Multi-Course Comparison of Traditional versus Web-based Course Delivery Systems

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Abstract

The purpose of this paper is to measure and compare the effectiveness of a Web-based course delivery system to a traditional course delivery system. The results indicate that a web-based course is effective and equivalent to a traditional classroom environment. As with the implementation of all new technologies, there are some pros and cons that should be considered. The significant pro is the element of convenience which eliminates the constrictive boundaries of space and time. The most notable con involves the impersonal nature of the online environment. Overall, we found the web-based course delivery system to be very successful in terms of learning outcomes and student satisfaction.

Introduction

There has been a proliferation of courses and programs that are available over the World Wide Web. This includes both distance education and resident student instruction. Traditional bricks and mortar courses have a long history of proving how effective they are through exams, student evaluations and student feedback. Yet, there has been a lingering debate in the literature and halls of academia as to whether online courses are as effective as traditional courses (Chen and Jones 2007; and Hiltz 1993).

The authors wanted to investigate if there are differences in learning in a Web-based section of a course and learning in a bricks and mortar section of the same course. We also wanted to investigate student satisfaction between a Web-based section of a course and a bricks and mortar section of the same course. There has been some recent research completed in regard to these topics.

Literature Review

Across the literature we found that there were several common assessment issues in regards to web-based courses. These include learning outcomes, course satisfaction, and technical issues. The last 14 years has provided a wealth of information with inconsistent results and few conclusions as to the effectiveness of web-based courses versus traditional brick and mortar. Some studies have been so broad as to look at the impact of institutional mission, faculty development, and course development strategies (Evans, 2001). Some studies even discussed potential barriers that faculty should be aware of when sharing information with students' online (Suter and Kopp, 1998). The general focus of this discussion will look at learning outcomes, course satisfaction and technical issues, as this has been the primary discussion in the literature.

Learning Outcomes

When looking at learning outcomes, researchers have found very different results (Vat 2006). They have identified trends, factors for success, and potential advantages and disadvantages associated with web learning (Hollenbeck et al. 2005). Vogt, Atwong and Fuller (2005) found that students in an advanced business communication course did

achieve a high level of proficiency and they did so equally in both traditional and online classes. Bata-Jones and Avery (2004) in research on nursing students who took a pharmacology course found that there were no significant differences between the mean exam scores of students enrolled in the web-based and traditional courses. In 2004, Kearns, Shoaf and Summey found that students in a Web-based second-degree bachelor of science (in Nursing) program scored significantly higher on the final examination and the comprehensive examination than did students in the traditional course. Buckley (2003) found that students in a web-based nutrition course received a lower mean course evaluation score than students in a traditional similar course. In 2002, Maki and Maki found that students in a Web-based course (psychology) learned more than students in a bricks and mortar section of the same course. Arbaugh and Duray (2002) compared two web-based MBA programs, one with some on-site meetings and the other totally online. They found that larger class sizes were negatively associated with perceived learning. Sankaran, Sankaran and Bui (2000) researched the amount learned in Web-based and bricks and mortar versions of an undergraduate business computer course. No significant difference in learning gain from pretest to the final exam was found. Wang and Newlin (2000) compared Web-based and bricks and mortar sections of a statistics course. They found that the bricks and mortar students scored higher on the final exam than did the Web-based students. Hiltz (1993) compared Web-based and bricks and mortar sections of several courses and found equal learning in the Web-based and bricks and mortar section in almost all courses and superior learning in the Web-based computer science course.

Table 1 illustrates a summarization of these various studies. An analysis of this table indicates that in 7 of the 9 studies there was no difference in learning outcomes or that there were higher learning outcomes than in traditional courses. While there is no definitive conclusion from looking at these studies, it does suggest that there is potential for achieving comparative or even higher learning outcomes in web-based courses.

TABLE 1: Learning Outcomes Studies

Authors	Sample	Outcomes
Vogt, Atwong and Fuller (2005)	Business Students	No difference between Web and Brick n' Mortar
Beta-Jones and Avery (2004)	Nursing students	No difference between Web and Brick n' Mortar
Kearns, Shoaf & Summey (2004)	Nursing (second Bachelors)	Web students earned higher scores on final exams and comps than traditional students
Buckley (2003)	Nutrition students	Web students earned lower mean course evaluation scores than traditional students
Maki and Maki (2002)	Psychology students	Web students learned more than traditional students
Arbaugh and Duray (2002)	MBA students	Web students had higher perceived learning than traditional students
Sankaran, Sankaran, and Bui (2000)	Business students	No difference between Web and Brick n' Mortar
Wang and Newlin (2000)	Business students	Web students earned lower scores on the final exam than traditional students
Hiltz (1993)	Computer science students	Web students learned more than traditional students

Student Satisfaction

When looking at level of student satisfaction in Web-based courses versus bricks and mortar courses results also varied in the studies we found. Chen and Jones (2007), Stanley (2006) and Arbaugh (2005) all find that satisfaction was similar to traditional course delivery systems. Yet, in 2004, Kearns, Shoef and Summey found less satisfaction for students in a Web-based second-degree bachelor of science (in Nursing) program than the traditional course method. Bata-Jones and Avery (2004) in research on nursing students who took a pharmacology course found that students in enrolled in the web-based course were more positive about their experience than those enrolled in the traditional course. In 2003, Buckley in her study on students in nutrition classes had much more neutral findings, where the students expressed both positive and negative aspects of the online instruction. In 2002, Wills found that students seemed to favor an online format for the teaching of graduate level nursing courses versus the traditional classroom environment. Maki et.al. (2000) found lower satisfaction in the Web-based

than in the bricks and mortar version of introductory psychology, a finding replicated by Maki and Maki (2002). Arbaugh and Duray (2002) in their investigation of Web-based MBA programs found that more experienced on-line students tended to be more satisfied with Web-based delivery mechanisms. They also found that smaller class sizes were positively associated with satisfaction. Wang and Newlin (2000) found fairly equivalent satisfaction. Hiltz (1993) found that satisfaction was high in the Web-based courses (but he did not compare Web-based vs. bricks and mortar). Table 2 provides a summary of these studies which illustrates that in 8 of the 11 studies satisfaction was the same or higher than traditional courses. While there appears to be some disparities between the studies, it looks like course satisfaction in web-based courses is favorable when compared to traditional courses.

TABLE 2: Student Satisfaction Studies

Authors	Sample	Outcomes
Chen and Jones (2007)	MBA students	No difference between Web and Brick n' Mortar
Stanley (2006)	Medical students	No difference between Web and Brick n' Mortar
Arbaugh (2005)	MBA students	No difference between Web and Brick n' Mortar
Kearns, Shoaf & Summey (2004)	Nursing (second Bachelors)	Web students reported less satisfaction than traditional students
Beta-Jones and Avery (2004)	Nursing students	Web students reported higher satisfaction than traditional students
Buckley (2003)	Nutrition students	No difference between Web and Brick n' Mortar
Wills (2002)	Graduate Nursing students	Web students reported higher satisfaction than traditional students
Maki and Maki (2002)	Psychology students	Web students reported less satisfaction than traditional students
Maki et al. (2000)	Psychology students	Web students reported less satisfaction than traditional students
Arbaugh and Duray (2002)	MBA students	Web students reported higher satisfaction than traditional students
Wang and Newlin (2000)	Business students	No difference between Web and Brick n' Mortar

Technical Issues

One of the issues frequently facing faculty members teaching web-based courses is the level of technical skills on the part of the students (Su, 2005). Kaynama and Keesling (2000) found the variations in students' technical skills constituted the most challenging task the instructor had to work through. This is a problem that was shared with many other educators (Martins and Kellermanns, 2004; and Siu and Chau, 1998). Although, this may not be considered an outcome variable, it may be important as a predictor of success.

In summary, a majority of studies that investigated learning outcomes found that web-based courses provided similar or even higher results than traditional courses. A few studies found opposite results. In terms of satisfaction, web courses appeared to perform well, but there was some variation in the results. There may be additional factors such as experience and motivation that are influencing the results. The following study attempted to replicate components (i.e. predictor variables and outcome measures) of the previous studies in order to further address these issues and possibly provide some contributing evidence as to the overall effectiveness of online courses.

Methodology

Design

For the comparison process, we conducted a study that spanned two academic years and four sections of a junior level course (Principles of Marketing). We compared traditional lecture style courses and web-based delivery courses during the study, which was similar in design to previous studies (Priluck, 2004). Our goal was to assess whether there was a difference in effectiveness between the two delivery formats. We defined effectiveness as the following:

1. Learning Outcomes

1.1. Final Exam

1.2. Semester Project

1.3. Final Grade in Course

2. Overall Course Satisfaction

2.1. With Course

2.2. With Instructor

We made no special announcements that one section would be web-based until the first week of class. This helped to reduce self-selection bias. In the case of a strong objection by a student to the web format, then the student would have been allowed to switch sections. There were no instances in which this was the case.

The traditional section of the course was conducted in a traditional "brick and mortar" environment with moderate utilization of technology such as, power-point presentations, TV/VCRs, overhead projectors, etc. It was essentially a lecture based format in a classroom setting that met twice a week.

The web-based section was conducted via the Internet, which meant that all course lectures and materials were delivered via web-pages. We looked at a variety of studies (Kaynama and Keesling, 2000) in order to develop the class with careful design considerations (Taylor et al., 2004). This used a modular format which presented information and incorporated learning activities on a weekly basis that was relevant and comparable to information being presented in the lecture-based sections (Su, 2005).

In order to control for certain elements and measure the difference in others, we maximized the number of design elements that were similar. For instance, the instructor, the book, exams, assignments, projects, and material coverage were the same across all sections. The elements that were different included issues like delivery method and instructor contact.

Predictor Variables

At the beginning of the semester, the predictor variables were measured across each section. The predictor variables are as follows:

- **GPA:** Student grade point averages were taken from official University records.
- **Academic Level:** Student academic level was taken from official class rosters. Categorized as Freshman, Sophomore, Junior or Senior (no graduate students enrolled in these undergraduate classes).
- **Web Based Experiences in classroom settings:** Information was taken from pretests, indicating student self-reported experience with prior web-based classroom settings.
- **Perceived Knowledge:** Information was taken from pretests, indicating student self-reported prior perceived knowledge with the Internet.
- **Course Format:** This is not a measured variable, but it may influence the dependent variables.

Based on other studies (Sweeney and Ingram, 2001), the authors felt that these predictor variables would all be important in helping to predict student performance in these classes.

The variables were measured utilizing standard demographic questions and a series of questions for assessing experience and knowledge. For instance, experience questions were literally based on a series of yes/no questions that assessed whether they had participated in a particular online activity. The perceived knowledge questions were based on a series of questions that utilized a 5 point Likert-scale, which assessed the degree to which the respondent believed they had knowledge of the specific issue (Berger and Topal, 2001).

Dependent Variables

At the end of each semester, the dependent variables were measured, based on the following variable descriptions:

- **Learning Outcomes:** This information was taken from the various assignments that students submitted for the courses, such as the final exam, the semester project and the overall final grade.
- **Course Satisfaction:** Information was taken from the student evaluations of the course at the end of the semesters.

Both of these dependent variables were felt to be important by the researchers because they would help to explain the outcomes from the students at the end of the semesters.

The measurement procedure for learning achievement was fairly straightforward as it was based on actual scores that were achieved by the students. While course satisfaction was measured utilizing a series of questions with Likert type scales ranging from "strongly agree" to "strongly disagree". These questions are illustrated in table 3.

Study 1

Data for study 1 was collected from two sections of a Principles of Marketing course at a private Southeastern University. This study was funded via a Title III Strengthening Institutions Program grant (*Achieving Excellence in Teaching & Learning*.) The demographic and predictor variables are described in detail in Table 1, below:

TABLE 3: Demographic and Predictor Variables for Study 1

Study 1		Traditional	Online	Sig-Diff
Enrollment		31	17	N/A
Average GPA		3.12	3.08	.093
Gender:	Male	15	6	N/A
	Female	16	11	N/A
Academic Level	Freshman	0	0	N/A
	Sophomore	5	1	N/A
	Junior	18	9	N/A
	Senior	7	7	N/A
Web-based Experiences	Perceived Knowledge of Web Based Courses	2.90	3.07	.078
	Experience in Online Course	1.98	1.93	.181
	Experience with Online Course Components	1.89	2.00	.074

As illustrated in table 3, the demographic and predictor variables have insignificant differences between the groups. This is important for establishing predictive validity as we examine the dependent variables. In terms of GPA's, we found that there was no significant difference in GPA's between the two sections (i.e. 3.12 and 3.08). Therefore, we assumed both sections started with similar academic backgrounds and potential for learning. The only variable with a notable difference was group size, because the online group was smaller than the traditional class.

Study 2

Data for study 2 was collected from two sections of a Principles of Marketing course at a second private Southeastern University. The study was conducted utilizing the same methodology and instruments as described in study 1. The primary purpose of the study was to provide validation for study 1, and provide a longitudinal investigation of the issues. The demographic and predictor variables are described in detail in Table 4, below:

TABLE 4: Demographic and Predictor Variables for Study 2

Study 2		Traditional	Online	Sig-Dif
Enrollment		35	34	N/A
Average GPA		3.25	3.18	.084
Gender:	Male	15	16	N/A
	Female	20	18	N/A
Academic Level	Freshman	0	0	N/A
	Sophomore	4	5	N/A
	Junior	20	21	N/A
	Senior	11	9	N/A
Web-based Experiences	Perceived Knowledge of Web Based Courses	3.10	3.06	.067
	Experience in Online Course	2.07	2.13	.089
	Experience with Online Course Components	3.15	3.23	.071

Similar to study 1, we found very little difference between the groups within the total sample. We were also pleased to have similar group sizes. There was an interesting significant difference between study 1 and study 2, in that the sample from study 2 had a significantly greater amount of experience with online course components.

Results and Discussion

The following results compare both the traditional course and the online course utilizing the pre-test and post-tests. The implications of each question are discussed. The statistical procedures utilized involved frequency analysis, means analysis, and a *t*-test to assess significant differences between means.

TABLE 5: Dependent Variables

		Study 1			Study 2		
		Trad.	Online	Sig. Dif.	Trad.	Online	Sig. Dif.
Learning Achievement	Final Exam	76.4%	75.3%	.091	79.3%	78.4%	.084
	Final Project	85%	84%	.084	86%	84%	.067
	Final Grade GPA	3	3.12	.078	3.15	3.05	.082
Satisfaction	Q1: Excellent Teacher	1.13	1.18	.754	1.12	1.19	.069
	Q2: Overall, I learned a great deal in this course.	1.22	1.25	.086	1.21	1.25	.079
	Q3: I would enjoy taking another course with this instructor.	1.09	1.12	.082	1.08	1.16	**.047**
	Q4: The instructor keeps students interested and motivated.	1.22	1.25	.086	1.17	1.26	**.046**
	Q5: The instructor creates a classroom environment that encourages students to learn.	1.17	1.25	**.043**	1.14	1.29	**.039**
	Q6: The instructor presents course materials in a clear and organized manner.	1.09	1.12	.082	1.05	1.15	.063
	Q7: The instructor utilizes time effectively and appropriately.	1.22	1.25	.086	1.13	1.19	.061
	Q8: Overall, I consider this course to be very important for my education.	1.13	1.18	.754	1.17	1.18	.127

* There was no significant difference for any measure between the studies.

Learning Outcomes

In terms of learning outcomes, we assessed results on the final exam, results on the semester project, and overall results in the course. In terms of course performance, we found no significant differences between sections across all four groups. The final exam consisted of 50 multiple choice questions and 3 of 4 short-answer essays. The semester project entailed the development of a marketing plan for a product or service of the students' choice. The online class tended to have projects that focused on some type of business entity with an online perspective. The overall course grade was a combination of the exams and the semester project. The results indicate that there was relatively little difference in learning achievement between groups or across studies. This is an indication that the online students performed equally well with the students in the traditional course. Although grades were similar, we did find that the drop rate was higher for the online sections. Even though the sample of those students that dropped was not large enough for appropriate statistical analysis, we can say that those who dropped were younger, had less experience, and had lower GPAs.

Course Satisfaction

In order to measure general course satisfaction, we utilized the standardized course evaluation forms used by one of the Schools of Business across all sections used in this study. There are 8 questions which are evaluations of the course and instructor, which utilize a 5 point Likert type scale ranging from "strongly agree" to "strongly disagree". The actual questions are illustrated in Table 5. The general results indicate that there is no significant difference between the two studies. But there are statistically significant differences and visually notable differences between sections. It seems that the online section tends to have higher ratings (lower being better) than the traditional section. This is an indicator that the students are satisfied with convenience and delivery mechanism, but they tend to miss the personal interaction with the instructor. This is generally the number one cause for higher ratings across the board, and this is due to the fact that the online environment is simply less personal.

Regression

In addition to the measurement of differences between groups, we assessed the degree to which the predictor variables actually predicted the dependent variables. This was important because it would help to identify which variables were important for success in both of these classroom environments. The results of the hierarchical regression for predicting learning achievement (Table 6) and course satisfaction (Table 7) for both studies are illustrated with significant results in bold.

TABLE 6: Regression for Learning Achievement: Study 1 and Study 2

Predictor Variables	Study 1			Study 2		
	R^2	R^2 Change	Beta	R^2	R^2 Change	Beta
GPA	.223	.223	**.360**	.228	.228	**.364**
Course Format	.227	.004		.235	.007	
Academic Level	.247	.02	**.144**	.250	.015	**.135**
Knowledge	.264	.017	**.136**	.268	.018	**.138**
Experience	.270	.003		.280	.012	**.121**

In study 1, the variables explained about 27% of the variance in learning achievement, while 28% was explained in study 2. GPA provided the most significant explanation of success in terms of learning achievement. A subsequent means analysis regarding GPA indicated that those with higher initial GPAs tended to perform better on the learning achievement variables. Course format had an insignificant contribution to learning achievements, which was a positive result for our study. This indicates that students learn equally in both formats. Both academic level and perceived knowledge were significant contributors to the equation, therefore indicating that upper level students with higher perceived knowledge tend to due better in either course. Finally, it was interesting to note that experience was only influential in study 2, as the students tended to have more experience in online environments. This seems logical as students tend to perform better in an environment in which they have greater experience.

TABLE 7: Regression for Course Satisfaction: Study 1 and Study 2

Predictor Variables	Study 1			Study 2		
	R^2	R^2 Change	Beta	R^2	R^2 Change	Beta
Course Format	.245	.145	**.376**	.248	.248	**.389**
Academic Level	.258	.013	**.130**	.268	.020	**.139**
GPA	.261	.003		.272	.004	
Knowledge	.281	.020	**.138**	.280	.012	**.129**
Experience	.287	.006		.295	.015	**.132**

In study 1, the variables explained about 28% of the variance in course satisfaction, while 29% was explained in study 2. Course format provided the most significant explanation of variance for course satisfaction. There were several similarities in the regression equations, indicating that both academic level and perceived knowledge were also significant contributors to the explanation of satisfaction, and that there was a difference in the importance of experience between study 1 and study 2. The major difference between the equations was that GPA had relatively little impact on course satisfaction, which was confirmed in a subsequent group means analysis.

In total, the results contribute to the discussion by showing that online formats can deliver comparable learning outcomes as that of traditional courses. Although, motivation is not a factor that we measured directly, it does appear to be an influential and interesting factor that appears to influence the degree of success that students enjoy in the online environment. Satisfaction is a more difficult element to gage as we found that students are generally satisfied with the convenience and format of online courses, but they generally want more interaction with the instructor. Additional strategies and techniques need to be developed that enhance the instructor-student interaction scenario. For instance, it may be necessary to set-up appointment times for online discussions or set-up course blogs. It terms of technology skills, this appears to have been a more important issue in previous studies. Our results indicate that students are adequately prepared for the online course environment in today's technology driven atmosphere.

Conclusions

Overall, the outcomes of this study lend strong support to the development and utilization of online technologies in the delivery of course materials. The following items represent the top 5 outcomes that we found while conducting this research:

1. Similar course objectives and goals are achieved in the online environment.
2. The same degree of learning outcomes was achieved in the online environment.
3. Course satisfaction was comparable to the traditional section, although a little lower, but it was seemingly an acceptable trade-off for convenience.
4. Students are comfortable with the technology and delivery environment.
5. The primary negative element is the lack of personal interaction.

The overall results of study 1 and study 2 help to substantiate some previous studies, and possibly rebuke the results of others. It seems we had similar results in terms of satisfaction (Maki and Maki, 2002), in that web-based sections tended to have lower satisfaction ratings. Our results differed from Wang and Newlin (2000), since we did not find a significant difference in learning achievement between groups.

The use of online courses can be very beneficial for the university community. The use of technology has many benefits in the learning environment. Essentially, online technology makes education available at any time and any place. Our research indicates that the online environment provides a comprehensive and comparable learning environment. Yet, as with any endeavor, there are pros and cons, which must be taken into account for a balanced strategy. As found in other marketing studies (Eastman and Swift, 2001), students enjoy the convenience provided by the online environment, but they miss the personal interaction. Thus, the online environment does not provide a warm and caring environment, and this presents a significant tradeoff with the traditional classroom environment. Yet, the integration of some online courses can be beneficial to both the

students and a university. For instance, online courses can be a productive strategy for driving course enrollments during the summer. The summer semester has traditionally shown lower enrollment figures, but with the integration of more online courses during the summer a University could expect to see higher enrollments. This is due to the convenience factor, because students can take courses from anywhere (including home). Obviously, there are also other benefits to the technology associated with online environment, in terms of supplementing the traditional course environment. This technology can provide a valuable information portal in a variety of traditional course settings. These results may indicate that a hybrid type of course could provide the ideal balance between interaction and convenience.

Implications for Future Research

The results of these studies have provided answers to some questions, while uncovering other issues that need additional research. For instance, it seems that a hybrid type of course that combines the benefits of an online environment with a traditional course may be very effective. Future studies may want to compare web-only, hybrid, and traditional courses to assess and directly compare the effectiveness of each. Another issue that might be important in both the web-only and hybrid learning environments is the concept of motivation. While we did not measure it in this study, it may be an important predictor variable for learning outcomes.

Finally, the technology and potential for online courses changes rapidly, therefore it is imperative to conduct ongoing research. A continuous longitudinal research approach would help to facilitate the continued development and refinement of online courses to ensure that various benchmarks are being achieved. In terms of benchmarks, it would be in the best interest of a university to establish a series of benchmarks, evaluation guidelines, online course strategy, etc., as we can expect the availability of online courses in the education community to continue to grow. This growth should be managed and coordinated centrally.

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