Conference Paper

The Effectiveness of the E-Learning Application: Impact Assessment of the Quality

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Abstract

The success and the efficiency of e-Learning should be measured by a reliable method in order to use it effectively. Although, there are several studies about the success of e-Learning systems, only a few of them are about the measurement of this success within the institutions. There is a study of [3] which examines the success of the introduction of e-Learning system with the help of ELSS model (e-Learning System Success).

We made two questionnaires to evaluate the application of e-Learning at University of Debrecen, Faculty of Economics and Business. One of them was for the students and the other one asked the lecturers. The aim was to develop such questionnaires which are suitable for both the evaluation of the e-Learning's quality and its economic benefits.

The basis of the e-Learning's quality questions was Wang's article (2007), in which he measured the success of the e-Learning systems, therefore the questions of the students' and the lecturers' questionnaires were the same.

The aim of this survey was to compare the opinions of the students and the teachers regarding the application of e-Learning. The role of the questionnaire for quality development is to give guidance for the University of Debrecen in the e-Learning application.

We have used the Mann-Whitney test to evaluate the questionnaires of the students who use the e-Learning system. This method is used to compare the means of two groups in case of ordinal scales or not normally distributed variables. We have also used factor analysis and binominal logistic regression. We have examined whether the background variables manipulating the variables are possible to be developed on the basis of the answers. We used factor analysis to demonstrate this since it contracts the coherent factors into one common factor. Factor analysis is used to compress data and explore data structure. In most cases, factor analysis is used foremost in order to filter out multicollinearity.

Keywords: e-Learning, higher education, binomial logistic regression

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Received: 19 January 2017
Accepted: 2 February 2017
Published: 19 March 2017

Publishing services provided by Knowledge E

Selection and Peer-review under the responsibility of the EBEEC Conference Committee.

OPEN ACCESS

1. Introduction

The number of educational institutions, companies and other users applying e-Learning systems has grown significantly in the last decade, therefore they have become as important means and resources as other informational systems of the institutions [10]. However, there are several conditions and components of successfully

using these systems in the educational institutions – for example what kind of system is chosen, how it is implemented and introduced. The operation of the system and the services available for the users (teachers, students) are also important [12].

Probably the most significant question is what teachers and students can profit from the system. What is the advantage of using it? How does it help the process of teaching and learning to become more effective and transparent? Does it support the management of institutional education? If it does so, what extent? Naturally, the organizational and economical aspects of the use of e-Learning systems are also important. The application of the e-Learning systems is gradually becoming more essential for those institutions, organizations and companies which have distant teaching and trainings and also for the improvement of human resources.

Our research objectives include the quality of e-Learning establishment and the support of our institution. Accordingly, tasks were set for the examination of e-Learning opportunities for quality improvement in education, improvements in this regard, proposals and recommendations for application development. The course structure recommended for the application of e-Learning for institutional quality improvement together with other functions reachable as a module of the system, can ensure an integrated and comprehensive e-Learning quality service. The strategy and implementation of quality improvement is only possible by providing qualified human resources. The basic objective of the introduced LMS is to improve the quality of education, which is one way where the students and instructors receive ongoing feedback about their experiences with the system. Corresponding objective is to compile a questionnaire, which was a result of useful information about the students and teachers e-Learning system and application views [6].

The aim of the questionnaires were to compare the opinions of the students and the teachers and also to evaluate the Faculty of Economics and Business (FEB) of the University of Debrecen and the Corvinus University of Budapest (CUB) regarding the application of e-Learning. The role of the questionnaire for quality development is to give guidance for the FEB in the application of e-Learning. E-Learning in the CUB is applied under certain organized institutional circumstances. The e-Learning application of CUB works with an organization defined extended several faculties of the University, which can be a good example for our faculty.

The following hypotheses can be defined: The quality development of e-Learning should be ensured under organized circumstances.

2. Applied Methods

2.1. Questionnaire Survey

Questionnaire survey was carried out at the FEB among of the economic and agricultural engineering and technical management of information technology students. The primary way of getting information (primary), as new, unknown and unpublished, original, primary data acquisition occurred during the survey.

Figure 1: Administration interface of Limesurvey system.

There was an on-line way of response, which is a quantitative online CAWI (Computer Assisted Web Interviews) survey over the Internet. Rapid market surveys carried out by this method [1]. Our questionnaire was accessible through Limesurvey system (The evaluation of application of e-Learning, 2015) (Figure 1), which is a free and open source on-line survey application written in PHP based on a MySQL database. As a web server-based software it enables users using a web interface to develop and publish on-line surveys, collect responses, create statistics, and export the resulting data to other applications [7].

In this Thesis a research survey designed from which the predetermined group of users to get answers to important research questions. A questionnaire to evaluate the Mann-Whitney test was used. With this method we can determine significance of the averages of the two groups as follows: the two samples are ranked together, regardless of group that is ready to make the ranks. A questionnaire to evaluate the SPSS (Statistical Package for the Social Sciences statistical package for social sciences) program version 22 was used. The application of the questionnaire responses LimeSurvey SPSS syntax and data files were exported to the files that I imported into SPSS.

2.2. The Applied Statistic Methods

We used factor analysis and binominal logistic regression. We examined whether the background variables manipulating the variables are possible to be developed on the basis of the answers given. We used factor analysis to demonstrate this since it contracts the coherent factors into one common factor. Factor analysis is used to compress data and explore data structure [1, 9]. This method contracts the basic variables into so called factor variables which cannot be directly observed. In most cases, factor analysis is used foremost in order to filter out multicollinearity [4].

Logistic regression quantifies the probability of occurrence of the category of a doubtful, category like dependent variable under the condition of the known outcomes of other explanatory variables. Logistic regression is a non-linear classification method that does not suppose the continuity of explanatory variables neither the normality of

multivariables. The decision-maker can construct a decision-making rule relying on the hypothetical probability value in order to classify the given observation unit into a predetermined, result like category [5]. If the number of the dependent variables' outcome is two, then the method is called a binomial logistic regression.

3. Results

The success and the efficiency of e-Learning should be measured by a reliable method in order to use it effectively. Although, there are several studies about the success of e-Learning systems, only a few of them is about the measurement of this success within the institutions. It is the study of [3] which examines the success of the introduction of the e-Learning system with the help of ELSS model (e-Learning System Success). We made two questionnaires to evaluate the application of e-Learning - one of them was for the students and the other one asked the lecturers. Therefore, the CUB's questionnaire responses are used as a basis of comparison.

The aim was to develop such questionnaires which are suitable both for the evaluation of the e-Learning's quality and its economic benefits too. The basis of the e-Learning's quality questions was Wang's article (2007), in which he measured the success of the e-Learning systems. Therefore the questions of the students and the lecturers were the same.

There were 273 students and 50 lecturers from the CUB and 288 students and 46 lecturers from the UD FEB who properly filled out the questionnaires. We examined the answers about the e-Learning's quality in this research on the basis of two criterions (student-lecturer, CUB - FEB). The basis of the answers' comparability was that both institutions applied the Moodle frame system. We tried to find out to what extent they exploit the facilities of the system.

The groups of questions are the following:

Quality of the system (1-7)

Quality of the information (8-12)

Quality of the service (13-17)

Benefit of the e-Learning system (18-24)

Conclusions (25-27)

The 27 questions could be answered in a scale of 10. Figure 2 represents a diagram that indicates the means of the answers of the two institutions' students and lecturers.

It is visible on Figure 2 that generally, according to the e-Learning users of the CUB, the quality of the e-Learning application is better. We have chosen the answers demonstrating significant differences based on the results of *t-tests*, therefore we found significant differences in the answers.

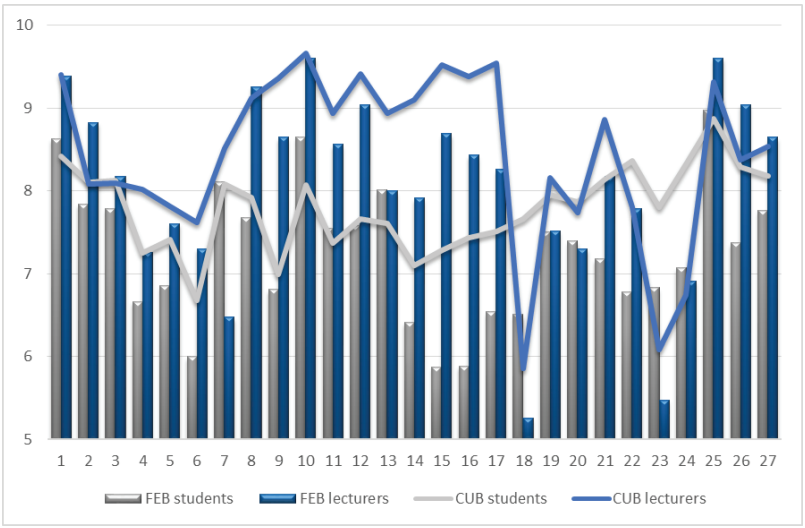

Figure 2: Comparison of the students and lecturers responses at FEB and CUB.

2. Easy to use.
7. The system is fast (speed of information access).
9. The necessary information is always at the right time published.
13. The e-Learning system an appropriate level of on-line help for.
14. The system is in constant contact developer(s) to users.
15. The operator (s) available (s) to solve problems.
16. The operators of the future development of cooperative relation.
17. The operator(s) provide appropriate assistance (they) use the system.
26. The e-Learning system is successful.

Table 1: Significant differences in evaluations of teaching issues.

3.1. t-Test

The significant differences of the lecturers' answers is illustrated by the table 1. All results were higher at Benchmark excepting for the question 26.

Regarding the result, it can be said that the e-Learning application of the CUB is more successful than the FEB according to the students' and the lecturers' evaluation. It is also obvious that the quality of the system's operation of the CUB is higher than the FEB. This result supports our hypothesis according to which the FEB can evolve in the quality of e-Learning application by ensuring the institutional frames for the system.

3.2. Factor Analysis

Hereafter, we examined whether background variables influencing the variables are possible to be formed. We used factor analysis to demonstrate this which contracts the coherent factors into one common factor. We examined the variables on the basis of the Kaiser-Meyer-Olkin (KMO) criteria to determine whether they are suitable for

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.886
Bartlett's Test of Sphericity	Approx. Chi-Square	17 114.773
	df	351
	Sig.	0.000

Table 2: The results of KMO and Bartlett test.

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulat %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.526	42.690	42.690	11.192	41.452	41.452	6.140	22.740	22.740
2	3.621	13.410	56.100	3.317	12.285	53.737	5.893	21.825	44.565
3	1.944	7.201	63.301	1.566	5.800	59.538	3.105	11.501	56.066
4	1.500	5.554	68.855	1.264	4.681	64.219	2.201	8.153	64.219
5	1.090	4.037	72.892						
6	0.953	3.530	76.423						

Table 3: Choice factors in the method variance.

factor analysis [2]. The value of the KMO is 0.886 (Table 2), which means that the variables are suitable for factor analysis.

The table also indicates the null hypothesis of the Bartlett test, which means that there is no correlation between the basic variables since the level of significance (Sig.) is smaller than 0.05. Consequently, the basic condition of the factor analysis, according to which the variables must correlate, is fulfilled.

We used two methods to determine the number of the factors. One of them is the percentage of variance, which determines the number of the factors on the basis of the cumulated percentage of the variance, which means that it is necessary to establish such number of the factors which makes it possible to reach a cumulated minimal level of variance. The table 3 indicates the variance explained by the factors.

The fourth row of the 'Cumulative %' shows the cumulated variance of the four factors (64.219%) which were developed by the Kaiser-criteria. It is above the necessary 60%.

The 5-factor solution would have been reasonable regarding the methods but relying on the fulfilled factor analysis there would only be one variable in the factor 5. Therefore, we have chosen a 4-factor solution which means that we replaced 27 variables which explains in 100% with 4 factors which explains in 64.22%.

After this, we rotated the factors during their selection to filter the correlated factors without relation and also in order to get a more simple and understandable solution. We used the Varimax rotational method during which the orthogonal rotation results in correlating factors.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-.043	.078	.300	1	.584	.958

Table 4: Parameter estimation based on the Wald-statistic.

			Score	df	Sig.
Step 0	Variables	FACTOR1	49.687	1	.000
		FACTOR2	20.899	1	.000
		FACTOR3	22.418	1	.000
		FACTOR4	.401	1	.526
	Overall Statistics		97.189	4	.000

Table 5: Significance of individual effects of variables.

Finally, we reached a 4-factor solution as a result of the analysis, where the KMO = 0.886 and the explained variance is 64.22%. The names of the factors are the following:

FACTOR1: Quality of the service

FACTOR2: Efficiency of the system

FACTOR3: Quality of the online material

FACTOR4: Usability of the system

3.3. Binominal Logistic Regression

We used logistic regression for the results of the factor analysis. Our aim was to determine the importance of a given factor for the users of the CUB compared to those of the FEB.

Table 4 and 5 represent the first phase of the analysis. Table 4 shows the constant Wald-statistic in the pre-analysis phase, which is the square of the beta (B) and the standard error. It demonstrated that there is not a significance.

Table 5 represents the individual effect of the independent variables yet not used in the analysis, according to which FACTOR1, FACTOR2 and FACTOR3 are also significant on their own, while the forth variable is not. The second part of the analysis demonstrates the final result. We used the „Enter" method, which means that we used the four independent variables in the analysis at same time [8].

Table 6 also applies the Wald-statistic. If the given variable is significant, then it supports the model. It is obvious that FACTOR1, FACTOR2 and FACTOR3 contributes to the model, while FACTOR4 does not. The Exp(B) indicates how each variables correct the estimation.

Regarding this, FACTOR1 corrects the estimation the most (Exp(B)=2.135) with 113.5%, while FACTOR2 corrects it with 68.3%. FACTOR3 worsens the estimation with

		B	S.E.	Wald	df	Sig.	Exp(B)	95,0% C.I.for EXP(B)	
								Lower	Upper
Step 1(a)	FACTOR1	.759	.105	52.118	1	.000	2,135	1.738	2.624
	FACTOR2	.521	.102	26.021	1	.000	1,683	1.378	2.056
	FACTOR3	-.596	.104	32.805	1	.000	,551	.449	.676
	FACTOR4	-.115	.087	1.748	1	.186	,891	.751	1.057
	Constant	-.108	.087	1.549	1	.213	,898		

Table 6: Wald-statistic.

44.9%, which means that according to the CUB users the first factor is twice, while the second factor is 1.683 times more important than according to the FEB.

4. Conclusion

We used statistic methods to examine the evaluation of the e-Learning among the students and the lecturers of the FEB and the CUB. We found significant differences between the CUB's and the FEB's application as well as between the students' and the lecturers' evaluation by performing a t-test. We determined that relying on the result, that it is more effective and better in quality to operate the e-Learning system under organized circumstances. This supports our hypothesis. We have created 4 factors from the 27 variables by factor analysis and we performed logistic regression on them. Our result was that according to the CUB users the quality of the service is more than twice as good, while the efficiency of the system is 1.683 times as more important than according to the FEB users.

The integrated e-Learning Portal is being continuously developed and used since 2007. It is now an integral part of the educational process. The Moodle system is used more and more and functions of the education system and developed training room booking system are using an increasing number of computer rooms in online teaching employment exams, for exams. Several ways of student evaluation are also used by lecturers, over which the student evaluation system is available as we need to develop multi-function use. The proposed quality e-Learning realized with the "quality e-Learning" at FEB.

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