Learning of Business Statistics: Online versus Classroom Courses

Rolando Pena-Sanchez
Division of International Business and Technology Studies
Texas A & M International University
United States

Abstract

This article describes the undergraduate students' academic progress through online and classic classroom (face to face) business statistics courses during the period 2012-2016; where, each student must maintain updated his/her GPA as a preliminary requirement specified by the Office of Financial Aid in order to get a scholarship. A nonparametric statistical technique named "the Friedman's test" was selected (whose justification is explained via the Levene's statistic) to perform the data analysis. Given that, the dropout of a course is an event that is associated to the learning-teaching process; this report focuses on the statistical summary of the students' tendency about the dropouts (withdrawals) of their courses during the regular academic periods of fall, spring, and summer

Keywords: Online courses, e-Learning, Levene's statistic, Friedman's test, course dropouts**.**

1. Introduction

The purpose of this article is to compare the proportions of undergraduate students who drop out of online and classroom courses, and to get the right conclusions from an appropriated statistical analysis about the data generated from a sample of students that had been participating at online and at classic (face to face) courses during a period of the last 5 years (2012-2016). The term "e" of e-Learning meant to be electronic, just likes every other e (i.e. e-Commerce, e-Business, etc.); and the span of electronic in the term e-Learning can include: Internet, intranet, extranet, satellite broadcast, audio/video tape, interactive TV and CD ROM.

Teaching involves the transfer of knowledge and feedback at two levels: group communication and individual communication. The virtual courses provide the opportunity to obtain a professional training when face-to-face training and geographical, physical and schedule limitations exist; but some students without this kind of limitations are using this resource expecting easy courses, less assignments, or less effort; and in this way to obtain a higher examination grade. Thus, the virtual courses are real academic challenges for all trainers whose priority is to offer high-quality training maintaining an ethical and professional environment. First was the arrival of the computer and later on the appearance of Internet; but, before the communication via Internet, the "distance learning" courses were provided by correspondence (mail); the technology is periodically and progressively changing our knowledge; the technology has always been the changing force for mankind (Close et al., 2000). Now the Internet combined with other technologies enables any person to have access to a never-ending process of information and knowledge.

Some of the advantages of taking virtual courses are the convenience and the flexibility for studying from any computer at anytime and anywhere, which permits to comply with working, personal and family responsibilities; but the most notorious disadvantages are the lack of interaction with trainers, advisors and job-mates, the lack of updated computing equipment (hardware & software) and the lack of self-didactic skills (the discipline of reading). The trainers/advisors provide power-point and audio presentations for the lessons, but it do not make up for the lack of a lecture; because most of the power point presentations are taken directly from the manuals. Therefore, reading is an essential part in being successful in virtual courses. About not-frequent disadvantages, we can mention the lack of computer knowledge from students, the slow e-response time from advisors and the lack of reading's skills (Steen et al., 2006). In addition, the exams will be held under controlled conditions of place, date and time.

2. Interactive Software

The major objective of interactive software is to provide to the learners with an understanding of how to interpret results, and how to solve problems (*basic competences*) as applied to job scenarios. In general, the selected software should run in different modes**:** First, using the instruct mode, the user gain an understanding of the technique and/or methodology. Second, using the practice mode, the participant gains the mastery of the technique with hints and help available to assist his/her training. Third, using the certify mode, the user are required to obtain his/her certificate indicating mastery of the topic without help or hints. At the end of a time-period of training, the student will be credited for each certificate earned. The total credit will be equal to a specific percentage with each certificate carrying a specific weight.

3. e-Learning and Technology

The term e-Learning can include Internet and several more electronic media technologies; of course, in this world of global communications, other factors affecting the e-Learning activity are the virtual teaching styles/techniques as well as the social environment. Cisco Systems is one of the largest corporations of e-Training users (technical participants) that explains its compromise with the e-Learning's components, where "components" can include content delivery in multiple formats, management of the training experience, and a networked community of learners (Crews et al., 2012), 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-Training supply their work force with the ability to turn change into an advantage (Kirschner et al., 2001).

In this context the differences between e-Learning, and online-learning should be noted**:** e-Learning represents the whole category of technology-based learning, while online-learning is synonymous of a web-based learning; in order to be more precisely, an online-learning is in fact a component of e-Learning. Thus, we can sketch a definition of e-Learning as any combination of virtual learning/teaching methods and styles supported by different electronic media technologies including Internet (Pena-Sanchez, 2012), Intranet, Extranet, Satellite Broadcast, Audio/Video Tape, Interactive TV, CD ROM, etc.

E-Learning helps us increase access to teaching/training and ensure that it is immediately relevant and cost-effective. Some advantages of an online-teaching include: Anywhere, Anytime, Anyone: e-Learning is available 24 hours a day, around the world. Organizations can distribute training and relevant information to multiple locations easily and conveniently, allowing students to access learning/training at their convenience. 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 individuals, accelerating the transfer of knowledge, and transforming training from an isolated example of qualified development into a powerful tool (Jones et al., 2002) for managerial decisions (Borchard, 2012).

4. Research Hypothesis

The following hypothesis explores the student academic interest through the number of droppings (withdrawals) on both type of courses: virtual (online) and face to face (classroom), where the academic period (fall, spring and summer) had been used as blocking factor; and the dependent variable is the proportion of withdrawals per course or section; thus, the null hypothesis about course type is

$$H_{01}: \square_{online} = \square\square_{classroom} \square\square\square\square\square\square\square\square\square\square\square\square\square\square\square\square\square\square\square$$

Where $\square$ represents the proportion of withdrawals per course, which can be associated to the students' academic progress. Meanwhile, the corresponding null hypothesis about the academic period is

$$H_{02}: \square_{fall} = \square\square_{spring} = \square\square_{summer} \square\square\square\square\square\square\square\square\square\square\square\square\square\square\square$$

Taking in account that each student must maintain updated his/her GPA as a preliminary requirement specified by the Office of Financial Aid in order to get a scholarship, at the beginning or before of any academic period the undergraduate advisors provide relevant information to the undergraduate students to facilitate his/her decision on course scheduling; but sometimes some students are looking for how to get the maximum grade at the minimum effort, and under this idea of the maximum benefit at the minimum work: had been selecting an online course assuming that such virtual course is much more easy because the attendance will not be necessary in comparison with a normal or classic classroom course where student's attendance affects his/her final grade.

Student's discipline as autodidact will be affecting his/her academic progress; thus, an online student without the sufficient autodidact discipline will be in a risky situation from an academic point of view.

5. Data and Technology

A sample of 22 sections (courses) involving 764 undergraduate students from year 2012 till 2016 was analyzed; the sections correspond to the three academic periods: fall, spring and summer; and in order to minimize some externals sources of variation the data was taken under controlled conditions of teaching, academic subject, and academic content; in other words: all sections correspond to the same instructor, the same course and the same syllabus.To avoid any conflict related to the lack of fulfillment at parametric assumptions: Normal distribution of the dependent variable, homogeneity of variances (homoscedasticity), etc.; we had been decided to test the previous null hypotheses through a nonparametric technique (Conover, 1999) named *the Friedman test*.

Homoscedasticity is a required assumption for the parametric method Analysis of Variance (ANOVA); and one form to verify such supposition is through the Levene's test. The Levene's statistic tests the null hypothesis that the error variance of the dependent variable (proportion of withdrawals) is *equa*l across groups (course types and academic periods). If the p-value is less than alpha (□), then the equal variances assumption is not acceptable. At a significance level of □=0.05, Table 1 shows the lack of homoscedasticity (**p-value=0.005**), which justifies the use of the mentioned nonparametric Friedman test.

Table 1: Levene's Test of Equality of Error Variances

F	df1	df2	**p-value**
6.162	3	18	**0.005**

6. Statistical Analysis

Table 2 contains the descriptive statistics for the sample of 22 sections classified by two course types (online and classroom) and three academic periods (fall, spring and summer). Meanwhile, Table 3 represents a summary of the Friedman test, which is used to test the difference in the ranks of scores representing the proportion of withdrawals or dropouts per course type.

Table 2: Descriptive Statistics for the dependent variable

Proportion of withdrawals per course

Course type	Academic Period	Mean	Standard deviation	Number of Courses
Online	Fall	.415709	.1977732	2
	Spring	.253576	.0809061	5
	Summer	.299900	.1309263	7
Classroom	Fall	.088375	.0461014	6
	Spring	.127592	.0578892	9
	Summer	.111905	.0554028	15
Total	Fall	.170209	.1733955	8
	Spring	.127592	.0578892	9
	Summer	.253576	.0809061	5
	Total	**.171722**	**.1223774**	**22**

Table 3 indicates that the null hypothesis H_{01} will be rejected at significance level of □=0.01

Table 3: The Friedman test for the proportion of dropouts per course (online and classroom) across the three academic periods (fall, spring and summer)

Number of courses	Chi-Square	degrees of freedom	**Asymptotic significance(p-value)**
22	37.740	2	**0.0001**

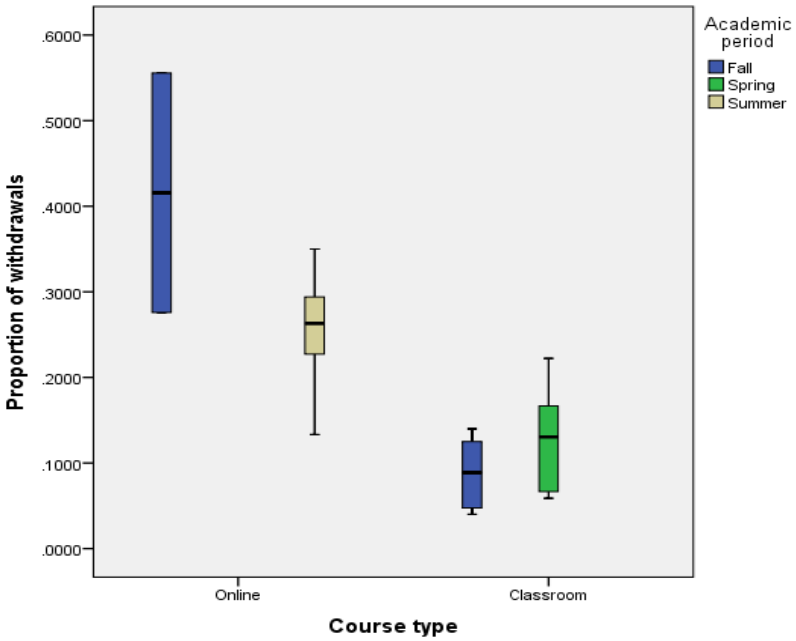
The nonparametric testing results for the 2nd null hypothesis H_{02} about the blocking factor (academic period) are shown on Table 4, whose p-value (0.068) is greater than alpha=0.05; thus, we cannot reject H_{02}.

Table 4: Nonparametric test for the proportion of dropouts during the three academic periods fall, spring and summer

Number of courses	Chi-Square	degrees of freedom	Asymptotic significance(p-value)
22	5.370	2	0.068

Figure 1 indicates that the medians (represented by the horizontal segment located at the center of each vertical rectangle) of the withdrawals' proportions tend to be greater for online courses than for the classic classroom sections.

Figure 1: Box Plot for the proportion of dropouts per course across the three academic periods



7. Conclusions

The null hypothesis about no difference on the proportion of withdrawals or dropouts per course type can be rejected at □=0.01; thus, our conclusion supported by a nonparametric statistical method through the Friedman test (Table 3) is that the proportion of dropouts for an online course tend to be greater than the proportion of dropouts for a classic classroom or face to face course. The Figure 1 is an indirect graphical representation of this conclusion; moreover, about the blocking factor (academic period), its null hypothesis (H_{02}) cannot be rejected (p-value=0.068 in Table 4) at a significance level of □=0.05; therefore, the data suggests that the proportion of dropouts tend to be similar during the three academic periods. Effectiveness of a teaching method measured as the student performance depends on several factors, whose optimal combination in general produce tangible benefits. The technology (Clark, 1989) and the Internet empower individuals and facilitate a more active position in the e-learning and e-teaching process.

8. Recommendations

Given that "e-Learning" can be viewed as a process in which the learners increase their skills and knowledge; by experience, we can say that the lack of skills as a self-didactic is a critical factor for to be a successful online learner. Therefore, before initiating a virtual course (USPAP, 2008), we recommend reinforcing such abilities**:** habit for reading, reduction and/or elimination of distractions, optimal time-planning to meet the technical prerequisites (USPAP, 2016), to attend the induction provided by the e-Teaching supervisor, etc.

Some other quantitative oriented courses (cost estimation, income evaluation, etc.) are also difficult because they likewise contain formulas and it would be better to see an instructor explaining his/her interpretations and applications during a classic (face to face) lecture, than to read about the subject matter in an e-manual or e-handbook.

9. Directions for Further Research

These findings should influence both administrators and instructors about their choice for some software and/or technology to support technical learning (Hilton, 1999). As instructors we all should seek the most effective and efficient tool for basic competences, as well as for e-collaborative tasks. 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). Related future articles should answer questions like: How to prevent course dropouts? How to prevent college dropouts? What are the dropout rates of college students? What happens to gifted students who drop out of college? Etc.

References

Borchard, Michael S. (2012). Annual Real Estate Mass Appraisal Report; Office of the County Appraiser. *http://www.sedgwickcounty.org/appraiser/home_values2012.pdf*

Clark, Kim B. (1989). What Strategy can do for Technology, *Harvard Business Review*, November-December 1989, pp.94-98.

Close, R. C., Humphrys, R. and Ruttenbur, B. W. (2000), *e-Learning and Knowledge Technology*. *SunTrust Equitable Securities report.*

Clyde, Anne. (1999). *The Traveler's Guide to E-Mail Access*, Teacher Librarian. Oct 1999. 27(1), 64-66.

Conover, W. J. (1999) *Practical Nonparametric Statistics*, 3 Ed. John Wiley & Sons.

Crews T. B, and Stitt-Gohdes, W. L. (2012). Incorporating Facebook and Twitter in a Service Learning Project in a Business Communication Course. *Business Communication Quarterly*. Vol. 75, No. 1; pp 76-79.

Hilton, Thomas S.E. (1999). A model for internet-enhanced education systems derived from history and experiment". Journal of Computer information systems. 39(3). Spring 1999.

Jones, S. and Madden M. (2002). The Internet Goes to College: How Students are living in the Future with Today's Technology. *Pew Internet & American Life Project*. http://www.pewinternet.org/pdfs/PIP_ College_ Report.pdf

Kirschner, Paul A., and Paasa, Fred. (2001). Web-enhanced higher education: a tower of Babel; *Journal of Computers in Human Behavior*. (17), 347-353. Issue 4, July 2001.

Pena-Sanchez, R. (2012). *Efficiency of Training Courses*. Competition Forum, American Society for Competitiveness. Vol. 10, Num. 2, pp 66-73.

Sitkin, S. B., Sutcliffe, K. M. & Barsios-Choplin, J. R. (1992). A dual-capacity Model of communications media choice in organizations, *Human Communication Research*. 18(1), 563-598.

Steen, G. and Seevers R. L. (2006). Does Reading a Book About Culture Increase Reading Frequency and Duration? *The Journal of Border Educational Research*. Vol. 5-Fall 2006, pp 121-128.

Uniform Standards of Professional Appraisal Practice USPAP. (2008); *e-Handbook 2008-2009* http://www.appraisalmanagementcompany.net/docs/USPAP.pdf

Uniform Standards of Professional Appraisal Practice USPAP). (2016); *the Appraisal Foundation's USPAP*. http://www.uspap.org/.