration of distance learning sites.

Preferred pedagogy mode: Lecture, discussion, case based problems, questioning.

Web-based or distance: Class or course presented online.

Learning: Acquisition of information and skills that can be utilized at a later time.

Student Outcomes Form: Investigator developed instrument used to assess outcomes; includes quantitative and qualitative responses.

Perceived quality: Value of distance learning from student viewpoint.

Perceived efficiency: Value of time invested from student viewpoint.

Perceived effectiveness: Value of content or course from student viewpoint.

Utilization enabler: Resource that empowers implementation of distance learning.

Utilization barrier: Resource that restricts implementation of distance learning.

Course Outcomes Form: Investigator developed instrument used to assess course management strategies and evaluation of learners during distance learning.

Participation: Actions and interactions by students engaged in distance learning.

Type of evaluation: Formative or summative appraisal of students provided by faculty.

Learner appraisal: Self-evaluation in the form of report, analysis, or critique.

Testing: Assessment (quiz, exam, essay, etc.) used as a measure of learning.

Class or course management: Faculty process to provide structure, manage time.

Class size: Number of students expressed as a whole integer.

Organization of content: Structure provided to guide progress through class or course.

Completion rates: Percent of enrolled students who complete course and program.

Online Data Form: Investigator developed instrument used to assess Intranet and Internet course characteristics.

Web-based course content: Teaching material that can be classified as syllabus, workbook, slides or PowerPoint, images, video or audio recordings, etc.

Learning activities: case studies, simulations, games, links, and animations, etc.

Non-traditional measures: portfolios, clinical applications, work related projects.

Pedagogy mode: classification of activities as teacher directed, inquiry based, student directed.

Qualitative response: participants written response to an open-ended question.

Protection of subject rights

Permission to conduct this study was obtained from the Institutional Review Board of Medical College of Ohio and administrator of each school. Student and faculty participation in the study was strictly voluntary. The study purpose and procedure was explained to participants in a cover letter; students in the School of Medicine and School of Nursing undergraduate program also received a verbal explanation of the study.

Subjects were guaranteed confidentiality and that participation or non-participation would not affect student or employment status. Subjects were informed of implied consent and ability to withdraw from the study in the cover letter. Participants were assured that only grouped or subgroup data analysis would be reported following conclusion of the study. Reports and presentations will not contain individual findings

All survey instruments will be retained in locked storage in the principal investigators office for one year after termination of the study, then destroyed. Access to forms and data during the study was limited to the principle investigators and research assistants. Coded data retrieved was permanently stored on CD-ROM to be retained by the principle investigators.

Strengths and weakness

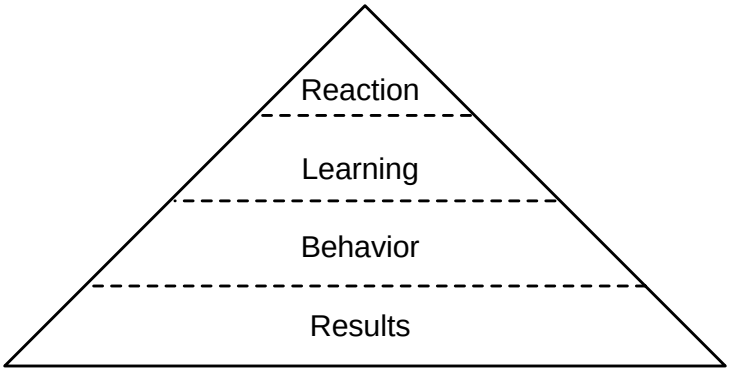
In an exploratory study, the goal is to collect a large quantity of information for data analysis in order to examine relationships between the variables (Wood, 1999). Survey research is the most common form of research, used to describe, explain or explore phenomenon; it is also an appropriate method for measuring personality orientations and attitudes about utilization or effectiveness. Because study variables were not

manipulated, intensive analysis or inferring cause-and-effect relationships is limited (Babbie, 1999). For that reason, student and faculty participants were asked to provide qualitative remarks related to pedagogy, management, assessment and evaluation, and institutional barriers and enablers. Since the study was designed to examine outcomes for sub-populations as well as a total population, the large number of participants was desirable.

II. Review of the Literature

There is an abundance of professional publications related to distance learning, web-based teaching, and online education. Numerous authors speak to development of materials, sharing databases, integrating activities, and overall design. A plethora of writers address difficulties of teaching online or reflect on positive interactions and increased communication with students. At the present time, consideration of appropriate processes and frameworks for evaluation is limited, however growing. This brief review of the literature provides a theoretical framework and serves to outline important points related to evaluation included in the study.

Athanasou (1999) developed a model for examining effectiveness of computer based training and adult learning (see diagram). Because technology-assisted is expensive to develop, consideration of cost, benefit and utility are important; however, determining whether objectives are achieved and desired outcomes met are vital. Likewise, the "perspectives and interests of all stakeholders" is crucial when evaluating for net effect.



According to Athanasou "Reaction" or basically whether students were satisfied or not is what most teachers assess. "Learning" i.e. skill acquisition or attitude change is

important to professional disciplines but usually evaluated prematurely. "Behavior" or the extent to which knowledge is applied to a practice or work setting requires follow-up assessment and is rarely accomplished in a meaningful manner. "Results" implies that the program had an impact on the organization or community; this level of assessment considers all the stakeholders from participant to management to regulatory bodies.

The fourth level or "results" is currently a hot topic by virtue of regional institutional certifying bodies, such as North Central Association (NCA), asking whether distance-learning programs have met the same standards as existing traditional programs. While not the point of this study, there is ample reason to apply equally rigorous evaluation to both modalities, since traditional education modes generally are not assessed beyond the "learning" level.

Vogel and Klassen (2001) discuss the status of "self-accessed" learning and obligation of students to seek content that matches their needs. This implies that individual professors will examine their preferred teaching style (pedagogy) for adequacy. Questioning should include 1) if the educator role is delivery medium or facilitating and mentoring; 2) whether the environment created accelerates learning; 3) how content expertise might dampen exploration; 4) must the teacher be technologically savvy; and 5) does faculty have time to agglomerate diverse materials into a cohesive package?

Hall (1999) is more pragmatic and suggests that instructional site design should be of paramount importance. Hall posits that usability and appearance should distinguish a web-based course as much as the content. Hall suggests noted that "good versus poor instruction is a consequence of design and delivery, not the medium

by which it is delivered." Consistent layout, limited wording, dual-coding with images and text, small units, reasonable download time, pertinent clearly labeled hyperlinks, and clear demarcation of weighty facts or major points are deemed vitally important.

Extensive review of the literature failed to provide reliable (tried and true) instruments for extensive audit of distance learning. Therefore, these publications, among others, provided structure during question development for the Web-based Student Outcome Form, Web-based Course Outcome Form, and Web-based Online Data Form.

Because of time constraints, pervasive assessment about Level 3 and 4 from Athanasou's model is impossible for every web-based course in this study. However, an attempt will be made to explore transfer of skills and generalization of knowledge to practice for participants providing care in clinical settings.

III. Methodology

Setting

The location for data collection in this study was the Medical College of Ohio, which is located in Toledo Ohio and composed of four specialized schools.

The School of Allied Health prepares professionals in physical therapy, occupational therapy, physician assistant, and public health and occupational health.

The School of Nursing has a basic baccalaureate nursing and RN to BSN degree (in consortium with Bowling Green State University and University of Toledo), as well as masters in nursing program (nurse practitioner and advanced nurse practice, post-masters certificate, and nursing education certificate).

The School of Medicine confers a doctor of medicine degree, and coordinates fifteen medical residency and eight fellowship programs. The Graduate School offers the doctoral degree (cellular and molecular biology, neurological science, and molecular basis of disease) as well as a master of science in biomedical science (clinical radiation therapy physics, dentistry, research), and certificate in health and medical science education.

Subjects

There were 260 first and second year medical students (550 total), 390 nursing, 52 physician assistant, 28 occupational therapy, 69 physical therapy, 80 public health students, 42 masters, and 94 doctoral program students. Currently faculty was comprised of 349 full-time and 60 part-time members teaching within the four schools. Participants were recruited from all disciplines either studying or teaching with web-

based curriculum materials. Individuals in residency or fellowship programs were be included in the study.

Sampling Criteria

A total population survey approach was used for answering the research questions, in order to determine quantity and quality web-based instructional material, student utilization and outcomes, and relationship to selected faculty, participant demographic variables. All members of the student and faculty population had equal probability of being included in the study. All web-based teaching and evaluation components were analyzed for format, content, and contribution to learning.

Data collection

Data collection process

A discussion with each Dean, School of Medicine, School of Nursing, School of Allied Health, and Graduate School, was held to explain the nature of this study and to obtain permission to access students. MCO Institutional Review Board approval process and consultation MCO Research and Grants Administration was done.

During Fall semester, the principal investigators met with students in the School of Medicine and School of Nursing to explain the study, review consent procedure and encourage participation. Graduate School and School of Allied Health students were contacted via mail. All students were asked to complete the Student Demographic Data Form. Students entering professional study during spring semester were approached in and asked to complete the Student Demographic form.

Each member of the faculty, whether full-time or part-time, was mailed an explanation of the study along with consent procedure, and invited to complete the Faculty Demographic Form.

Prior to adjournment of spring semester, students and teachers involved in web-based learning were asked to complete the Web-based Student Outcomes and Web-based Course Outcomes forms.

Even though some students were not involved in distance learning during the investigation period, data from this subgroup was compiled and used for comparative purposes.

Data collection using Web-based Online Data Form began during fall semester and continued the duration of the study. Since each web-based class and course had to be accessed online, considerable time was required to complete reviewing and scoring. Prior to beginning data collection, the student research assistants received instruction in use of the tool and coding. During the training sessions, interrater reliability was assessed until the index of equivalence was 99%.

Once coded, data was entered into the Statistical Package for Social Sciences v10.1 program, then reviewed for accuracy and cleaned. Responses were recoded into categories for selected variables, particularly nominal data. Descriptive, bivariate and multivariate statistics was performed; post hoc analysis was run only if a strong relationship was detected and would corroborate expectations or contribute to discussion of findings.

Data Collection Instruments

The Student Demographic Data Form was used to obtain descriptive data such as gender, age, program, grade point average, health profession major, previous degrees; preferred learning channel style; as well as computer expertise, access, and utilization.

The Web-based Student Outcomes Form was used to identify conditions under which distance learning lead to increased learning; perceived quality, efficiency, and effectiveness of online course content; facilitators and barriers related to utilization; as

well as application to the real world of healthcare practice. Opportunity for qualitative response was provided via open-ended questions.

The Faculty Demographic Data Form was used to obtain characteristics about professors such as age, major, degrees; preferred learning channel style; technology utilization, access and utilization; as well as instructional experience, preparation for web-based teaching, preferred pedagogy mode, and primary role.

The Web-based Course Outcomes Form was used to collect information on authentication of participation (students performing own work); types of evaluations and actual application in the distance learning environment; class or course management (time-saving approaches, class size, and organization of content); and completion of course rates. Qualitative responses were solicited through open-ended query.

The Web-based Online Data Form was used to compile information for categorizing web-based course content; variety of learning activities (simulations, games, links, and animations) and inclusion of non-traditional measures (portfolios, clinical applications, work related projects). The major pedagogy mode (teacher directed, inquiry based, student directed) was also identified. Research assistants used a standardized tool to perform data collection. This method permitted unbiased data collection and enabled coding of findings into meaningful data. Information on actual intranet web utilization and operation as denoted by hit reports was generated by the research assistants.

To assess computer proficiency and technology utilization, participants were asked to mark each specific computer skill that could be performed without referring to "Help" or seeking assistance. The range of possible scores was 0 to 54; the score was then recoded into one of three mutually exclusive categories (beginner 1-18, intermediate19-36, advanced 37-54). Technology utilization was the number of specific devices for which participants reported use; the range of possible scores was 0-8.

The Preferred Learning Channel determination used a 13-item self-report instrument to identify whether subjects classified as visual, auditory or kinesthetic learners. Each item had three possible answers; the selected response was coded as "1" and a total score calculated; when participants marked more than one response for an individual item "0" was entered. Two qualitative questions were used to collaborate the score; these responses were also coded as visual, auditory or kinesthetic.

Data analysis

The Statistical Package for Social Sciences (SPSS for Windows 10.0, 2001) was used to perform data analysis, develop tables, and generate graphic displays. The principle investigators are experienced in use of this program, as is the statistical consultant.

Statistical methods for data analysis were selected based on properties of the test, and sample size. Therefore, multiple statistical procedures were applied to explore relationships as fully as possible. Analysis of data included Cronbach's alpha coefficient to test reliability of Preferred Learning Channel instrument (Cronbach, 1951). Other statistical tests included analysis of frequencies, means, standard deviations, Pearson product moment correlation, chi square, and analysis of variance tests of group means. Responses were tested separately and grouped for selected variables.

Analysis of qualitative data was accomplished by coding written narrative to open ended questions, grouping into categories, and examining for common themes. Themes were derived from student and faculty responses, rather than predetermined prior to data collection or coding; this represented a genuine commitment to prevent investigator bias and minimized misinterpretation of qualitative material.

Level of significance

Alpha for this study was .05; the sample size should provide adequate power and exceeded the minimum of 30 cases per variable recommended for correlation statistics (Munro, 2001)

Reliability

The general concept of reliability refers to accuracy of the estimate of the true score for a population on a given test or instrument. The reliable test produces similar outcomes when different people are tested; reliability estimates are influenced by the number of items on the test, heterogeneity of the population, and statistical procedure (Norusis, 2001). Alpha reliability (Cronbach, 1951) is a coefficient based on the internal consistency for items within an instrument or test. Values range from 0 to 1; reliability coefficient values of .90 or above are needed when investigators plan to classify individuals based on a test score (Munro, 2001).

IV. Results

The purpose of this study was to examine variables that impact on web-based learning and teaching. Data was conducted over a twelve month period using a purposive sample of students and faculty in a Midwest academic medical center.

In this chapter, a brief description of the population is presented followed by data and statistical analysis for each research question.

Population

A total of 1313 surveys were distributed to students and faculty; Table 1 displays survey distribution, return, utilization, and percent return rate by hospital.

Table 1. Survey Distribution, Return Rate, Utilization, and Return Percentage.

	SOM	SON	GRAD	Faculty	Total
Surveys Distributed	260	324	320	409	1313
Surveys Returned	124	178	76	142	520
Return Rate	48%	55%	24%	35%	40%

378 students participated in this study. The student mean age was 25.7 (range 20-57), with 4.98 years of education since high school (range 2-12), 3.4 overall grade point average of 3.4 (range 2.5-4.0), and 9.11 years experience using a computer (range 1-22). For faculty members, the mean age was 48.3 (32-74), with 10.96 years education since high school (rage 4-15) and 15.32 years teaching experience (range 1-50).

Data and statistical analysis for each research question is now presented.

Research Question 1

Is there a relationship of gender, age, major, years of education, and student or faculty status to computer proficiency or technology utilization?

Table 2: Mean Values by Gender

	Students			Faculty		
	Male	Female	Total	Male	Female	Total
Age	26.4	25.6	25.9	49.3	47.0	48.3
Years of education	5.8	4.66	4.98	11.6	10.2	10.96
Computer proficiency	37.88	33.60	34.95	40.30	36.70	38.76
Technology utilization	2.04	1.58	1.72	2.84	2.11	2.50

For students and faculty, the Anova test for difference in age was not statistically significant as related to gender. Years of education since high school, computer proficiency, and technology utilization by gender were statistically significant for students; only years of education and computer proficiency were statistically significant for faculty.

Table 3. ANOVA outcomes

	Students	Faculty
Age	F (1,342) = 0.700, p .403	F (1,132) = 1.86, p .175
Years of Education	F (1,336) = 19.65, p .000	F (1,110) = 5.68, p .019
Computer proficiency	F (1,346) = 25.04, p .000	F (1,138) = 15.08, p .000
Technology utilization	F (1,342) = 15.31, p .000	F (1,139) = 2.72, p .102

The computer proficiency raw score for faculty by rank was statistically significant, with F(5,136) = 5.548, p .000. Tukey's B post hoc analysis showed associate and assistant professor mean scores were similar (43.46 and 41.22 respectively); however, professor and instructor mean scores were substantially lower (31.16 and 34.14). The highest mean score was for research assistants and associates (49.00), possibly due to research role requirements.

Research Question 2

Is there a predominate preferred learning channel (PLC) for students and faculty? The self-reported preference was kinesthetic (K) activity for learning and free time; however if both groups need to learn complex material the visual (V) mode was preferred. A small percent of subjects preferred the auditory channel (A). Many students did not indicate a preference for complex material.

Table 4. Channel Preferences

	Students			Faculty		
Preferred channel	V	A	K	V	A	K
Learning	120	29	175	56	10	65
Free time activities	119	12	128	51	5	61
Learn complex material	80	40	65	48	2	34

Chi-square analysis indicates little difference in learning preference for the two subgroups; however, results for both students and faculty differ from previous studies that report 60% of people prefer visual, 30% prefer auditory, and 5% prefer the kinesthetic channel. Obtained contingency coefficient values in the table below indicate a statistically significant difference for free time activities and learning complex material preference between the two subgroups.

Table 5. Chi-square analysis

	Statistic
Learning	X^2 (2, 455) = 1.317, p .518
Free time activities	X^2 (2, 380) = 8.890, p .031
Learn complex material	X^2 (2, 276) = 30.626, p .000

Research Question 3

Is there a relationship of student PLC to satisfaction with web-based learning?

The Anova test for difference in overall satisfaction with web-based learning by PLC was not statistically significant, with an F (2,88) = 480.04, p 493.

Table 6. Student satisfaction and PLC values

	Mean	Range
Visual	54.35	0-98
Auditory	69.00	50-90
Kinesthetic	56.53	0-100

An interesting finding is that auditory learners in this study were more satisfied than visual or kinesthetic channel participants. Web-based educational sites may have limited sound incorporated into content sessions; however several courses reviewed during the included video clips which may have influenced student responses.

Research Question 4

Is there a relationship of student PLC to preference of delivery mode?

Qualitative coding of responses to the open-ended question revealed the majority of participants prefer the classroom setting.

Auditory channel preference students rated the classroom as best, but several remarked that small groups did allow exchange of ideas and not just the teacher's perspective. The need to "communicate feelings" was also voiced. Individuals with visual channel preference identified the classroom as better.

Overall, a large number of students identified preference for classroom and small group activity, but some learners favored online. Classroom was viewed as more efficient and forced student into a routine that was familiar. A cautionary observation

was that web-based courses "are a fad and will die out"; in contrast another student expressed optimism that web-based study be an option for future graduate study. However, when convenience is at stake, web-based study is highly valued.

Research Question 5

Is there a relationship of student GPA to perceived success in a web-based course?

Pearson's product moment correlation was used to determine the relationship between the grade point average and perceived success, with r(249) = .023, p .859. The mean GPA of 3.40 (range 2.5 to 4.0) is high but the perceived success mean is low at 60.22 (range 5-100).

Research Question 6

Is there a relationship of student and faculty computer proficiency to degree of satisfaction with distance learning or online classes?

Pearson's product moment correlation was used to determine the relationship between the computer proficiency and overall satisfaction. Student findings were r(90) = .166, p.118. The computer proficiency mean score was 37.45 (range 8 to 54); mean satisfaction was 58.79 (range 5-100). Only four faculty marked the analog scale used to determine overall satisfaction so a value was not determined.

Research Question 7

Is there a relationship of student and faculty PLC to level of satisfaction with online discussion groups?

Only a small portion of students marked the analog scale for this question but results were statistically significant, with $F(2,54) = 3.3469$, p .038. The auditory learner mean score for satisfaction with online discussion groups was 23.00, dramatically lower than visual learners (63.42) and kinesthetic learners (51.52).

Too few faculty marked the analog scale to calculate a meaningful statistic; for the most part an online discussion group was not a feature of their course or class.

Research Question 8

Is there a relationship of student and faculty reported hours online to outcomes in a web-based course?

Faculty answered from"0" to "5" hours per week to "2 hours per student". Others commented that time requirements "depend on number of students and need for discussion and guidance". Managing email correspondence took "about an hour".

Students reported a wide variation in time with web-based study, from "0" to "10" hours a week. The data from this question needs to be correlated to the particular courses, which will be done during Fall 2002.

Research Question 9

Is there a relationship of student ability to apply new knowledge and skills to quality of online course? To preferred learning channel? To learning activities?

Themes related to applying new knowledge were "repetitive exposure to material reinforces information" and "allows student to work on skills that need to be mastered and to skip what is already known".

In regard to preferred learning channel, answers implied the kinesthetic mode "involves learning by doing" and "requires active participation instead of being passive in class". Conversely, there were comments that it is "not hands on" and "takes motivation away".

Responses associated with learning activities were "increased computer skills", "more exploration of resources on the web", "enhanced proficiency finding information". Of more importance was clinical application including "finding material on the web to give to patients" and "enhanced the way I interact with patients in practice".

Research Question 10

Is there a relationship of student report of course quality to efficiency? To enablers? To barriers?

Student responses indicate that efficiency of online study is associated with quality of online material, $r(103) = .589$, $p.000$; the overall quality mean was 68.78.

Student identified enablers include "computer that works" and "easy access" that address system issues, whereas "multimedia", "interactivity", "good design" and "entertaining" are associated with information processing.

Consistent points raised about barriers were "decreased interpersonal communication" along with "easy to cheat and unable to accurately test student knowledge". Universal technical issues were "slow speed connection", "hardware problems" and limited "computer illiteracy". Money and work constraints also were identified as problems for web-based courses.

Research Question 11

Is there a relationship of faculty years teaching to quality of materials and activities in online course?

Mean faculty age was 48.40 (range 32-74) and mean years teaching 15.32 (1-50). Experienced faculty are more productive in development of web-based content and courses F(2,76)= 9.640, p.000. Nine individuals created over 50 online units; range of productivity was 1 to 96 distinct units, with some containing multiple sub-units Although faculty in all schools contributed web-based content, two predominately online programs contained the most pages.

Research Question 12

Is there a relationship of faculty years teaching online to quality of online course?

Faculty with less teaching experience placed more static course support material online, while mature teachers created animations, managed discussion formats, and incorporated interactive exercises, voice, video, and linked to other sites.

Examination of each web-based pages and units showed statistically significant differences for “good” web content F(2,1507)=4.455, p.000 and “poor” web content F(2,1507)-15.627,p.000.

Student evaluation of web-based courses was positive when interactivity was included; incorporation of images and video was particularly valued by learners. This was collaborated by review of hit reports for individual pages and courses.

Research Question 13

What is the faculty perception of student participation during online course? What measures are used to evaluate student interaction online (quality, quantity)?

Faculty qualitative responses on participation varied from "good" to "minimal" with concern expressed about less than optimal group discussion activity. Faculty reported using student feedback, the amount and depth of online discussions, written assignments and exam outcomes, as well as hit reports as a gauge of interaction.

Research Question 14

What measures are used to evaluate student progress in course (quiz, test, reports, projects, etc.)? Used to verify that student is doing own work and testing?

Faculty measured student progress with quizzes and examinations, written papers and essays, self-assessment feedback, student presentations, and ongoing discussions. To verify that students are performing own work, faculty report checking references and viewing online pages citations to assess for plagiarism. Faculty also used student generated progress reports, online discussion, and email to assess involvement.

Research Question 15

Which measures are more effective in evaluating student progress in course?

For the most part, faculty responded "don't know" as to what is most effective; one participant reported using questionnaires and another stated that "homework" was used to measure progress.

Research Question 16

What strategies do faculty use to manage online time with students? What is most effective and why?

Faculty suggested a number of strategies for time management, such as using email or telephone contact and setting deadlines for student assignments. Having students work as groups or implementing Usenet discussion was also stated. There were no comments about what is most effective, but one respondent reported as not "managing well".

Research Question 17

What strategies do faculty use to provide structure to a distance learning course? To assist students to progress through online material?

Faculty used pre-established timelines, content outlines, objectives and syllabus, lesson plans, and practice quizzes to provide structure. Some courses were structured like "traditional classroom" but other faculty used weekly "logs" and "plans".

Research Question 18

What is the course completion rate? Program completion rate?

Although there is a high volume of online content and approximately 80 individuals who produced online material, review of data indicated that most faculty do not have sole responsibility for a course. Four faculty members, who served as course coordinators as well as content producers, reported 100% course completion rate.

Program completion for strictly online students is high, particularly in the RN/BSN program where 90% of students graduate and online is the only option offered. Attrition for BSN and medical students is not related to online content (finances, grades, etc). The graduate school, except for physician assistant and physical therapy programs, has higher enrollment of part-time status students so attrition data is incomplete for the time frame of this study.

Research Question 19

Is there a relationship of faculty preparation for web-based teaching to quality of course or quality on material online from student perspective? Faculty perspective?

Forty-eight instructors reported taking education courses, training or having teaching degrees; one individual is degreed in instructional design and six have formal instruction in media development.

Student evaluation of web-based content developed by faculty with education degrees was more positive; however, sorting data by faculty and course is difficult since some individuals teach in more than one web-based course or program. The table below reflects mean scores by program.

	Overall Quality of Material	Overall Course Quality
Doctorate	90.0 (90)	n/a
Medical	77.4 (25-100)	71.9 (30-98)
BSN	57.4 (0-100)	57.2 (0-100)
RN/BSN	68.8 (10-100)	84.17 (10-100)

BSN students have the least consistent volume of web-based material, so those outcomes may be skewed by less experience online or less variety in online content. In light of RN/BSN student lower computer scores and competency levels, mean scores of

57 are worrisome but understandable. In-depth data mining indicates RN/BSN students who had completed a greater number of online courses expressed higher satisfaction with both quality of material and the individual courses. Certainly this is an area for further exploration and indicates need for enhanced student preparation prior to web-based study.

As reported in Question 19, 48 faculty have education training along with a professional degree and a small number have taken courses in media development. An incidental finding is the teacher with instructional design education is not involved in web-based course development.

Research Question 20

Is there a relationship of faculty preparation for web-based teaching to structure of course? Activities in course? Willingness to teach via distance learning?

Faculty interest in web-based teaching varies considerably based on contribution to a given course. Five faculty expressed “no” interest and had nothing online; 13 reported “little” interest in web-based teaching, three of whom served as content experts for a course. Teachers with “some” or “moderate” interest in web-based instruction were more likely to have developed content or serve as content experts. Faulty with “high” interest were by far the most productive producers of web-based learning material; there exists a statistically significant difference by level of faculty interest and contribution, X^2=.389, p.024.

Course structure was more sophisticated and extensive when faculty had some formal preparation in education or media; solitary text-based content was developed by less experienced teachers or those with “little and ”some interested in online.

Research Question 21

Is there a relationship of faculty PLC to online course development? To preferred pedagogy style? To quality of distance learning material?

Statistical outcomes indicate there is no relationship of faculty preferred learning channel to online course participation, pedagogy, or quality of online material. Thirty-two percent of faculty who are “visual” PLC and 32% of “kinesthetic” PLC have served as content expert, developed online formats or placed learning material online. Only three “auditory” PLC had any involvement with web-based teaching.

Research Question 22

Is there a relationship of faculty primary role and teaching online? Pedagogy preference?

Contingency coefficient was statistically significant, X^2 (3, 136) = .265, $p < .017$, with primary role of teaching more likely to have published web-based content. There was no relationship of faculty preferred pedagogy (lecture, demonstration, small group, lab) to online production of learning materials.

Research Question 23

What factors motivate faculty to teach content online? Motivate students to take coursework online?

There were four major themes. Obtaining a new computer, meeting a grant commitment, and "being asked" to develop online content was reported. A second theme was promoting student flexibility and independence in learning material that is available 24/7. Thirdly, opportunities for wider distribution of material and alternate way to present content was reported. Lastly, interest in using new technology and creating alternatives for student learning were noted.

Student remarks varied widely; positive remarks included "convenience", "time flexibility", "less travel" along with "congruence with work and family responsibilities". Some students expressed "interest in technology" while others cited that required courses were available only online with "no choice" as far as delivery mode.

Research Question 24

What measures do faculty use to assess the quality of online coursework? Are students asked to evaluate online coursework?

Participants stated that learner feedback, exam grades and quizzes, and student course evaluations were used to assess for quality. Faculty peer feedback was also used; however two teachers reported using nothing.

Research Question 25

What types of pedagogy are evident online? What types of activities are used most frequently? What types of learning material is online?

Thirty-two different categories of data were used to assess 1584 units (classes, courses, or individual pieces of support material) on the Academic Intranet. The mean (range) in pages per unit of analysis for an individual offering was 251.59 (0-94); hit report was 251.59 (0-7962); and average hits 22.46 (0-2323). 190 units were developed by faculty for the PhD program in the Graduate School, 648 units by Allied Health; 446 units by School of Medicine 446, and 290 units by the School of Nursing. Not all units are alike as evidenced by the number of pages per unit cited above; some were text only while others contained animations and extensive graphics.

Pedagogy evident in review of pages was extremely mixed: lecture 442, slides 772, study guides 183, practice questions 308, quizzes 62, exams 24, and written assignments 153. One unit was directed to portfolio development; 315 contained real-world application such as clinical project; 172 case studies; and 407 units embedded links to other sites, with 384 of the links functional. Support material online included 103 syllabi, 2 workbooks, 47 handouts, and 422 sets of lecture notes.

An extensive array of media was incorporated into courses: 518 units of images; 35 animations (a gross underestimate of total animations as some units have eight to ten per unit); 19 units with video clips (again total online is greater); 125 audioclips; 0 games; 45 simulations; 130 lab exercises; 43 statistical calculation drills; 9 model creations. No synchronous discussions were active at time of the study, however 30 courses involved students in asynchronous discussion for credit. Video or audio conferencing were available but not implemented on the Academic Intranet; white board was not available. 105 units contained links to faculty; 160 acknowledged copyright.

Several incidental findings warrant attention: 937 units do not identify a author, 1155 lack the respective unit or course name; all but 269 contain the module or topic name.

Research Question 26

Is online content aesthetically appealing? Interactive? Variety of activities?

Sixty-three elements were assessed to determine aesthetics; as a whole, use of good design principles was apparent. Unappealing background features included solid black background, (5), three or more colors (4), excessive design or detail (3), primary colors adjacent (5), poor contrast with text (15), and distracting graphics (1).

Misuse of graphics included (1), feature unrelated to topic (2), poor quality images (48), type or images to small to see clearly (78), too many templates (1), mix of border styles (3) and greater than 35K pages (3).

Issues with tables were unaligned text or numbers (1), greater than 6-7 lines (12); special effects issues included repeating sounds (1). Copyright and reference citation was missing for artwork or photos (32) and one brand name product.

Inappropriate use of text features that make web-based content hard to visualize included serif font (8), heard to read fonts (6), italics (12), bold (32), underlining (7), all caps (2), font less than 28 points (55), centered or justified body of text (7), more than six or seven lines (16), multiple colors (32), poor contrast to background (7), and running off page (8).

Grammatical errors noted were exclamation points (1), misplaced parenthesis (1), and misspelled words (20). General formatting faux pas included unorganized content (1), inconsistent layouts (25), information overload (21), excessive scrolling to read

pages (190), dead links or buttons (28), unappealing or boring (121), and file size to large to load (1).

Details as to interactivity were listed in response to Question 25; evidence of a large volume of simulations, lab exercises, statistical calculation drills, and model creation is present as well as asynchronous dialogue.

Room for improvement exists, particularly in units where text was not converted to html and appears as hieroglyphics or aesthetics is overwhelming. With over 540 learning activities were built into the various units, there is good evidence that faculty are encouraging active knowledge mastery or application and not rote memorization.

V. DISCUSSION, IMPLICATIONS, RECOMMENDATIONS

The purpose of this study was to determine factors that contribute to learning by healthcare profession students. The preferred learning channel, student and faculty demographic information, and online course content, and web-based learning variables were examined during this longitudinal study.

Findings are that students and faculty preferred learning channel have some influence on utilization of web-based material development, use, and appreciation. Faculty are diverse in relationship to computer proficiency and online course production; students are also dissimilar in computer skills and application of web-based content.

Students identified time and travel efficiency as positives related to online study, however access and quality continue to be issues for this population of healthcare students. Faculty view having options for learners to attain knowledge as positive but are uncertain about what constitutes effective online course management. Structuring a web-based course tended to reflect current classroom practices, but this was not consistent for all faculty.

Completion rate for online courses and programs is high; since student motivation to obtain the respective degree was not assessed, it is unclear what factors are at work. Certainly electronic based format is not providing too significant a barrier to healthcare students in this study.

Quality of web-based content and courses per student perspective is mixed, especially as viewed by degree program. Students with a smaller amount of content or requirements online expressed significantly lower opinions; overall, many students were 80 to 100% satisfied. Faculty assessment of quality is limited and student focused; a few individuals used peer review as a means to identify areas to elaborate or improve.

Numerous faculty have formal education in learning theory and good teaching practices; the sheer volume and variety of web-based material attests to overall commitment to learners.

Since online productivity is not generally considered during promotion review, motivation must be highly internalized for many teachers. Some faculty were directed to develop online material, however the majority are not mandated to teach online and have not attempted to implement the format. As far as preferred learning channel, visual and kinesthetic faculty predominate web-based teaching; no relationship of online production to preferred pedagogy and primary role were noted.

Students were motivated to enroll in web-based courses and programs because of expediency and congruence with role demands; faculty reported desire to foster independent learning, chance to implement new technology, or new equipment, grant or department expectations as prompts.

A multiplicity of pedagogy and teaching strategies is present in web-based units and courses. Media was widely distributed and high quality, which is essential when conveying healthcare profession content; hit report data indicates high access which means some students repeatedly utilized the material. Authorship is missing for the majority of units, as is a course name; various content is used by multiple programs, but most is not so identification needs to be addressed as units are revised.

Web-based content is aesthetically appealing, interactive and contains a plethora of endeavors to engage students in active learning. There are over 1500 units (classes, courses, individual pieces or support material) of web-based substance available to learners. The volume is impressive and presents continued opportunity for research investigation.

Future study should be directed to effective course conduct and means of providing structure for online students. Further refinement of the quality appraisal tool utilized in this study is a priority, as well as means for faculty to evaluate online content quality.

References

Athanasou, J.A. (1999). A framework for evaluating the effectiveness of technology assisted learning. Virtual University Journal, 2, 13-21.

Babbie, E.R. (1999) The basics of social research (3rd ed.). Belmont, CA: Wadsworth.

Colliver, J.A. (1999). Constructivism with a dose of pragmatism: a cure for what ails educational research. Advances in Health Sciences education, 4,187-190.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika,16, 297-334.

Furnell, S.M., Evans, M.P., Phippen, A.D., & Abu-Rgheff, M.N. (1999). Online distance learning: expectations, requirements, and barriers. Virtual University Journal, 2, 34-48.

Hall, R.H. (1999). Instructional web site design principles: a literature review and synthesis. Virtual University Journal, 2, 1-12.

Munro, B.H. (2001). Statistical methods for health care research. Philadelphia: Lippincott Williams & Wilkins.

Norusis, M.J. (2001). SPSS 10.0 guide to data analysis. Upper Saddle River:Prentice Hall

Sims, R.R. & Sims, S.J. (1995). The importance of learning styles: understanding implications for learning, course design, and education. Westport, CN: Greenwood Press.

North Central Regional Technology in Education Consortium (2001). Learning with technology profile tool. http://www.ncrtec.org/capacity/profile/profwww.htm.

http://www.universaleducator.com/LearnSytle/sense.html (2000). Media or sensory channel.

Vogel, D. and Klassen, J. (2001). Technology supported learning: status, issues and trends. Journal of Computer Assisted Learning,17, 104-134.

Wood, M.J. (1998). Advanced design in research. Thousand Oak, CA: Sage