Acceptance of E-Learning System at Faculty of Technical Sciences

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Abstract. *This paper shows a research carried out at the Faculty of Technical Sciences, University of Novi Sad regarding the acceptance of e-learning system by students. The questionnaire used as a data collection tool was created in accordance with the UTAUT[1] model with the aim of determining the acceptance of the implemented system. Within the paper, the obtained research results are analyzed using different statistical methods, after which a final model for measuring the acceptance of the e-learning system was obtained. The results contribute to a better understanding of how to measure the acceptance of e-learning systems, and how to improve its usage.*

Keywords. E-learning system, IS acceptance, UTAUT model, SEM, Moodle

1 Introduction

Nowadays, technology usage as a part of teaching process is necessary. The concept of knowledge is changing. Bearing in mind that each organization is striving to become a learning organization, the use of technology in the process of learning is becoming inevitable (Marjanovic, Delic & Lalic, 2016). Modern education requires transformation of "traditional model of knowledge reproduction" into a model of active knowledge construction, where teachers and students work together to create a knowledge base which needs to be adopted.

Universities and faculties, as institutions of higher education, are also focusing on information and communication technologies and systems, with the aim of competitiveness, efficiency and effectiveness improvement. Technology usage in teaching process varies at different levels – from simple tools like MS PowerPoint and Prezi, to usage of more complex systems for e-learning such as Moodle. Usually, focus is on creating learning content which is necessary for students learning process.

E-learning is defined as a learning which is facilitated and supported through the usage of information and communication technologies (Jenkins & Nunamarker, 2003). Accordingly, e-learning concept includes utilization of information and communication technologies (Internet, computer, mobile phone and multimedia) as a way to support teaching and learning.

Continuous search to provide the acceptance of technology by clients is current challenge for management (Schwartz & Chin, 2007). The research of technology acceptance in the field of information systems (ISs) and information technologies is nowadays considered as one of the basic research topics (Venkatesh et al., 2003). Various techniques are used for acceptance testing of different systems and technologies in many different contexts. Therefore, diverse perspectives of stakeholders, technologies and contexts, theories and research methods are discussed (Williams et al., 2009). This situation has led to confusion between researchers, since they are commonly forced to choose characteristics and components from the wide spectrum of, usually competitive, models and theories. As a reply to this challenge Venkatesh et al., (2003). have developed unique model which sums up alternative views of user and acceptance of innovations – Unified Theory of Acceptance and Use of Technology (UTAUT).

In this paper are analyzed different aspects and possibilities of measuring acceptance and usage of systems for e-learning with a focus on post implementation phase. After that, it summarizes the results about how much these approaches are relevant for measuring acceptance and usage of systems for e-learning.

In this research the acceptance of e-learning system by the students at the Faculty of Technical Sciences, University of Novi Sad has been examined. Different stakeholders are interested in e-learning system's acceptance, like: creators and managers of information system, e-learning process managers, professors who use e-learning system for more efficient and easier

[1]Unified Theory of Acceptance and Use of Technology

communication with their students at one place. Surely, the main goal for all stakeholders is to determine whether the implemented system is positively accepted by its primary users – students. For the research purpose UTAUT model has been used.

2 Background and related work

Acceptance of an IS one of the arguable questions that draws attention of researchers in the field of IS. Problem is even more complex because acceptance is multidimensional concept which can be graded from different levels, such as technical, individual, group or organizational.

E-learning systems are gaining importance and are increasingly being used in everyday teaching activities. In order for teachers to have an insight into the state of contribution of this system, there are various models that allow the measurement of the acceptance of an e-learning system. Many researchers are focusing on this issue in past decades (Weerasinghe, 2017), as well as today (Ayele & Birhanie, 2018; Yakubu & Dasuki, 2018).

2.1 E-learning system

An e-learning system is a type of IS based on Internet technology that provides training of the learner in an independent and flexible way (Wang et al., 2007; Lee & Lee, 2008), supporting teaching and learning processes (Hassanzadeh et al., 2012). Users or e-learners access the system through Internet or intranet portals in order to acquire information, knowledge and skills (Chen, 2012). During the learning process, users can interact with other participants, such as the instructor or other users. A lot of web based learning and training programs are developed that make learning self-paced. The e-learning process is usually designed in the way to enable users to control learning elements. These two features, self-pacing and control over learning, are providing new opportunities for the individuals and for the companies. In the process of design and delivery of e-learning and training programs, enterprises have to consider both effectiveness and acceptance of e-learning systems.

2.2 Unified Theory of Acceptance and Use of Technology

In the field of ISs, many researchers have concluded that information technologies are insufficiently used in organizations, which leads to huge economic loss in their business. As a result, a lot of theories and models about acceptance of technology are developed or used for studying the acceptation of information systems. These models include: Theory of rational action (Fishbein et al., 1977), Model of technology acceptance (Davis, 1989) and extended Technology Acceptance Model (TAM) (Venkatesh & Davis, 2000), UTAUT (Venkatesh et al., 2003) and many others.

UTAUT suggests that there are three constructs of the main determinant of behavioral intention towards using information technologies. Those three constructs are: Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI). They have direct impact on construct Behavioral Intention (BI) which, in the end together with Facilitating Conditions (FC), influences on construct System Usage (SU).

2.3 Hypotheses development

In this section, the rationale for each of the proposed hypotheses, stating connection between constructs from the proposed e-learning acceptance model is explained. The hypotheses about the relationships in the UTAUT model, with corresponding discussions, are presented below.

H1: Performance Expectancy has positive effect on the Behavioral Intention.

Maldonado et al., (2011) have found strong and positive effect while observing educational portal for e-learning in South America. Abdekhoda, Dehnad & Gavani (2016) confirmed that statistically significant relationship between PE and BI exists. They examined this relationship on an example of e-learning system at the University of Tabriz, Faculty of Medicine. Chaka & Govender (2017) have also confirmed significance of this connection. Fourth group of authors, in their research of student behavior while using e-learning systems, showed that the relationship between the two, previously mentioned, factors is strong and significant. Wang, Wu & Wang (2009) were testing the acceptance of Mobile Learning (m-learning) Systems, and as the result they have represented that the connection between PE and BI is statistically significant and strong. In his research about effects of Technological expectations on BI, Chen (2012) has shown the statistical significance of this relationship.

H2: Effort Expectancy has positive effect on the Behavioral Intention.

Previous researches whose topic was significance of relationship between these two factors have got the results which indicate that significance of the relationship exists. Maldonado et al., (2011) have shown, as a part of the Motivation for e-learning factor, that relationship between these two factors is strong and statistically significant. Some other authors (Abdekhoda, Dehnad & Gavani, 2016; Chaka & Govender, 2017) have also confirmed that the relationship between EE and BI is strong and significant. On the other side, Masa'deh et al., (2016) have found that previously mentioned relationship is weak and that it does not have statistical significance. However, the relationship between EE and BI has also been confirmed as strong and significant in the research which was conducted by Wang, Wu & Wang (2009). While searching for the answer about the

impact factors of Technological expectations on BI, Chen (2012) confirms significance of this relationship, too.

H3: Social Influence has positive effect on the Behavioral Intention.

Almost all previous researches have shown that connection between these two factors exists (Maldonado et al., 2011; Abdekhoda, Dehnad & Gavani, 2016; Ra'ed Masa'deh et al., 2016). Maldonado et al., (2011) have shown that the connection between SI and Behavioral Intention is very strong. Abdekhoda, Dehnad & Gavani (2016) in their research claim that if SI increases by one, BI will increase by 24%. Significance of the relationship between SI and BI is shown as strong and important (Chaka & Govender, 2017). While researching usage and acceptance of technology with m-learning concept, authors (Wang, Wu & Wang, 2009) have concluded that relationship between these two factors exists and it is statistically significant and strong. The fact that SI has positive and statistically significant impact on BI was also shown by Chen (2012).

H4: Behavioral Intention has positive effect on the System Usage.

All relevant previous researches have shown statistical significance (Maldonado et al., 2011; Chaka & Govender, 2017) and strong relationship between BI and SU (Abdekhoda, Dehnad & Gavani, 2016), which is natural – if someone has intention to use the system, he will.

H5: Facilitating Conditions have positive effect on the System Usage.

On one hand, some of the previous researchers have found that the connection between FC and SU is small, but statistically significant (Masa'deh et al., 2016). On the other hand, a few researchers have found that this relationship is at the borderline of statistical significance (Maldonado et al., 2011; Abdekhoda, Dehnad & Gavani, 2016).

3 Materials and Methods

Within this section, materials and methods that have been used for the proposed research are shown.

3. 1 Measures

The indicators and constructs[2] of the conceptual model have been determined based on previous research on IS success. The measures of constructs that have been used to analyze the success of various types of IS, in previous studies, which have been adopted in this study are listed in Table 1.

[2]In the methodology of Structural modelling notions construct and factor are used interchangeable as dimensions to be measured (Pallant, 2010).

Table 1. Construct measures

Construct	Indicator	Ref.*
Performance Expectancy	PE1. Usage in learning	1, 2
	PE2. Faster obligations fulfillment	1, 2
	PE3. Increase in work productivity	1, 2
	PE4. Easier learning	2
	PE5. Better learning performance	2
Effort Expectancy	EE1. System usage – clear and understandable	1, 2
	EE2. Fast system understanding	1, 2
	EE3. Simplicity of using	1, 2
	EE4. Learning to handle the system	1, 2
	EE5. System responsiveness	2
Social Influence	SI1. Effect of people that have an influence on student	1, 2
	SI2. People that student care about	1, 2
	SI3. Older Faculty colleagues	1, 2
	SI4. Influence of the Faculty	1, 2
	SI5. Other colleagues	2
Facilitating Conditions	FC1. Owning a resources	2
	FC2. Owning a knowledge	2
	FC3. Compatibleness with other systems	2
	FC4. Fitting into way of working	2
	FC5. Instructions for using	2
Behavioral Intention	BI1. Intention to use system in the future	1, 2
	BI2. Prediction of future usage	1, 2
	BI3. Planning to use the system in the future	1, 2
System Usage	SU1-11: Forum, Chat, Learning material, Lesson Video resources, Quiz, Assignments, Marking of completed activity, Messages, Gradebook, Participants directory	3, 4

*References: 1 – Wang, Wu & Wang (2009); 2 – Venkatesh et al., (2003); 3 – Persico, Manca & Pozzi (2014); Lolić, (2018) p.80.

3.2 Sample and data collection procedure

Data which has been used for this research was collected from the students at the Faculty of Technical

Sciences (Department of Industrial Engineering and Management), University of Novi Sad. These students use e-learning system Moodle eLLab.

The researched system is open source code software – Moodle which has been used for development of e-learning system (Romero, Ventura & Garcia, 2008). Moodle owns flexible set of modules that can be organized by using activities and resources. By developing different activities and resources, it also supports creation of different types of statistical and interactive materials. This software has tools for collaboration, which makes it a collaboration system, too. Moodle keeps and records detailed notes about all activities that participants take (Rice, 2006). Recording these notes makes possible keeping a track of materials and tools used by participants (Romero, Ventura & Garcia, 2008). This system reports every activity that participants do and uses it for navigational purposes. Besides that, system has a built-in record log, which is also accessible, as well as information about activities of certain participant and his performance (Martín-Blas & Serrano-Fernández, 2009).

Data collecting process lasted one month. Students' opinions about using the e-learning system Moodle eLLab were collected online with help of the questionnaire (Lolić, 2018. p. 78-80) which has been made based on the theory (Table 1) that was distributed through Internet tool as instrument for data collection. For research implementation SurveyMonkey[3] has been used.

For the needs of data collection process, researchers used e-mail addresses which were available in the database of Faculty of Technical Sciences e-learning system Moodle eLLab. Participants were contacted and asked to give their opinion about usage of the e-learning system. Participation in this research was voluntarily and none of the participants, in any way, was forced to respond.

Participation invitation in this research was sent to 2017 e-mail addresses of students, while valid replies were collected from 796 of them. Response rate is 37,78%. Initial data screening showed that 50 cases had very low standard deviations (below 0.2). Thus, to minimize the non-engage bias, they were removed from further analysis (Nunnally & Bernstein, 1994). The final number of validly filled questionnaires that was used in analysis was 746.

In this research, 387 of the respondents were female (51.9%), while 359 of them were male (48.1%). Respondents are categorized in four categories according their age: respondents younger than 21 year, respondents at age between 21 and 24, respondents at age between 25 and 30 and respondents older than 30 years. Most of the respondents are found to be in the second category – between 21 and 24 years (46.8%). Degree of computer literacy was divided in the three categories according to years of experience in using e-learning system: professional user (more than 3 years), middle user (1-3 years) and beginner (less than 1 year). Respondents mostly declared themselves as a middle user, which means that most of them belong to the second category – 489 (65.5 %).

4 Results

After the data collection process was done, next step was to analyze the results. That was done with the IBM SPSS Amos (version 20) tool, which is explained in the following part of the paper.

4.1 Statistical methods used for analysis

For the need of showing the results, researchers used the analysis of the basic items characteristics (descriptive statistical analysis) which represents a group of methods that describe results and have a goal to group, arrange and show the statistical data, as well as to determinate basic indicators of statistical series (Marjanovic, 2014).

Exploratory Factor Analysis (EFA) was used to identify the structure of factors by examination of correlation matrices.

After that, Confirmatory Factor Analysis (CFA) is used to statistically confirm a definition of dimensions by manifest variables. This analysis is used as a tool to test the conceptual model and hypothesis. Based on the CFA, a Structural Equation Modeling – SEM (Tabachnick & Fidell, 2007) has been conducted.

4.2 Identifying the factor structure

On courses supported by the e-learning system, students have the need to use the system in order to get all the materials necessary for passing the exam. For this reason, the dimension Voluntariness of Use from the UTAUT model is not being observed because its role is insignificant for this research. Following that, we have researched the relationships between other constructs of UTAUT model.

A thirty indicator instrument is tested on the bases of collected data. With the aim to improve validity of model by using EFA, next steps were conducted:

1. Applying the Keizer-Guttmans rules or "validity of variance higher than 1";
2. Screen Plot – visual representation of variance value;
3. Eliminating the variables that made other factors, not important for this research;
4. Suitability of Chi-square index and Usage of suitability index (Root-mean-square error of approximation – RMSEA and Comparative fit index – CFI) (Tabachnick & Fidell, 2007).

[3] www.surveymonkey.net

Factor analysis was done in an iterative procedure until an adequate model and factor structure that satisfies all the criteria shown in the previous five steps was made. This model explained 72.74% of variance, and the value of variance and its percent explanations for factors were in a range of 6.75% and 16.82%.

At the end of the factor analysis process, nine indicators were eliminated EE5, SI4, FC5, SU1-SU5 and SU9 because they have built other constructs which are not important for this research.

Final model consisted of 6 factors and 24 indicators/variables.

4.3 Reliability and validity assessment

Reliability of measurement instruments is determinated by calculating a coefficient of Cronbach's alpha for each dimension. Calculated values for each of the dimensions are: PE = 0.879; EE = 0.866; SI = 0.760; FC = 0.771; BI = 0.957 and SU = 0.876. All these values satisfy a minimal criteria (0.60 or higher) accordingly to (Hair et al. 2009).

Besides from that, reliability and convergent validity of factors is estimated with a usage of Composite Reliability (CR) and Average Variance Extracted (AVE). Results are demonstrated in Table 2. All coefficients of Cronbach's alpha and CR values satisfy minimal criteria value – 0.70, which was suggested in (Hair et al., 2009).

Average variations are above recommended 0.50 level (Straub, 2012), which means that more than half of variations observed as indicators were calculated with their factors hypothesis. CR was higher than AVE for each factor. Because of that, we can conclude that all factors in the model of measurement have adequate convergent validity.

Discriminant value can be estimated by testing AVE, MSV and ASV. By Hair et al., (2009), if MSV is higher than AVE and ASV, it leads to discriminant importance. Regarding convergence (Table 2), all factors were satisfying. Summarized, model of measurement had adequate reliability, convergent validity and discriminant validity.

4.4 Structural model

This research has had a goal to examine relationships between constructs suggested by model and to examine suggested model with collected data.

Model consisting of six constructs had adequate suitability indexes. Values of suitability indexes are shown in the Table 3 which represents that all the values are in the acceptable range, which further indicates a good fitting of models.

Table 3. Suitability indexes for CFA and SEM

Model	$\chi 2$/df	NFI	CFI	RMSEA
Measurement model	4.617	0.909	0.927	0.070
Structural model	4.752	0.905	0.923	0.071
Recommended value	less, the better	>0.90	>0.95	<0.08

Path coefficients, p-values, z-results and explanation of variance are shown in the Fig. 1. All obtained values for path coefficients are above recommended values of 0.20 as suggested in (Chin, 1998) with the exception of the paths between assumed dimensions of BI and SU, and FC and SU.

Relationship between PE and BI is statistically significant and positive (path coefficient = 0.306; t = 6.834).

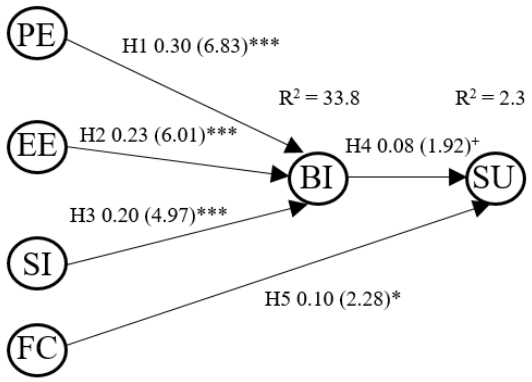

Figure 1. Structural model for examination of e-learning system *Moodle* eLLab acceptance

Table 2. Reliability, convergent validity and construct correlation

Construct	Middle value	SD	α	CR	AVE	MSV	ASV	SI	SU	PE	EE	BI	FC
SI	3.25	.84	.760	.844	.660	.234	.119	.812[a]					
SU	3.18	.90	.876	.840	.514	.078	.037	.247	.717[a]				
PE	4.13	.75	.879	.882	.603	.266	.194	.484	.280	.777[a]			
EE	4.55	.56	.866	.908	.714	.323	.161	.213	.116	.495	.845[a]		
BI	4.28	.90	.957	.957	.880	.266	.161	.395	.118	.516	.421	.938[a]	
FC	4.24	.66	.771	.819	.535	.323	.154	.310	.127	.382	.568	.437	.731[a]

Note: SD – Standard Deviation, MSV - Maximum Shared Variance, ASV - Average Shared Variance.
[a] Indicates the square root of AVE construct

This connection is the strongest and statistically most significant. EE has statistically significant effect on BI and relationship between these two dimensions is distinctively strong and positive (path coefficient = 0.233; t = 6.009). Statistically significant relationship between SI and BI is also proven (path coefficient = 0.20; t = 4.97). Dimension FC has statistically significant effect on factor SU, but with low statistical significance. As for relationship between BI and SU, we can conclude that this is the weakest relationship and it is at the borderline of statistical significance (path coefficient = 0.08; t = 1.92).

Together, both assumed dimensions explain 36.1% of variance in structural model. Assumed dimension BI is explained in 33.8% of dimensions PE, EE and SI. On the other side, dimensions FC and BI shows significantly lower effect (influence) on assumed dimension SU, with only 2.3%.

Results of SEM show that all five hypothesis are accepted, but also that hypothesis H4 is barely accepted since its value is a little below the borderline of statistical significance ($p < 0.1$).

5 Discussion

Measuring instrument that is used in this paper is tested with EFA. Results of this analysis indicate the existence of five strong dimensions of acceptance and usage of information system. All of these dimensions were taken from UTAUT model of acceptance and usage of technology.

Results of the CFA have shown a high degree of reliability and validity of relationships between dimensions in measurement model. A strong connection within all elements in the model is established, with one exception – relationship between two dimensions, BI and SU.

All five dimensions represent stable elements in model of acceptance of e-learning system Moodle eLLab, while the relationship between these dimensions is interdependent one. These results are in accordance with the original creators of technology acceptance and usage model, who also claimed that the relationship among these dimensions is interdependent (Venkatesh et al., 2009; Wang, Wu & Wang, 2009).

The results of this research purpose the acceptance of the e-learning system Moodle eLLab at the Faculty of Technical Sciences by the students. Results showed the existence of high expectations of system usage by the students, as well as their will and desire to be a user of e-learning system Moodle eLLab.

During the analysis, mutual influence of four independent and two dependent variables from conceptual model was observed. Connections of independent factors PE, EE and SI towards dependent factor BI were analyzed, as well as relationships between BI and SU and between FC and SU. Obtained results indicate that observed dimensions are reliable and valid acceptability measures in context of e-learning system. Analysis of data obtained in this research has strongly supported four out of five defined hypotheses.

Higher intention to use a system leads to higher usage of it, and consequently to higher total usage of the system by students.

Designers of e-learning systems (in this case professors) should pay a special attention to expectations of the system, when it comes to system usage. Students should be conscious that the usage of e-learning system will be useful in their learning process, and that it will upgrade their performance as well as make their learning easier.

Furthermore, it will make learning process much faster. Cognition like this will result in an increase of their intention to use the system.

Summarized results are shown in Table 4.

Table 4. Results of testing on the defined hypothesis

Hyp.	Relationship			Path coefficient	t-value	Result
H1	PE	→	BI	0.306***	6.834	Accepted
H2	EE	→	BI	0.233***	6.009	Accepted
H3	SI	→	BI	0.200***	4.970	Accepted
H4	BI	→	SU	0.082^{+}	1.918	Marginally accepted
H5	FC	→	SU	0.105*	2.280	Accepted

Note: *** $p < 0.001$, *$p < 0.05$, $^{+}p < 0.1$

Hypothesis H1: PE has positive effect on BI is confirmed. Results of structured model indicate that PE is the most important component from the aspect of measurement of technology acceptance and usage. Through the direct influence on BI, PE also has an influence on SU.

EE, as second important component that has an effect on BI, proved itself as important in a way that if students expect that their usage of e-learning system will be clear and understandable, that they will not have to put a lot of effort and time to learn how to use the system, their intention to use e-learning system will be higher. Therefore, hypothesis H2: EE has positive effect on BI, is confirmed.

In the most cases, students are imposed to use the e-learning system because it offers them the materials which are necessary for them to pass the exam. In general, this shows that Faculty encourages, and of course, supports usage of e-learning system. Besides the Faculty initiative, influence of the people that students care about and influence of the Faculty colleagues are segments of the SI factor which, if is strong, leads to higher Behavioral Intention for e-learning. This conclusion resulted in the acceptation of the hypothesis H3: SI has positive effect on BI.

If we look at the conditions that have to exist so that students can use the system, we can claim that their existence will result with usage in higher percent. By conditions, we mean having necessary knowledge and resources and that the e-learning system is compatible

with other systems that students already use. Based on that, hypothesis H5: FC have positive effect on SU, is confirmed, but with the statistical significance at the borderline. Very important data, collected with the usage of descriptive statistics over the factor FC is that students rated every item of this factor with the mark 5. In other words, this means that all necessary conditions for system usage exist, but it does not have high influence on the final system usage.

The most important hypothesis H4: BI has positive effect on SU that indicate the relationship between BI and SU, has shown itself as a borderline statistically significant ($p < 0.1$), which is the result that is not in compliance with the results of other researches that examined this connection. This way, the weakness of this model is presented.

In order to find the answer to this question, descriptive statistics was done over the SU factor, with the aim to find out which items are mostly used. In this respect, items Quiz, Lessons, Marking of completed activities, Gradebook and Participants directory were proved as important for research. Firstly, conclusion is made that Lessons and Gradebook are items which creators of e-learning system expect from students to use, and from that aspect students' intention to use this system does not have important influence od final system usage since they have to use the system anyway.

On the other side, from the descriptive statistics we can see that the items Quiz, Marking of completed activities and Participants directory are mostly answered with the mark 1, which means that students rarely use these items, almost never. If we look at the real situation more closely, reason why the hypothesis H4 is at the edge of acceptance is obvious. Hypothesis H5 shows that even though resources for usage, as well as all the other conditions exist, that does not necessarily mean that students will use the e-learning system. Likewise, even though the results have shown that students mostly have a high positive intention to use system – over 70% of them, that fact does not insure us that they will actually use it. These conclusions lead to answer on the question why the relationship between BI and SU is weak. In most of the teaching courses we cannot find Quiz nor Marking of completed activities, or Participants directory. If these items do not exist within the courses which are part of e-learning system, students surely cannot use them, even if they have an intention to.

6 Conclusion

In this paper, research about the acceptance and usage of the e-learning system Moodle eLLab which is implemented at the Faculty of Technical Sciences, University of Novi Sad is done. For this purpose, UTAUT model was used.

Model that has been tested in this paper can be used to estimate the acceptance and usage of e-learning system and its influence on learning performance from the students' perspective. For example, developmental teams of e-learning systems, mostly professors, should use the simplicity of usage and easiness of understanding this system with the aim to increase the satisfaction of students and system usage. This estimation will enable Faculty to collect the feedbacks on efficiency of implemented information system. IT managers, whose job is to develop and use the e-learning system at the Faculty, can use the model to successfully undertake corrective measures for its advancement.

There are many different ways to make learning process better through using ICT in it (Stevanov et al. 2017; Lolić, 2018. p.58). On the basis of established relationship in the model, Faculty can estimate on which dimensions to pay attention with the aim to advance system acceptance and usage by the students. Also, if professors want to improve students' behavioral intention, they have to pay attention to what they offer to students when they offer them this system as an option for use.

Presented research can help in determination of improvement or degradation in the process of e-learning system implementation. Changes could be made in a few teaching courses, and the next step would be to analyze previous and new state, on both courses that had some changes and the ones that have not had it. This would be done with the aim to determinate the result of changes made over system.

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References

Abdekhoda, M., Dehnad, A., & Gavgani, S. J. (2016). Factors influencing the adoption of E-learning in Tabriz University of Medical Sciences. *Medical Journal of the Islamic Republic of Iran*, 30 (1).

Ayele, A., Birhanie, W. (2018). Acceptance and use of e-learning systems: the case of teachers in technology institutes of Ethiopian Universities, *Applied Informatics*, 5 (1), p. 1.

Chaka, J. G., & Govender, I. (2017). Students' perceptions and readiness towards mobile learning in colleges of education: a Nigerian perspective. *South African Journal of Education*, 37 (1).

Chen, H. J. (2012). Clarifying the empirical connection of new entrants' e-learning systems

use to their job adaptation and their use patterns under the collective–individual training environment. *Computer Education*, 58(1).

Chin, W. W. (1998). Issues and Opinion on Structural Equation Modeling. MIS Quarterly. *MIS Quarterly & The Society for Information Management*, 22 (1), 1-4.

Fishbein, M., & Ajzen, I. (1977). *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Addison-Wesley, Reading, MA.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). *Multivariate Data Analysis* (7th edition). Prentice Hall, p. 816.

Hassanzadeh, A., Kanaani, F., & Elahi, S. (2012). A model for measuring e-learning systems success in universities. *Expert Systems with Applications*, 39 (12), 10959–10966.

Jenkins, M., & Hanson, J. (2003) *E-learning Series: A Guide for Senior Managers, Learning and Teaching Support Network (LSTN).* Generic Centre, United Kingdom.

Lee, J.-K., & Lee, W.-K. (2009). The relationship of e-Learner's self-regulatory efficacy and perception of e-Learning environmental quality, *Comput. Human Behavior*, 24 (1), 32–47.

Lee, S.H. et al. (2005). Technical Trend of Location-Based Service. *Electronics and Telecommunications Trends*, 20 (3), 33-41.

Lolić, T. (2018). *Electronic learning – acceptance of the system and its contribution to the learning process* (In Serbian). Zadužbina Andrejević

Maldonado, U. P., Khan, G. F., Moon, J., & Rho, J. J. (2011). E-learning motivation and educational portal acceptance in developing countries. *Information & Knowledge Management.* 35 (1).

Marjanović, U. (2014). *The model of the collaboration system development and its impact on the organizational performance of the company* (In Serbian). PhD thesis, University of Novi Sad.

Marjanovic, U., Delic, M. & Lalic, B., (2016). Developing a model to assess the success of e-learning systems: evidence from a manufacturing company in transitional economy. *Inf. Syst. E-Bus. Manage.* 14 (2), 253-272.

Martín-Blas, T., & Serrano-Fernández, A. (2009). The role of new technologies in the learning process: Moodle as a teaching tool in Physics. *Computer Education*, 52 (1), 35-44.

Masa'deh, R., Tarhini, A., Mohammed, A. B., &Maqableh, M. (2016). Modeling Factors Affecting Student's Usage Behavior of E-Learning Systems in Lebanon. *International Journal of Business and Management*. 11(2).

Nunnally, J., & Bernstein, H. (1994). Psychometric theory. New York: McGraw-Hill.

Pallant, J. (2010). *SPSS Survival Manual 4th edition*.

Persico, D., Manca, S., & Pozzi, F. (2014). Adapting the Technology Acceptance Model to Evaluate the Innovative Potential of E-Learning Systems. *Computers in Human Behavior 30*. Elsevier Ltd: 614–22. doi:10.1016/j.chb.2013.07.045.

Romero, C., Ventura, S., & García, E. (2008). Data mining in course management systems: Moodle case study and tutorial. *Computer Education*. 51 (1), 368–384.

Schwartz, A., & Chin, W. (2007). Looking forward: toward an understanding of the nature and definition of IT acceptance. *Journal of the Association for Information Systems*. 8 (4).

Stevanov, B., Stefanovic, D., Anderla, A., Sladojevic, S., & Tasic, N. (2017). New Approach to Information System Engineering Study Program to Meet Industry Expectations. *International Journal of Engineering Education*. 33 (4).

Straub, D. (2012). Does MIS Have Native Theories? MIS Quarterly, *MIS Quarterly & The Society for Information Management*, 36 (2), 3–7.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics.* Boston: Pearson Education, Inc., p. 980.

Venkatesh, V., & Davis, F. D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Manage. Sci*. 46 (2), 186.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: toward a unified view. *MIS Quarterly*, 27 (3), 425-478.

Wang, Y. S., Wu, M. C., & Wang, H. Y. (2009). Investigating the Determinants and Age and Gender Differences in the Acceptance of Mobile Learning. *British Journal of Educational Technology*, 40(1), 92-118.

Weerasinghe, S. (2017). Technology Acceptance Model in the Domains of LIS and Education: A Review of Selected Literature, *Library Philosophy & Practice*, pp. 1-26.

Williams, M. D., Dwivedi, Y.K., Lal, B., & Schwarz, A. (2009). Contemporary trends and issues in IT adoption and diffusion research. *Journal of Information Technology*. 24 (1), 1-10.

Yakubu, M., Dasuki, S. (2018). Assessing elearning systems success in Nigeria: An application of the DeLone and McLean Information Systems Success Model, *Journal Of Information Technology Education*, 17(1), p. 182.