

Questionnaire Analysis for Improvement of Student's Interaction in Tesys e-Learning Platform

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Abstract. This paper presents an extension of a previously conducted study that aims to reveal usability problems of specific functionalities. The current study also uses Tesys e-Learning platform as our study environment, therefore we made several improvements on the survey and extended the audience of the study. The main problem with the first study was the small number of students that filled the questionnaire. The current study uses a survey that was available for all the students enrolled in two long distance programs. We used the newly designed questionnaire to find how students perceive the ease of use and usefulness of a large number of features available to students. Experimental results show a good general acceptance of technology due to the general average grade of answers and detailed interpretation of results for statistical Wilcoxon test. Several limitations in perceived usability were observed in functionalities like finding chapters, finding homework or understanding question's text when groups were divided based on reported number of hours that were spent online. Redesigning the interface for these specific functionalities and reevaluation of usability may have further a great impact in a better acceptance of Tesys e-Learning platform

Keywords: questionnaire evaluation, Wilcoxon test, perceived ease, e-Learning.

1. Introduction

Extensive usage of e-Learning platforms in many undergraduate programs represents a challenge for analysis of student's interaction such that bottlenecks in usage may be correctly spotted and thereafter solved. Currently, there is a wide range of e-Learning platforms such as Moodle (Dougiamas & Taylor, 2003), ATutor (2016) or Bradford et al. (2007) which have implemented a large number of functionalities. For such

platforms, due to their extensive use for a large number of users and for a long time, usability testing can be performed with by means of custom HCI testing tools (Melton, 2006).

Still, for new and less widespread e-Learning systems such as Tesys investigation of student's interaction from HCI perspective represents a critical step for wider acceptance. In this context, the specific HCI research methodology needs to be addressed for investigating technology's usability as a major design element (Rozanski & Haake, 2003; Sharp et al., 2007). Several models may be used to explain and further predict the acceptance of a technology, among which are the one developed by Davis (1989), and Davis et al. (1989).

This paper presents a study that aims to reveal design and interface problems that affect the usability of Tesys e-Learning platform (Burdescu & Mihaescu, 2006) for students. There is also further analysis that aims to explore if the results were influenced by other factors like the time spent on the platform. In some cases, the interface may have been wrong designed so the user adaptability was too weak or the users just need to spend at least a specific amount of hours in order to use the platform good enough.

Based on one qualitative study carried on in, a questionnaire was developed and tested during a pilot study (Popescu et al., 2016) on twelve students from the Faculty of Automation, Computers and Electronics, University of Craiova. The questionnaire was revised and then administered again in 2016 at the University of Craiova in Faculty of Economics and Business Administration (FEAA) and Faculty of Letters (FL) for students enrolled in long distance undergraduate programs.

Current student's usability evaluation of Tesys platform was performed on a redesigned questionnaire of 26 checkbox questions with a Likert scale from one to five. Besides checkbox questions, we added also three more questions with a text box where the students are able to write detailed feedback or provide a motivation regarding the grade. The questionnaire was designed to take no more than half an hour in order to be sure that many students will complete all the fields and will not deliver incomplete questionnaire.

We choose the Likert scale because it was using such a structure will provide us with well-structured data which can be used for better interpretation and analysis tasks.

All the users that received the questionnaire were having previous experience with Tesys. The study started in the second month of the first

semester of the academic year so even the students from the first years got in touch with the platform. The first questionnaire that evaluated Tesys was having fewer questions and the responder's group was seeing for the first time Tesys e-learning platform.

The study was designed to answer the following research questions:

- How students perceived the ease of use and usefulness of main page, self-testing and communication functionalities?
- Which are the factors that differentiate among groups?
- How often do university students log on Tesys and how much time do they spend daily?
- Which are the variations of use by a programme of study and year of study?

The sample consists of 114 university students from FEAA and 31 from FL.

In order to evaluate if there are the difference between groups, we use Wilcoxon (1945) (analysis of variance) statistical method and from it, we extract the only the significant difference between groups. In order to conduct the experiments, we use R programming language (Ripley, 2001) and the "Wilcox.test" method.

The rest of this paper is organized as follows. The following section briefly presents related work in the area of HCI evaluation of e-learning systems with an emphasis on methodological approaches and comparisons. Next, we describe the proposed methodology (i.e., questionnaire design and data analysis) and variables used in experiments. The experimental results are presented and interpreted. Finally, conclusions and future work are presented.

2. Related work

Many studies address the problem of e-learning application optimization for better user's satisfaction. Ardito et. al. (2006) presented an approach to usability evaluation of e-learning application. At the moment the paper was published, the authors were mentioning that there was no consolidated evaluation methodology for e-learning applications. In the paper, which is the first step towards a definition of a methodology for evaluation of the e-

learning applications, they also claim that educational software must consider its usability, accessibility and didactic effectiveness.

Previous research by (Chiu et al., 2005) shows that the success of e-Learning systems design depends on initial acceptance but also in continued usage. The paper proposes a decomposed expectancy disconfirmation theory model that aims to examine cognitive beliefs and affect that influence user's continuance decision in the context of the e-Learning actions.

Costabile et. al (2005) proposed a consolidated evaluation methodology for e-learning applications. The authors also state that the evaluation of educational software must ensure both the pedagogical effectiveness and the software usability. In the paper, they also present the results obtained from observation and analysis of the interactions between the actors from the e-learning system that was targeted.

Ssemugabi et. al. (2007) made a comparison between two usability evaluation methods for e-Learning web-based applications. The first method refers a selection of usability methods that encapsulates time, cost, efficiency, effectiveness, and ease of application; the second refers a heuristics approach that involves evaluation by experts. The study makes a comparison between these two methods and reveals that the expert evaluators were able to identify more problems than the learners and identified 91% of the learners' problems.

Later, Zaharias and Poylymenakou (2009) published another paper regarding the usability of e-Learning applications. The authors describe in the paper a questionnaire-based evaluation procedure for e-learning applications. They take into consideration not only the cognitive aspect of e-learning applications but also the affective aspect that may influence the usability. The intrinsic motivation to learn is proposed as a new usability measure and they consider that this intrinsic motivation to learn is more appropriate to evaluate the e-Learning designs. The results presented in the paper provides evidence that the researchers can use the method when they aim to evaluate the e-Learning platforms.

The importance of evaluation of e-Learning platforms has been addressed by Adzobu (2014) with the focus on experiential evaluation whose analysis has the outcome in the shape of strategies for refining the e-learning platform with a focus on improving learning efficiency and satisfaction. This perspective is different from the one addressed in the current study, which focuses on perceived usability by students.

Another issue regarding the ingredients necessary for enhancing the level of learning regards the proper integration of usage of monitoring tools for e-learning platforms (Alowayr & Badii, 2014). The proposed approach is data driven and presents the impact of an integrated learning path that is used to track performed activities and finally evaluate the performance of learners. Our study does not use a data-driven approach, instead, it uses a questionnaire-based approach.

Recent research in the area of social networking in education is presented by Pavlovic et. al in (2015), which point out the tendency of e-Learning platforms towards inflexibility with the consequence of making students passive. The benefits of adopting and using social networks in the context of learning bring high benefits such as content sharing, collaboration, and criticism that stimulates and improves the effectiveness of learning.

From technology acceptance perspective in the area of social media studying and learning, Silius et. al. (2010) provide a clear roadmap. Analysis of students' motivations for studying within social network context found out that challenges associated with using the e-Learning platforms will disappear as underlying technological drivers are highly accepted. Although is such situations technology acceptance is not an issue, our study is based on Tesys e-Learning platform which is not widespread and therefore may heavily benefit from the analysis of perceived usability of its various features.

3. Proposed Method and Conceptualization

3.1 The methodological approach

The questionnaire was given in the Romanian language to students that learn at distance learning programs from FEAA and FL at the University of Craiova (UCV). The motivation for choosing them is that they used Tesys e-Learning platform for different periods of time: one, two or three years. We received 114 questionnaires from FEAA and 31 from the FL. Regarding questionnaires distribution, from FEAA we received 42 (36,8%) from the first year, 35 (30,7%) from the second year and 37 (32,5%) from the last year of studies; from the FL, we received 18 (58,1%) from the first year, 10(32,3%) from the second year of studies and only 3(9,7%) from the last

year of studies. The distribution over the years reveals that more students from the first year were interested in participating in such a study. Before analyzing the questionnaires, we eliminated 5 from FEAA and one from the FL because of incomplete data.

Students distribution over study programs is presented in Figure 1:

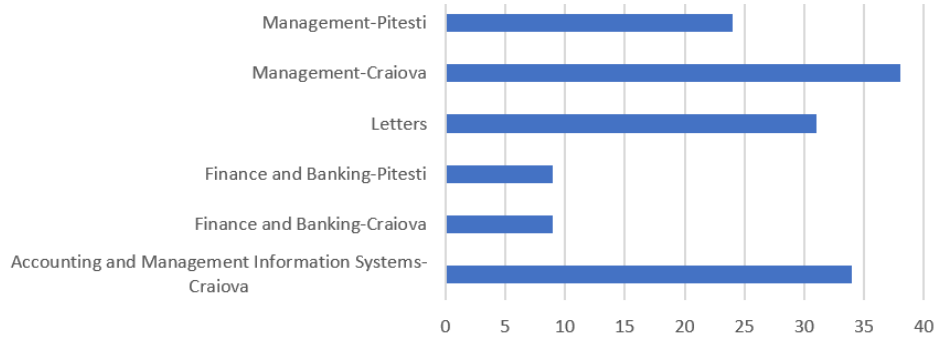


Figure 1 The distribution of students who answered the questionnaire over study programs

3.2 Questionnaire Structure

There were nineteen questions that were used in this study even if in the questionnaire were more because we had four questions regarding their year of study, their learning programme, the time spent on platform and if they use any other e-Learning platform and more questions with text areas in order to get feedback and recommendations for several functionalities. The question regarding if the students have used before other e-Learning platform was aiming to see if previous experiences in e-Learning have an impact on usage of Tesys e-Learning platform but all the answers say that they never used another platform.

Table 1 Variables from questionnaire

Item	Question/Description
M1	How do you evaluate the buttons arrangement on the main page?
M2	How often do you use the "Home" button to return home from another page?
M3	How fast did you found chapters in the section "Courses"?
M4	How fast did you found the "Videoconference" button?
M5	How fast did you found the "Auto testing" button?
M6	How fast did you found the homework?
T1	Do you consider the auto testing procedure based on chapter separation to be an efficient one?
T2	While you do auto testing, the question's text was shown good enough?
T3	Regarding the questions, the main controls (e.g. checkboxes, buttons, etc) were easily

	accessible?
T4	How fast did you found the marks for correct answers and the answering button during auto testing?
T5	Do you consider that the checkboxes should be bigger?
C1	Starting from the home page the messages for professors/secretaries/colleagues were found fast enough?
C2	Being on the main page, how fast did you found the button "Communication"?
C3	Entering the section "Communication", how comfortable are you with the layout buttons on the page?
C4	How easy did you found a student in the section "communication with students"?
C5	Starting from the home page, the messages for the conversation with professors/secretaries/colleagues were easy to find?
C6	In the section "communication with professors" how fast did you found the professors from a specific discipline?
C7	The message's text field is big enough?
C8	Did you found convenient sending a message to one or more professors from a specific discipline?
C9	Do you consider that the messages display from the "communication with secretaries" section are well designed?

The questionnaire was divided into three sections, each of them aiming to evaluate one subject from Tesys e-Learning platform.

Table 1 presents the questions divided into three groups: main interface - M1 to M6, testing module - T1 to T5 and the communication module which contains questions C1 to C9. Each question was evaluated using a Likert scale from one to five where five express a strongly positive reaction and one express a negative reaction to the question. A larger number of questions referring the communication module is motivated by the complexity of this module and by the messages received in the questionnaire as feedback.

Table 2 Characteristics of usage

Variable	Question
YOS	What is your year of study?
POS	What is your program of study?
WHT	How many hours do you spend weekly on Tesys?

One important aspect of this study refers the number of hours spent on the platforms as it may influence the user adaptability to the interface and the working speed may also improve.

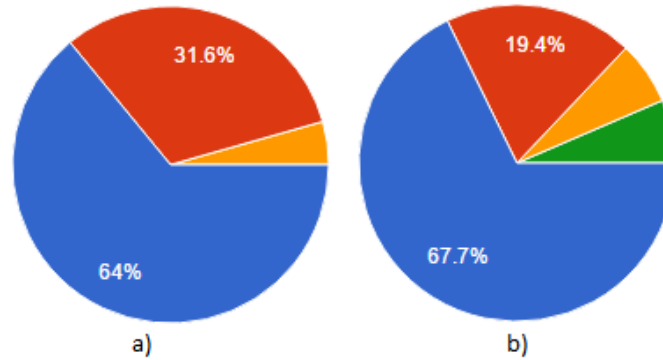


Figure 2 Distribution of students in terms of reported time spent

Figure 2 presents the distribution of the time spent on the platform: a) is for FEAA and b) is for the FL. For FEAA, 64% of the students spent less than ten hours on the platform, 31,6 of the students spent between ten and twenty hours per week and 4.4% spent between twenty and forty hours per week. No student from FEAA spent more than forty hours per week. In the case of the FL 67.7% spent less than ten hours per week, 19.4% between ten and twenty hours per week and 6.5% for the next two categories: between twenty and forty hours per week and more than 40 hours. In both cases, most of the students spent less than 10 hours weekly on the platform and for this study we used the first group being formed by the students that spent less than 10 hours and the second group with more than 10 hours per week.

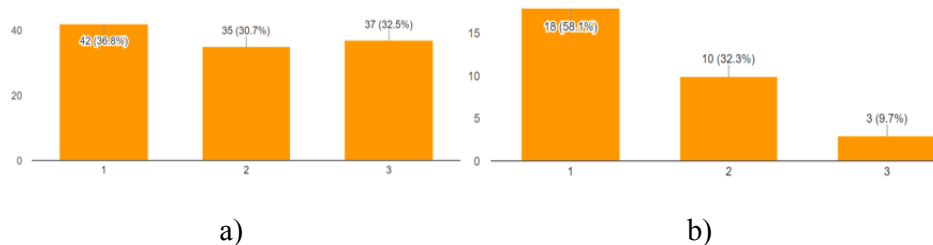


Figure 3. Distribution of students in terms of year of study; a) FEAA, b) FL

Figure 3 presents the distribution of students that attended the study over the year. In the case of the FEAA, the students were almost equally distributed but in the case of FL, more than 50% of the students were from the first year of study. This percent can have an influence on the results of the questionnaire because they had less experience with the platform.

The submitted questionnaires use 5 Likert scales which is considered to

provide a ranking of answers not grades for answers. Considering the answers like grades would imply a strong assumption in the fact that there is equal "distance" between any two consecutive answers of questions. This approach would allow considering the value of the answer as the numeric type and therefore further computation of analysis of variance and mean values. Because the values are ranks lead us to use nonparametric analysis of variance and therefore the Wilcoxon test was selected and used to run on data.

The purpose of the Wilcoxon test was to reveal the questions whose p-value is smaller than 0.05 threshold value, which represents a clear indication that there is a significant change in perceived ease of use among the students' groups differentiated by a certain factor.

W (sum of signed ranks) is a test statistic used for statistical hypothesis testing. Computation of the signed rank reduces to computing the difference among the groups, assigning a rank and finally computing the sum of all ranks.

4. Experimental Results

Tesys is the e-learning platform that works for two learning distance programs at the UCV. There are four roles/actors that use Tesys: professors, students, secretaries, and administrators. The administrators and secretaries have administrative roles like adding users (i.e. students/professors) on the platform or managing learning programs/disciplines. Professors and students are the actors that are actively implied in the learning process. Professors upload courses, homework, and other learning resources or define tests; they also have an important responsibility to answer the student's questions using the platform. Students are the subject of this study, using the questionnaires we aim to find key issues that affect their experience using the e-Learning platform. They can download courses, view homework, upload the solution to the homework, and use the platform to communicate. Their view was designed in the beginning but over the time several functionalities were added but no review was done.

Running of the Wilcoxon test has been performed on two groups whose factor of differentiation was the time spent on the platform. Thus, the two groups were characterized by the reported weekly time spent on platform:

one group consists of students that spent less than ten hours weekly on e-Learning platform and the second one consists of students that spent more than ten hours. Thus, the purpose of the study was to investigate how students perceived the ease of use of various functionalities (i.e., general, self-testing, communication) in relation to the weekly time spent online.

Other indicators that may be computed and bring knowledge that correlates well with results provided by Wilcoxon test are: median and mean values of questionnaire answers, the average number of log-ins and the average time spent on the platform. Other factors that may be used for discriminating among groups are the study program or the year of study.

Table 3 presents the results of Wilcoxon's test on questionnaire answers given by FEAA students.

Table 3 Descriptive statistics of Wilcoxon test on FEAA student's answers

Item	<10 online hours per week	>10 online hours per week	W	p-value
M1	4.02	4.43	1758.5	0.0913
M2	2.87	2.70	1415.0	0.6191
M3	4.15	4.70	1926.5	0.0031
M4	4.10	4.29	1617.5	0.4257
M5	4.24	4.56	1722.0	0.1245
M6	3.97	4.58	1923.0	0.0052
T1	4.09	4.19	1581.0	0.5949
T2	4.16	4.46	1785.5	0.0619
T3	4.15	4.26	1551.0	0.7302
T4	4.12	4.26	1567.0	0.6543
T5	3.00	2.90	1439.5	0.7314
C1	4.05	4.19	1609.5	0.4766
C2	4.35	4.41	1495.5	0.9973
C3	4.15	4.31	1610.5	0.4657
C4	3.83	4.07	1663.5	0.2968
C5	4.16	4.26	1574.0	0.6188
C6	4.04	4.24	1638.5	0.3712
C7	4.19	4.09	1467.5	0.8565
C8	4.13	4.26	1537.0	0.7991
C9	4.12	4.19	1583.5	0.5850

The first observed result regards the p values smaller than 0.05, which were obtained for questions M3 and M6 and a close result at question T2. Therefore, students with more than ten hours spent online weekly perceived

that they may find much faster the chapters, the homework and understood in a better way the text of the quiz questions. This interpretation of obtained results is also supported by the large gap in mean values of the two groups for M3, M6, and T2. On the contrary, close values for all other questions is an indication that the ten hours' threshold between groups did not make a difference, a fact supported by the close mean values.

Table 4 presents the results of Wilcoxon's test on questionnaire answers given by FL students.

Table 4 Descriptive statistics of Wilcoxon test on FL student's answers

Item	<10 online hours per week	>10 online hours per week	W	p-value
M1	3.95	4.1	114.5	0.6850
M2	2.42	2.9	129.0	0.2962
M3	4.19	3.9	91.0	0.5391
M4	4.04	4.4	117.0	0.5917
M5	3.90	4.0	109.0	0.8741
M6	3.76	3.7	102.0	0.9118
T1	3.47	3.7	107.5	0.9295
T2	3.33	3.5	103.0	0.9477
T3	3.57	4.0	113.0	0.7411
T4	3.47	3.9	115.5	0.6594
T5	3.19	3.9	134.5	0.2026
C1	4.00	3.8	82.0	0.3119
C2	4.00	4.3	110.5	0.8184
C3	3.76	3.7	95.0	0.6764
C4	3.76	3.3	83.5	0.3546
C5	3.90	4.1	102.5	0.9284
C6	4.09	3.3	57.0	0.0345
C7	4.09	3.8	85.0	0.3831
C8	4.00	4.0	92.0	0.5742
C9	3.76	3.6	90.5	0.5314

The first observed result regards the p-value of the C6 question. This is an indication that FL students had problems in communication with professors. Regarding this result, we note that the mean grade in a group with more than ten hours is larger than the mean grade in a group with less than 10 hours. This result strengthens the conclusion that communication with professors and especially finding specific professors that a student

needs to communicate with is a possible critical issue in interface design.

In general, as a comparison of results between FEAA and FL students, several observations need to be done. Firstly, the mean of grades given by FL students is smaller than grades given by FEAA students. This may be explained by the fact that FEAA students are more technical than FL students and therefore technology has a higher acceptance rate at FEAA students. Another supporting aspect regards the fact the Tesys platform runs FEAA for a longer time than at FL and therefore FEAA students may be much more used to implemented features. This is also supported by a large number of first year FL students that answered the questionnaire which did not previously used Tesys. On the contrary, the distribution in terms of year of study is well balanced at FEAA students, as can be seen in Figure 2.

The sum of the signed ranks (W statistic) is dependent upon by the number of subjects that answer the questionnaire. The big difference between the number of students that attended the study from FEAA and the FL motivates the big difference in terms of the value of W statistic for these two groups.

Let's suppose we have a number of „ n ” maximum ranks; in the case of FEAA, we got 114 learners that answered the study so we will have $n \leq 114$ when we compute the sum and in the case of the FL only 31. If we compute the sum using the standard formula $(n(n+1)/2)$ we get a maximum rank of 3277.5 for FEAA and 450 for the FL. These numbers represent the absolute maximum that can be computed for those two groups in case of maximum difference and is relevant only for that group. As W statistic decreases, the difference between the groups becomes smaller and the p -value computed for them becomes bigger, as opposite a big W statistics value corresponds to a small p -value and a strong difference between groups. The maximum possible value may never be achieved as it is always the possibility to have more than one instance with no difference in the dataset and that rank will never be computed.

5. Conclusions and future work

We have found that Tesys e-Learning platform has been well accepted by students as they perceive it in general as easy to use and useful. Several shortcomings were spotted: users perceive that it takes them too much time to find the course and homework related documents and question's text is

sometimes hard to understand. On the other hand, students in the first year of study with little technical background encountered difficulties in finding professors when using the communication module. The Wilcoxon test that revealed this conclusion used the weekly time spent online by students reported in a questionnaire. One group consisted of students that reported that they spent online a week average of less than ten hours, while the second group reported that they spent online a week average of more than ten hours. We obtained different results for FEAA and FL students, which is a clear indication that technical background and the number of usage years highly influence the perceived ease of use and usefulness. An important result of the current study consists in the complementarity of the findings and the proper identification of issues that need to be further addressed.

Therefore, the first improvements that needed to be performed regard redesigning the interface such that students may find easier the course and homework related documents, better understand the question's text and find more easily the professors they want to communicate with.

Future work may need to further investigate if other indicators may represent a good discriminator among groups. One option regards the year of study, since students in the larger year of study may have a distinct perception of the ease of use and usefulness due to their prior usage of the platform. Another option regards the study program since students with the more technical background (i.e., Accounting and Management of Information Systems) usually have more technology acceptance than students with the less technical background (i.e., Management).

Further studies need to confirm the current findings in a data-driven approach. Accurate statistics on logged activities may further validate the relationship between the time spent online and easiness - in terms of a number of clicks and necessary time - by which a student performs a specific task, such as finding homework or course related documents.

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