An Online Course Of Business Statistics: The Proportion Of Successful Students

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ABSTRACT

This article describes the students' academic progress in an online course of business statistics through interactive software assignments and diverse educational homework, which helps these students to build their own e-learning through basic competences; i.e. interpreting results and solving problems. Cross-tables were built for the categorical variables: course-type (at 2 levels of classification: "online" and "classroom") and the 2 levels of gender, where the dependent variable was the proportion of successful and unsuccessful students. The statistical analysis was performed via the Chi-square test for which we found that the variable "course-type" was not significant (p-value=0.512). Similarly, the variable "gender" was not significant (p-value=0.652). Both conclusions were also confirmed via the Normal distribution z-test with similar p-values: 0.516 for course-type and 0.556 for gender. Thus, our research indicates that the population proportion of successful students in a course of Business Statistics does not depend on their gender; likewise, the proportion of success is not affected nor depends on the manner on how these students decided to take their course instruction, whether online or in a classroom.

Keywords: Online Course, Business Statistics, e-Learning, Educational Assignments, Chi-square test

INTRODUCTION

Online courses provide the opportunity to obtain an education when geographical, physical and/or schedule limitations exist, but some students without these types of limitations are using this resource expecting easy classes, less assignments, or the need to exert less effort to obtain a higher grade. Thus, the online courses are real academic challenges for all professors whose priority it is to provide high-quality teaching and maintaining a professional ethics environment.

Teaching involves the transfer of knowledge and feedback at two levels: group communication and personal communication. This paper describes the students' academic progress in an online course of business statistics through interactive software assignments and diverse educational homework, helping each person to build their e-learning in a course of business statistics online at a small state university.

Before communications via Internet, the "distance learning" courses were provided by correspondence (mail). Technology is periodically and progressively [Jones 2002] changing our lives. Now technology, combined with the Internet, enables any person to have access to a never-ending process of information [Steinfield 1987]. Technology and the Internet empower individuals and facilitate a more active position in the e-learning process.

Some of the advantages of taking online courses are the convenience and flexibility for studying from any computer at any time and anywhere, which permits one to comply with working, personal and family responsibilities; but the most notorious disadvantages are the lack of interaction with professors and classmates, the lack of updated computing equipment (hardware & software), and the lack of systematic (discipline) reading from students. The instructors/professors provide Powerpoint and audio presentations for the lessons in the chapters, but it does not make up for the lack of a lecture because most of the Powerpoint presentations are taken directly from the book. Therefore, reading is an essential part of being successful in online courses. Non-frequent disadvantages are the lack of computer knowledge from students, the slow e-response time from professors, and the lack of reading skills [Steen 2006]. In addition, the final exams will be held under controlled conditions of place, date and time.

INTERCTIVE SOFTWARE ASSIGNMENTS

The major objective of an interactive software of Business Statistics is to provide students with an understanding of how to interpret results, and how to solve problems (*basic competences*) as applied to business scenarios. Topical coverage includes descriptive statistics, probability theory, random variables, probability distributions, the normal distribution, sampling methods, sampling distributions, hypothesis testing, simple linear regression and correlation analysis.

In general, the selected software runs in three modes**:** 1) Using the instruct mode, the users gain an understanding of the statistical technique or methodology. 2) Using the practice mode, the participants gain the mastery of the technique with hints and help available to assist his/her learning. 3) Using the certify mode, the users are required to obtain their certificates, indicating mastery of the topic without help or hints. At the end of a time-period of training, the users will be credited for each certificate earned. The total credit is equal to a specific percentage with each certificate carrying equal weight.

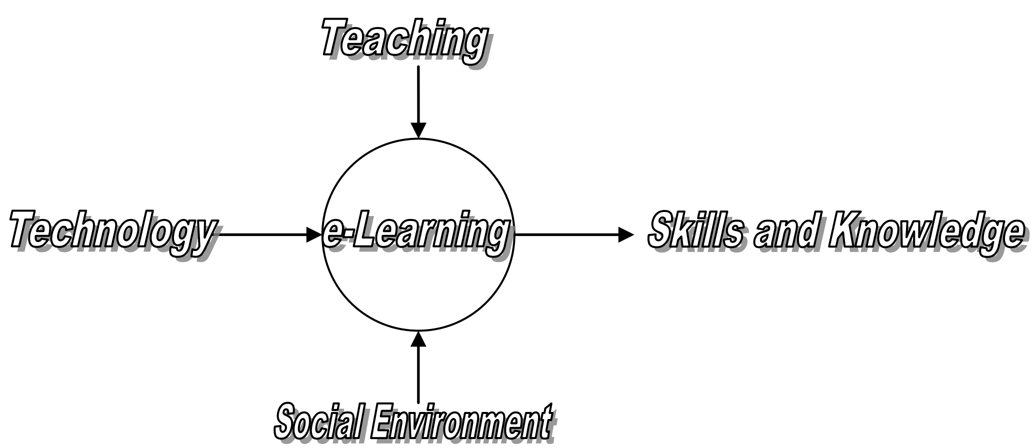
e-LEARNING AND TECHNOLOGY

Technology has always been the changing force for mankind [Close 2000]. e-Learning looks like every other “e” construct or concept (i.e. e-Commerce, e-Buy). The term "e" of e-Leaning means “electronic” and the span of electronics in the term e-Learning can include Internet and several other electronic media technologies. Of course, in this world of global communications, other factors affecting the e-Learning activity are the teaching styles/techniques, as well as the social environment (see Figure 1).

Cisco Systems is one of the largest corporations of e-Learning users (technical participants) that explains its compromise with e-Learning components as "Components can include content delivery in multiple formats, management of the learning experience, and a networked community of learners, content developers and experts. e-Learning provides faster learning at reduced costs, increased access to learning, and clear accountability for all participants in the learning process. In today's fast-paced culture, organizations that implement e-Learning provide their work force with the ability to turn into an advantage" [Kirschner, 2001].

In this context, the differences between e-Learning and online-learning should be noted; i.e. e-Learning represents the whole category of technology-based learning, while online-learning is synonymous with web-based learning. In order to be more precise, online-learning is in fact a component of e-Learning. Thus, we can sketch a definition of e-Learning as a delivery process of knowledge through different electronic media technologies, including internet [Pena-Sanchez, 2005], intranet, extranet, satellite broadcast, audio/video tape, interactive TV, CD ROM, etc.

Figure 1: The e-Learning Process and its Related Factors



e-Learning helps us increase access to training and ensure that it is immediately relevant and cost-effective. Some advantages of online-learning include: Anywhere, Anytime, Anyone, e-Learning is available 24 hours a day, around the world. Organizations can distribute training and relevant information [Glauser 1984] to multiple locations easily and conveniently, allowing employees to access training at their convenience [Pena-Sanchez, 2007].

Since geographical and time barriers are virtually removed, e-Learning is no longer limited to a few people who can travel to a seminar or conference. e-Learning can occur throughout organizations and e-collaborative [Kock 2005] individuals, accelerating the transfer of knowledge and transforming learning from an isolated example of qualified development into a powerful tool for managerial decisions.

RESEARCH HYPOTHESES

The following hypothesis uses the proportion of students getting or exceeding passing final grades as the dependent variable.

First, we determine if any difference exists between the proportion of successful students taking online courses with respect to the proportion of successful students registered in a classic (classroom) courses. As the students receiving instruction in a classroom are more comfortable with the academic feedback and have more complex problems discussions, we would expect these student groups would have a higher proportion of success than for the groups of students without this practice in the classroom.

Dependent Variable: Proportion of students that got passing (D) or better (C, B or A) final grade.

Independent Variable: Course-type of Business Statistics (type 1: Online, type 2: Classic or Classroom)

Research Hypothesis H_{A1}**:** The population's proportion of students receiving classroom instruction that got passing or better final grades exceeds the proportion of students receiving online instruction.

H_{A1}: $p_{\text{classroom}} > p_{\text{online}}$

The corresponding null hypothesis is

H_{01}: $p_{\text{classroom}} \leq p_{\text{online}}$

Next, we consider the impact of gender on business statistics' learning. As men tend to feel more comfortable with computers [Frankel 1990], we expect the online software usage for the proportion of males to be associated with passing, or better, final grades than females who are also in the same online-type courses.

Independent Variable: Student gender (male and female).

Research Hypothesis H_{A2}**:** The population's proportion of male students (with passing or better final grades) receiving instruction in an online courses exceeds the proportion of female students (with passing or better final grades) who were also registered in online courses:

H_{A2}: $p_{\text{males}} > p_{\text{females}}$

In this case, the corresponding null hypothesis is:

H_{02}: $p_{\text{males}} \leq p_{\text{females}}$

DATA AND METHODOLOGY

Sampling

A random sample of size n = 278 students was used to test the previous hypotheses. The sample data corresponds to the students' final grades reported during the academic period from Spring-2004 to Spring-2008 at an American state university where we work. In order to eliminate a source of variation due to the factor instructors (professors); the total sample of students was under the same instructor supervision.

Statistical Technique

Given that the two independent variables are in categorical (nominal) scale, the appropriated statistical technique is a nonparametric method used in case of contingency (cross) tables. The analysis is performed via the Chi-square test.

The Chi-square Test

The observations of a random sample of size n are classified according to two criteria in an r×c contingency table [Conover 1999].

H_o: The event "an observation is in row i" is independent of the event "that same observation is in column j" for all i and j; or P(row i ∩ column j) = P(row i)·P(column j)
H_A: P(row i ∩ column j) ≠ P(row i)·P(column j)

The test statistic χ^2 (chi-square) is defined as

$$\chi^2 = \sum \sum (O_{ij} - E_{ij})^2/E_{ij} \ , \ i=1,\dots, r \ ; \ j=1,\dots, c \qquad (1)$$

Where, O_{ij} represents the observed frequency in cell (i,j); while the term E_{ij} represents the expected frequency in cell (i,j), if H_o is really true.

$$E_{ij} = R_i C_j/n \qquad (2)$$

R_i and C_j are the sum of observed frequencies in row i and column j respectively.

The statistic χ^2 is compared with quantiles from the Chi-square distribution with $(r-1)\cdot(c-1)$ degrees of freedom.

In terms of goodness-of-fit, the chi-square test [Conover 1999] compares the observed and expected frequencies in each category to test whether all categories contain the same proportion of values or if each category contains a researcher-specified proportion of values.

STATISTICAL ANALYSIS

Table 1 contains a cross-tabulation for the variables Grade status (at 2 levels: passing and not passing) and course type (also at 2 levels; i.e. level 1 – Online and level 2 - Classroom). The corresponding χ^2 test shows up in Table 2.

Similarly, Table 3 is a contingency table for the variable Grade status (at 2 levels**:** passing and not passing grade) combined with gender in the presence of just one level of the factor course type and only students who have been taking the online course. Its corresponding χ^2 test is given in Table 4.

Table 1: Cross-Tabulation for the Variables Grade Status and Course Type

Course type (n=278)	Count / %	Grade status: Not passing	Grade status: Passing (successful students)	Total
Online	Count	17	62	79
	%	21.5%	78.5%	100.0%
Classroom	Count	36	163	199
	%	18.1%	81.9%	100. 0%
Total	Count	53	225	278
	%	19.1%	80.9%	100.0%

Table 2: Chi-Square to test H_{01}: $p_{Classroom} \leq p_{Online}$

Null Hypothesis: H_{02}	Value	degrees of freedom	p-value
Chi-Square statistic	0.431(b)	1	0.512
Continuity Correction(a)	0.237	1	0.626
n of Valid Cases	278		

a Computed only for a 2x2 table
b 0 cells have expected count less than 5

Table 3: Cross-Tabulation for the Variables Grade Status and Gender

Only students receiving online instruction (n=79)		Count / %	Grade status: Not passing	Grade status: Passing (successful students)	Total
Student gender	Male	Count	9	29	38
		%	23.7%	76.3%	100.0%
	Female	Count	8	33	41
		%	19.5%	80.5%	100.0%
Total		Count	17	62	79
		%	21.5%	78.5%	100.0%

Table 4: Chi-Square to test H_{02}: $p_{male} \leq p_{female}$

Null Hypothesis: H_{02}	Value	degrees of freedom	p-value
Chi-Square statistic	0.203(b)	1	0.652
Continuity Correction(a)	0.031	1	0.860
n of Valid Cases	79		

a Computed only for a 2x2 table
b 0 cells have expected count less than

CONCLUSIONS

Our conclusion, supported by a nonparametric statistical analysis through the Chi-square test, is that the population proportion of successful students (who received passing or better final grades) in a course of Business Statistics does not depend on how these students decided to take their course instruction; i.e. *online* or in a *classroom* (p-value=0.512 in Table 2). In other words, for the students who received passing or better grades, the proportion (78.5%) of students registered online does not differ significantly from the proportion (81.9%) of students who received their instruction through a classic manner in a classroom. A confirmation of this conclusion was obtained via the z-test [Cooper 2008] for two proportions (z-test p-value=0.516), where p_1=62/79 and p_2=163/199; thus, the data does supports the research hypothesis H_{A1}. The majority of successful students have been reading and completing their business statistics assignments. A student's discipline, in combination with his/her basic foundation in mathematics, is the key to success in a course of business statistics, independently from the manner of how the student decided to take his course instruction; i.e. whether online or in a classroom.

From the information in Table 4, our conclusion is that we do not have sufficient evidence (p-value=0.652) to support the second research hypothesis (the data does not support H_{A2}) of the gender effect on the students' academic performance, measured through their final grades, if they have been taking an online course, which means: the proportion of male and female students does not show a significant difference. That is, the proportion of students registered in an online course who received passing or better final grades does not depend on how these students were classified according to their gender. This conclusion was verified via the z-test [Cooper 2008] for two proportions (z-test p-value=0.556).

RECOMMENDATIONS

Given that "e-learning" can be viewed as a process in which the learners increase their skills and knowledge (see Figure 1), by experience, we can say that the lack of skills as a self-didactic is a critical factor for being a successful online student. Therefore, before initiating an online course, we recommend reinforcing such abilities as reading, reduction and/or elimination of distractions, optimal time-planning to meet the academic prerequisite, etc.

Statistics courses are difficult because they contain formulas that are difficult to understand and require the instructor to explain their interpretations and applications during the lectures versus reading from the textbook. If a statistics course must be taken online due to geographical limitations, work restrictions and/or scheduling conflicts, we recommend that the student be prepared to do a systematical activity of reading and studying several hours per week for such online course.

DIRECTIONS FOR FURTHER RESEARCH

These findings should influence both administrators and educators about their choice of software and/or technology to support academic learning [Hilton 1999]. As educators, we all should seek the most effective and efficient tool for basic academic competences, as well as for e-collaborative tasks [McEntee 1997].

It is hoped that this paper will foster more research into the relationships between software diversity, e-communication [Clyde 1999], and academic tasks for e-Learning purposes so that more effective and efficient decisions will occur, both in universities and organizations [Sitkin 1992].

As a reference to the importance of e-communication, second-by-second, the number of organizations making use of e-mail is shown as expanding in a geometrical form. According to a study, the following results were evaluated**:**

Year	Number of e-mails being sent
1995	101 billion e-mails were sent
2000	2.6 trillion e-mails were sent

(Source: http://www.mybestdocs.com/mitchell-l-email-v5.htm) [Mitchell 2002])

This is an increase of almost 26 fold over a five year period.

AUTHOR INFORMATION

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NOTES