

A Comparison Of Internet And Classroom Students' Performance In The Course "Information Society"

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ABSTRACT

This empirical study investigated the performance of the students who took an undergraduate course "Information Society" either online, or in a traditional classroom setting in the semesters fall 2002, spring 2003, spring 2004, and summer 2003. Our study analyzed the performance of 279 students in those semesters. The students in each semester or summer session completed the same course work, including listening to the same lectures and taking the same exams. The results of our analysis indicates that that the Internet students performed at least in the same level as the on-campus students and that the online delivery method did not negatively affect success of the students. However, we also found that the non-completion rates for the course Information Society (SOC285) in fall 2002 and spring 2004 were different for students who took the course online or in a traditional classroom setting, indicating that Internet students in the course had more difficulties in finishing the course. The third major finding is that for online delivery, the students in the short summer session (in summer 2003) performed as well as students in normal semesters (fall 2002, spring 2003, and spring 2004) in terms of both completion rate and median scores.

Key Words: online instruction, Internet, distance education, significant difference, student performance

INTRODUCTION

This paper presents the findings of students' performance based on the methods in which the students took the course SOC285 - Information Society. The course SOC285 at a public, liberal arts college in a rural area in the Midwest has been offered for many years but changes have been made recently to meet the demands of the 21st century. Utilizing two different settings beginning the fall 2002 semester, the course SOC285 is offered on campus, and online. The decision was made to offer the courses in this way to provide more opportunities for students to take a required class. It also provides a sociology class about the impact of computer technology on society that is not offered at many universities. The on-campus students are required to use tablet pc's in class to do class assignments. This in-class requirement was not extend to the internet students. Except for that, all students were asked to do virtually the same things. The students in each semester or summer session completed the same course work, including listening to the same lectures and taking the same exams regardless in which way they took the course, online or in a traditional classroom setting.

Many studies have been conducted on e-learning over the past fifteen years or so. For instance, Chan and Welebir (2003) studied the strategies for e-education; Zhang and Nunamaker (2003) provided an overview of e-learning and enabling technologies. Liu (2005) investigated the effects of online instruction vs. traditional instruction on student's learning. Smart and Cappel (2006) studied the students' perception of online learning. There are numerous researches on e-learning for particular subject fields/areas as well. For example, Vinaja and Raisinghani (2001) analyzed the strategies used in teaching an online course in a predominantly Hispanic university. Smith (2001) presented a comparison and contrast of electronic and traditional MBA marketing planning courses; Stoughton *et al.* (2002), Olson (2002), Dexter and Gurwitz (2002) examined e-learning for computer and information science courses. Marold and Haga (2004) discussed how to measure online students' ability to apply

programming theory. Sarkar and Nicholson (2005) explored some of the myths about online education in information systems. Beaudry *et al.* (2005) evaluated the learning style of students and their performance in a MIS course. Kleinman and Entin (2002), Mascuilli (2004) compared an online course to its classroom counterpart for a mathematics course. There is, however, not much research on online or Internet learning in social issues of computing courses. Dennis *et al.* (2002) discussed a conceptual framework for hybrid distance delivery for information system graduate programs. Dennis *et al.* (2003) performed a case study on teaching IT in this hybrid learning environment but did not include student performance analysis this paper was proposed to do.

THE AIMS AND OBJECTIVES OF THIS WORK

The Objectives Of This Research

- To evaluate the students' performance to determine if successful outcome is dependent upon the method in which the students took the course; and
- To examine if there is any difference in term of completion when student took the course online or in a traditional classroom setting.

Research Hypothesis And Questions

This research was intended to measure the effectiveness of online (Internet) education by considering the students' performance measured by the number of students completing the course (student completion) and their overall scores earned on the materials covered and presented. In particular, we attempt to answer the following four questions in this research:

- Is there a significant difference in the students' performance (as measured by percentage of students completing the course successfully) when the students take the course online, or in the traditional classroom settings?
- Is there a significant difference in the students' performance (as measured by overall mean or median scores) when the students take the course online, or in the traditional classroom settings?
- Is there any significant difference in the students' performance (as measured by percentage of students completing the course successfully) when the students take the course online, in a regular semester, or in a much shorter summer session?
- Is there any significant difference in the students' performance (as measured by overall mean or median scores) when the students take the course online, in a regular semester, or in a much shorter summer session?

BACKGROUND

The Course "SOC - 285 Information Society"

The course selected for our study is "SOC - 285 Information Society". SOC285 is a required course for majors in Computer Science, Multimedia Web Development and Computer Graphics Development. It is also an elective for all other majors offered at the university. The total number of students in the study was 279. Of those students 169 or 59.86% were on campus students. The other 112 students took the course online using the Internet. This number represented 40.14% of the total. The purpose of this study is to assess the effectiveness of the student learning in the two learning environments. We intend to analyze the data collected and would like to determine how we can best improve learning effectiveness for this course for both online and traditional classroom settings. This class was selected because it is a course taken by students of all kinds of majors and it hopefully affords the researchers to examine a wide range of student profiles. For instance some students are not full time students and elect to take a lesser course load. Many students that are not full time tend to not follow the traditional path toward a degree. Others are the traditional student living on campus or within the campus community. It seemed appropriate to do a statistical analysis to see if the delivery of the course possibly made a difference in student performance and outcome.

The Campus Students

The campus students form a diverse student body, ranging from traditional college-aged to nontraditional-aged students. Typically, the students are predominantly four year students majoring in computer science, computer graphic arts, and web publishing.

The Online (Internet) Students

The Internet students also have diverse background. For the most part, Internet students are, however, nontraditional-aged. Most of them are working full-time in a variety of occupations or were students at other universities with sociology majors or some other related majors. Not all the students were within the same state as the university. Many of the online students have families, besides taking college classes. They are enrolled in the program because they want to improve their work status, although oftentimes school is not their priority.

METHODOLOGY

Samples

Data collected and used in this study were from students who completed SOC285 in the following semesters: fall 2002, campus and Internet; spring 2003, campus and Internet; spring 2004, campus and Internet; summer 2003, Internet only. We do not have data from fall 2003, fall 2004, and summer 2003 (on-campus) because the course was not offered in those times.

Measures

The scores for all the components of course were collected and included. The final grade for the course was calculated with the scores from class assignments that included writing, problem-solving, case study, Internet searches, (group or individual) projects, tests/examinations, and participations over the material covered for the class.

Statistical Methods: Parametric Versus Non-Parametric

The appropriateness of the normal distribution as a model for describing the distribution of the population is often examined first in statistical analyses. If this assumption about normal distribution is reasonable, or if the normal approximation is considered sufficient, the data analysis can then be conducted using the various kinds of normal theory methods. The F test for the analysis of variance could be used to see if the means of overall scores are equal for the performance of students taking the courses online, or in the classical classroom settings. On the other hand, if the normal distribution can not be assumed, it is a common practice to transform the original data so that normal-theory methods may be applied to the transformed data. If neither of these two methods deems appropriate, there can be two alternatives to proceed. If another type of distribution (say exponential, Cauchy, Laplace, or uniform, etc.) can be identified, then we can use the methods that specifically apply to that particular distribution. There are, however, some cases where no sufficient data are available to determine the form of distribution, or the data may come from a known distribution for that no methods exist. In those cases, nonparametric methods provide a useful tool and can often be used if the researchers do not want to make unsound assumptions about the distribution.

Nonparametric methods differ from the parametric counterparts in a very significant way: they require minimal assumptions about the form of the distribution of the population (see Higgins 2004). It might be assumed that the data are from a population that possesses a continuous distribution. Other than that, no additional assumptions need to be made. Alternatively, it might be assumed that the population distribution depends on location and scale parameters, but the function form of the distribution (normal or otherwise) is not known. Even though it is widely known that F test for the analysis of variance is robust against departures from normality (Kunter et al. 2004), we choose nonparametric tests over the parametric one in our study. We believe that nonparametric

tests are more appropriate because some of the samples are not very big and we can not ascertain the form of distribution.

Non-Parametric Tests Of Hypotheses

The Kruskal-Wallis Test of the equality of medians for three or more populations is one of the most widely used nonparametric tests for k-sample (three or more treatments). The Kruskal-Wallis Test is based on the ranks of the observations. In a Kruskal-Wallis Test, the original observation is replaced with ranks and then a permutation F-test is performed on these ranks. The Kruskal-Wallis hypotheses (for four different treatments) are:

H₀: the medians of the overall scores for those four groups of students are equal (i.e.,

$$\mu_1 = \mu_2 = \mu_3 = \mu_4)$$

H_a: the medians are not all equal

The statistic (H) has a p-value of 0.05 or smaller suggests that the null hypothesis can be rejected at a significance level $\alpha = 0.05$ in favor of the alternative hypothesis of at least one difference among the four groups. If not, we fail to reject H_0 at alpha level of $\alpha = 0.05$. Failing to reject H_0 indicates that there is no statistical difference in the medians of the overall scores for those four groups of students. In this study, we wish to test whether or not the performance (as measured by the overall scores) of students taking the course online, in a regular semester, or in a shorter summer session are the same.

When there are only two samples, the Kruskal-Wallis becomes Mann-Whitney test (or the two-sample Wilcoxon rank sum test). The Mann-Whitney hypotheses are:

H₀: the medians of the overall scores for those two groups of students are equal (i.e.,

$$\mu_1 = \mu_2)$$

H_a: the medians are not equal

Similarly, the statistic (H) has a p-value of 0.05 or smaller indicates that the null hypothesis can be rejected at a significance level $\alpha = 0.05$ in favor of the alternative hypothesis that there is difference between the two groups. Otherwise, we fail to reject H_0 at alpha level of $\alpha = 0.05$. Failing to reject H_0 means that there is no statistical difference in the medians of the overall scores for those two groups of students. We will conduct a Mann-Whitney test for each of these three semesters when the course was offered in fall 2002, spring 2003, spring 2004 and summer using two kinds of delivering methods: online, and on-campus.

RESULTS, ANALYSIS AND DISCUSSION

Student Groups

There were 279 students in the study. Please refer to Table 1 for details.

Based on our aims and objectives, we will conduct analysis in the following ways:

- fall 2002 - campus vs. Internet
- spring 2003 - campus vs. Internet
- spring 2004 - campus vs. Internet
- Internet - regular semester (fall 2002, spring 2003, spring 2004) vs. summer (summer 2003)

Table 1: Summary of students enrolled in SOC285

	fall 2002	spring 2003	spring 2004	summer 2003
Internet	34	24	29	25
campus	50	46	71	
total	84	70	100	25

Student Completion

Tables 2, 3, 4 and 5 provide information about the number of students who either withdraw or did not pass the class. We wanted to point out an interesting fact that the student rate of withdrawal from SOC285 was less than the university average. The students might enroll in the class with great expectations but later found out that the time commitment and level of work were greater than they originally expected. It seemed that students withdraw or failed to pass the class for many different kinds of reasons. The following are some of the common reasons that students have given when withdrawing:

- They, or a family member, become ill
- Enrolled in too many courses
- It is more work than they anticipated
- Failing the class
- Other family reasons
- Change of jobs
- Moved
- Change major
- Out of school

We believe that this is a trend we will continue to see in the future, and that the students will have a higher withdrawal rate in internet classes than that in a traditional classroom setting.

Table 2: Summary of student completion for SOC285 in fall 2002

	N	Completion	Completion %	Non-Completion	Non-Completion %
Internet	34	22	64.71	12	35.29
Campus	50	46	92.00	4	8.00
Overall	84	68	80.95	16	19.05

Table 3: Summary of student completion for SOC285 in spring 2003

	N	Completion	Completion %	Non-Completion	Non-Completion %
Internet	24	20	83.33	4	16.67
campus	46	36	78.26	10	21.74
Overall	70	56	80.00	14	20.00

Table 4: Summary of student completion for SOC285 in spring 2004

	N	Completion	Completion %	Non-Completion	Non-Completion %
Internet	29	17	58.62	12	41.38
campus	71	66	92.96	5	7.04
Overall	100	83	83.00	17	17.00

Table 5: Summary of student completion for SOC285 for Internet delivery

	N	Completion	Completion %	Non-Completion	Non-Completion %
Fall 2002	34	22	64.71	12	35.29
Spring 2003	24	20	83.33	4	16.67
Spring 2004	29	17	58.62	12	41.38
Summer 2003	25	17	68.00	8	32.00
Overall	112	76	67.86	36	32.14

Student Success

In order to answer the second and the fourth research questions: 2. *Is there a significant difference in the students' performance (as measured by overall mean or median scores) when the students take the course online, in the DDN studios, or in the traditional classroom settings?* and 4. *Is there any significant difference in the students' performance (as measured by overall mean or median scores) when the students take the course online, in a regular semester, or in a much shorter summer session?* We first conducted a Mann-Whitney test for SOC285 in fall 2002. The results are summarized in Table 6. The 95.0 Percent CI for ETA1-ETA2 is (-22.59, 2.90) for SOC285 in fall 2002. We failed to reject the H_0 , which indicated that there was no statistical difference in the medians of the overall scores for those two groups of students in this course.

Table 6: Mann -Whitney Test for SOC285 in fall 2002

	N	Median
Internet	34	78.05
Campus	50	84.75

Point estimate for ETA1-ETA2 is -3.55
 95.0 Percent CI for ETA1-ETA2 is (-22.59,2.90)
 W = 1338.5
 Test of ETA1 = ETA2 vs. ETA1 not = ETA2 is significant at 0.3341
 The test is significant at 0.3340 (adjusted for ties)

Table 7: Mann -Whitney Test for SOC285 in spring 2003

	N	Median
Internet	24	88.80
Campus	46	79.35

Point estimate for ETA1-ETA2 is 7.50
 95.0 Percent CI for ETA1-ETA2 is (1.21,14.40)
 W = 1035.0
 Test of ETA1 = ETA2 vs. ETA1 not = ETA2 is significant at 0.0239
 The test is significant at 0.0239 (adjusted for ties)

Similarly, we performed Mann -Whitney tests for SOC285 in spring 2003, and spring 2004. The results are summarized in Tables 7 and 8, respectively. From Table 7, we found that 95.0 Percent CI for ETA1-ETA2 is (1.21, 14.40), and the Median were 88.80 and 79.35, respectively for Internet students and on-campus students for SOC285 in spring 2003. We can reject the H_0 , which indicated that there was a statistical difference in the medians of the overall scores for those two groups of students in this course. Please note that Internet students fared better than on-campus students. From Table 8, we noticed that 95.1 Percent CI for ETA1-ETA2 is (-30.70, 2.81). In this case, we failed to reject the H_0 , which indicated that there was no statistical difference in the medians of the overall scores for those two groups of students in the course SOC285.

Table 8: Mann -Whitney Test for SOC285 in spring 2004

	N	Median
Internet	29	64.10
Campus	71	74.80
Point estimate for ETA1-ETA2 is -7.70 95.1 Percent CI for ETA1-ETA2 is (-30.70,2.81) W = 1281.0 Test of ETA1 = ETA2 vs. ETA1 not = ETA2 is significant at 0.1645 The test is significant at 0.1645 (adjusted for ties)		

Finally, we performed a Kruskal-Wallis test for Internet students enrolled in SOC285 in fall 2002, spring 2003, spring 2004, and summer 2003. The results are put in Table 9. Since the P-values = 0.053 (after adjusted for ties), we failed to reject H_0 , which meant that there was no statistical difference in the medians of the overall scores for those four groups of students. In other words, the Internet students in the shorter summer session fared as well as the internet students in the regular semesters (fall 2002, spring 2003, and spring 2004).

Table 9: Kruskal-Wallis Test for SOC285 for Internet delivery

	N	Median	Ave Rank	Z
Fall 2002	34	78.05	58.2	0.37
Spring 2003	24	88.80	69.5	2.22
Spring 2004	29	64.10	44.9	-2.23
Summer 2004	25	81.80	55.0	-0.26
Overall	112		56.5	
H = 7.69	DF = 3	P = 0.053		
H = 7.69	DF = 3	P = 0.053 (adjusted for ties)		

CONCLUSION

The results of our analysis indicates that that the Internet students performed at least in the same level as the on-campus students and that the online delivery method did not negatively affect success of the students. However, we also found that the non-completion rates for the course Information Society (SOC285) in fall 2002 and spring 2004 were different for students who took the course online or in a traditional classroom setting, indicating that Internet students in the course had more difficulties in finishing the course. The third major finding is that for online delivery, the students in the short summer session (in summer 2003) performed as well as students in normal semesters (fall 2002, spring 2003, and spring 2004) in terms of both completion rate and median scores.

Based on the evidence presented in the study, the decision to offer the course utilizing the Internet was successful in that student education was not sacrificed due to the delivery method of the material. It was found that students in internet courses for many reasons will have higher non-completion rates than those taking on campus course. Those students that do complete the course show no difference in grades achieved in the class.

LIMITATIONS AND FUTURE DIRECTIONS

We believe that this research provided some insight on and resulted in better understanding of student performance associated with different course delivery methods and instructional methodologies. It is, however, preliminary and future work is needed. For instance, in this study we did not collect information about student age or type (traditional vs. non-traditional) which may also be factors affecting student performance. In addition, we did not record student gender which may or may not make some difference in student performance. Also, major students may or may not take the course more seriously than non-major students. Students' computing background in general, and past experience with the Web/Internet and the course management software in particular, may have an effect on their performance. Students' social-economic status, employment status and other factors may also affect

their performance. In the future, we may wish to extend the study to include student age and gender, as well as marital status, family obligations, and other information that help determine a student's motivation and desire to succeed.

It is important to make educational opportunities available to people in places that otherwise would not have access. The future looks promising for the hybrid or online course offerings in college curricula. Our preliminary study showed that online (Internet) course delivery could be a viable way for people to get educated. We need to continue to strive for better understanding of the issues related to online education and making e-learning even more effective.

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