Education and Information Technologies (2019) 24:2341–2355
https://doi.org/10.1007/s10639-019-09869-4

Extension of technology acceptance model by using system usability scale to assess behavioral intention to use e-learning

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Received: 5 November 2018 / Accepted: 11 January 2019 / Published online: 1 February 2019

Abstract

This study examines the acceptance of technology and behavioral intention to use learning management systems (LMS). In specific, the aim of the research reported in this paper is to examine whether students ultimately accept LMSs such as eClass and the impact of behavioral intention on their decision to use them. An extended version of technology acceptance model has been proposed and used by employing one of the most reliable measures of perceived eased of use, the System Usability Scale. 345 university students participated in the study. The data analysis was based on partial least squares method. The majority of the research hypotheses were confirmed. In particular, social norm, system access and self-efficacy were found to significantly affect behavioral intention to use. As a result, it is suggested that e-learning developers and stakeholders should focus on these factors to increase acceptance and effectiveness of learning management systems.

Keywords Learning management system · Behavioral intention to use · Technology acceptance model · System usability scale · Partial least squares

1 Introduction

During the recent years, the development of information systems has been performed at a rapid pace. This ascertainment raises significant questions related to the acceptance of those systems. Technology Acceptance is defined as the willingness of a user to use the technology and tools which have been developed to support it (Teo 2011). A significant

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body of research unveils that users' intention to use a system is affected primarily by their perceived usefulness and ease of use toward it (Al-Gahtani 2016).

The use of e-learning technology is incontestably recognized as an important and integral part of the educational process. Considerable research studies are carried out in order to explain how effective, usable and acceptable the e-learning systems are. Several researchers examined factors which influence people to accept and use an information system (Altanopoulou and Tselios 2017; Fathema et al. 2015; Scherer et al. 2015). For these reasons, researchers of educational technology develop and elaborate different techniques and models to better understand these factors and to predict the success of the systems, thus consequently improving their design.

1.1 Literature review

1.1.1 Technology acceptance model (TAM)

One of the most widely accepted and reliable models to predict the intention to use a specific technology has been proposed by Davis et al. (1989). It is named Technology Acceptance Model (TAM) and it is estimated that explains on average the 40% of the variance in usage intention (Ajzen and Fishbein 1980; King and He 2006). The purpose of this theoretical framework is to examine and explain how and why users accept or reject a technology and specifically to investigate the impact of technology on users' behavior. The basic premise of its underlying psychology theory, named Theory of Reasoned Act (Ajsen & Fishbein, 1980), is that behavior is influenced by attitude of person toward this behavior, by the individual belief in relation to the result if he adopted it and by the evaluation of behavior (Davis 1993).

TAM is implemented by using a questionnaire in which the answers are provided in Likert scale, from strongly disagree to strongly agree. According, to the model there are two key factors in evaluation of acceptance and some others minor factors. These are the following (Fig. 1):

1. *Perceived Ease of Use:* Davis et al. (1989) defines perceived ease of use as "the degree to which a person believes that using a particular system would be easy, that it requires no effort".

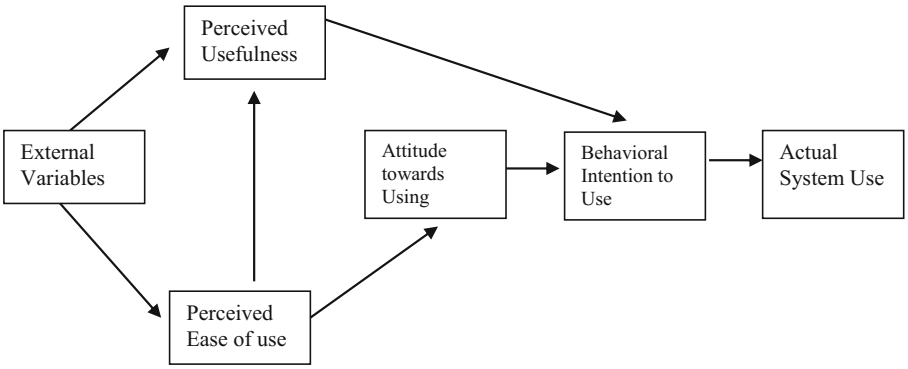

Fig. 1 Original technology acceptance model proposed by Davis et al. (1989)

2. *Perceived Usefulness:* Defined as "the degree to which a person believes that using a particular system would enhance his performance on the job Davis et al. (1989)."A system with high perceived usefulness is one for which the "user believes that there is a positive correlation between the use and performance".
3. *External Variables:* affect perceived ease of use and perceived usefulness and can be identified as external incentives associated with the system design and could be different for each system (Davis 1993).
4. *Attitude towards Using:* it is related to the evaluation of the system by the user and his attitude towards the use, this configures the user's intention to a possible use of the system.

Venkatesh and Davis (2000) investigated model enhancement by adding more parameters. The new model, named TAM2, incorporated several other factors namely subjective norm, job relevance, output quality, result demonstrability in addition to perceived ease of use and perceived usefulness.

The TAM model has been used and extensively validated in many relevant studies and is widely adopted due to the simplicity which characterizes it (Hsu and Chang 2013). It can be used as a tool in various environments such as in IT sector for evaluation and investigation of information systems or new products, in distance learning to test users' acceptance and more specifically in platforms which are used not only for learning purposes but also in marketing and sales such as purchases over the internet and internet banking.

A considerable body of research focused on the factors which influence the learners' intention to use e-learning in academic environment and how these influences can be explained. The study of e-learning acceptance conducted by Al-Gahtani (2016) took place in Saudi Arabian university and as participants were 286 students from 6 colleges. The results showed that most of hypothesis of TAM were supported so it is suggested that better organizational e-learning management can lead to greater acceptance and effective utilization.

Nikou and Economides (2018) attempted to investigate science technology and mathematics teachers' intention to use mobile-based assessments in the teaching environment. This study proposes an extended TAM based on teachers' acceptance mobile-based assessment (TAMBA) model by introducing some more variables such as individual, social, institutional and instructional design factors. The sample of this study was 161 STEM teachers from 32 European countries and the most important result was the effect that the perceived ease of use had to the teachers' intention to use mobile-based assessment.

Studies on teachers' acceptance and use of information and communication technology (ICT) have revealed that perceived usefulness is a a crucial determinant for integrating ICT in classrooms (Scherer et al. 2015). The interest of the research focused on teachers' perceived usefulness of ICT for learning and teaching. The participants were 1190 teachers of Norway and the aim was to explain the relations between self-efficacy, ICT use and teachers' age. They found positive relations between self-efficacy and ICT use and a negative relation with teachers' age.

Park (2009) used an extended TAM model in a study conducted in Korea. As a sample consisted of students from the country's university who had attended at least one course e-learning. The interest of the research focused on investigating the acceptance e-learning

course and what factors affect the final acceptance of such courses by students. It turned out that self-efficacy was the factor that most affects the behavioral intention followed by social influence, which explains through the incentive theory of students who have a major influence on whether he will use a course e-learning.

Moreover, Yueh et al. (2015) examined the factors that could influence students' use of wikis. Their model included six factors: performance expectancy, effort expectancy, social influence, facilitating conditions, behavioral intention of continued use and actual use. What they found was that effort expectancy affects the actual use of wikis. Furthermore, social influence and the actual use of wikis had a positive impact on students' use.

Moreover, Dasgupta, Granger and Mcgarry (2002) attempted to investigate the user acceptance of electronic collaboration technology by using a courseware management tool. For the purpose of the study they used an extended TAM and took part 62 students who had attended at three courses and used this tool in one semester. The findings indicated that perceived usefulness had as a positive impact on perceived usefulness instead of usefulness, in turn, has a negative relationship with system usage. In addition, system usage could influence student performance in the course.

Based on TAM another related study (Hsu and Chang 2013) took place in Taiwan, which purpose was to investigate the acceptance of Moodle by using an extended TAM. In this study, another factor was added as an external variable, namely the perceived convenience. In this study participated 47 college students and 35 senior high school students. The findings showed that perceived convenience could affect perceived usefulness and attitude toward using Moodle and add to this, perceived usefulness affected attitude toward using Moodle.

Liaw (2008) examined learners' satisfaction, behavioral intentions, and effectiveness of the Blackboard e-learning system attempting to investigate why it dissatisfied some learners. He collected responses from 424 university students and used an integrated TAM based on social cognitive theory and theory of planned behavior. The findings suggest that there was a significantly correlation between behavioral intention of students to participate in e-learning and effectiveness of e –learning, perceived self-efficacy is the most important factor that affect learners' satisfaction with the Blackboard e-learning system, and perceived satisfaction and effectiveness could be affected by behavioral intention towards the use of e-learning.

Another study that based on TAM and LMS (Fathema et al. 2015) examines how members' beliefs and attitudes influence their intention and actual use of LMSs under conditions of non-mandatory use of LMSs in higher education institutions. The sample consists of 565 teaching assistants and professors. The study results proved that the three variables system quality, perceived self-efficacy and facilitations conditions were significant predictors of faculty attitude towards LMSs.

Sun et al. (2008) investigated the factors affecting user satisfaction in e-learning because it is shown that many users abandon their online learning after their initial experience. An integrated TAM was proposed. 295 students from Universities of Taiwan participated. The results demonstrated that learner computer anxiety, instructor attitude toward e-Learning, e-Learning course flexibility, e-Learning course quality, perceived usefulness, perceived ease of use, and diversity in assessments are the factors affecting learners' perceived satisfaction. The obtained results could substantially aid the institutions of e-learning environments to improve the effectiveness of e-learning systems as well as the learner's satisfaction.

1.1.2 System usability scale (SUS)

System Usability Scale questionnaire (SUS, Brooke 1996) is considered one of the most reliable and valid questionnaires to measure users' perceived usability. The questionnaire comprises just 10 questions / statements which are rated by respondents on a 5-point scale ranging from "strongly disagree" to "strongly agree." The final score ranges from 0 to 100.

Nowadays use of SUS is widespread due to several advantages which characterize it (Bangor et al. 2008). It is technology agnostic. As a result, it can be used to evaluate any type of interactive technology, the short length of time required to complete, it can be filled by any user without specialist knowledge. Last but not least it is provided without any charge (Bangor et al. 2008). Moreover, one of the key features is its reliability even with a small sample (12–15 persons, Tullis and Stetson 2004).

A study conducted by Ayad and Rigas (2010) was performed to evaluate the usability of educational entertainment in e-learning using the SUS instrument. The research involved assessment of three systems, Virtual Classroom, Game-based and Storytelling in terms of users' performance the correct answers provided by them and their satisfaction. The students completed the SUS questionnaire and the findings showed that the game-based platform was the best compared to the other two as far as users' performance, their perceived usability and their overall learning experience were concerned.

In the Greek context, the study conducted by Orfanou et al. (2015) investigated SUS applicability in learning management systems (LMS), while simultaneously examined and validated the Greek translation of the SUS questionnaire (Katsanos et al. 2012). Then, it investigated the effects of SUS in relation to various factors, such as gender and age. The survey involved 771 students in total across 11 studies. The LMSs under evaluation were eClass and Moodle which were the systems used in courses of their curriculum. It has been demonstrated that the SUS questionnaire is a valid usability assessment tool for LMS's. Furthermore, it has been demonstrated that the Greek version is valid and reliable (Orfanou et al. 2015).

Other notable TAM modifications proposed in the literature have also employed SUS (Altanopoulou and Tselios 2017). This study investigated intention of undergraduate students to use wiki technology. A TAM extension has been used by taking into account not only students' wiki perceived utility and usability but also Big Five personality characteristics, Social Norms and Facilitating Conditions. Students' beliefs before (pre-wiki scenario) and after (post-wiki scenario) the actual use of the wiki system were also investigated.

2 Goal of the study

This paper examines the acceptance of technology and behavioral intention to use a learning management system (LMS). More specifically, the aim of this paper is to examine whether students ultimately accept and use eClass educational system and the overall effect of behavioral intention to use it. EClass is the LMS used in the University of Patras (and in most, if not all, Greek higher education institutes). It has been selected because: a) we had access to a wide variety of courses, and b) we wanted to have benchmark data for its perceived acceptance. Our framework is inspired by the research and the accompanied model developed by Park (2009). SUS has been adopted, given

its widely adoption and robustness to extend appropriately the beforementioned model developed by Park (2009). Thus, the following hypotheses were formed:

H1. University students' behavioral intention (BI) to the use of eClass is affected by their attitude (AT), perceived usefulness (PU), perceived ease of use (PE), e-learning self-efficacy (SE), social norm (SN), system accessibility (SA) and year (Y).
H2. University students' eClass attitude (AT) is influenced by their perceived usefulness (PU), perceived ease of use (PE), e-learning self-efficacy (SE), social norm (SN), system accessibility (SA) and year (Y).
H3. University students' perceived usefulness (PU) of eClass is affected by their perceived ease of use (PE), e-learning self-efficacy (SE), social norm (SN), system accessibility (SA) and year (Y).
H4. University students' perceived ease of use (PE) of eClass is impacted by their e-learning self-efficacy (SE), social norm (SN), system accessibility (SA) and year (Y).

2.1 Research method

The present study was carried out in two phases; the pilot and the main study. The pilot phase was designed to determine whether the developed tool is effective tool and to iteratively amend any potential errors. The proposed extension of the Technology acceptance Model comprised a total of 8 variables namely year, self-efficacy, perceived usefulness, perceived ease of use, system access, social norm and behavioral intention to use in order to examine how students ultimately accept or not educational technologies such as eClass and what effect these variables do have on the acceptance of the technology. For this reason, a theoretical model is constructed which is based on the model proposed by Park (2009). However, in our model perceived ease of use is measured by adopting SUS questionnaire (Brooke 1996) since it is characterized by several advantages (Bangor et al. 2008) and is nowadays considered as the de facto standard to measure perceived usability.

2.2 Participants

The sample comprised students of the Department of Educational Sciences and Early Childhood Education of the University of Patras, who used the eClass platform (Fig. 2) in various courses throughout all years of their studies. This study was carried out from 31/10/2016 to 11/11/2016. 345 students (330 females, 15 males) aged 18–51 (mean = 20.8, SD = 4.8) years participated in the study. 164 participants were first-year students, 47 attended the second year of their studies, 36 the third year, 35 the fourth year, 22 the fifth and above. In addition, 41 participants were master students of the department.

2.3 Materials

For the implementation and the distribution of the survey the Google Forms service has been used. Data analysis was performed using the SmartPLS software version 3 (Ringle et al. 2005), Google Sheets and SPSS version 21.

Participants

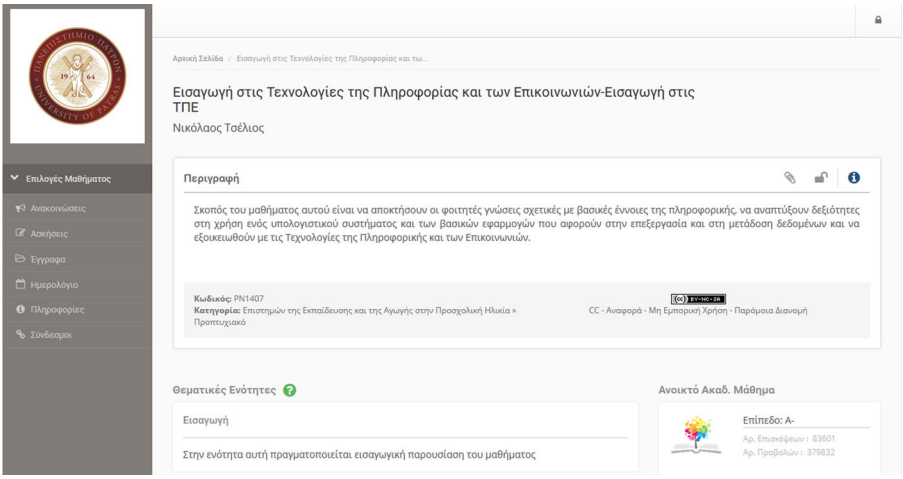

Fig. 2 The eClass-based system for the course entitled *Introduction to ICT*

2.4 Procedure

The participation in the study was voluntary and there was not any motivation for participation. The completion of the questionnaire took place in courses, and in particular in their laboratory section, and in the official Facebook group page of the department. In particular, one of the authors explained the goals of the study while introducing the questionnaire in the students. Afterwards the students used the computers of the computer laboratory to fill out the questionnaire. The process lasted approximately 20 min. In the department's Facebook group page, a suitable post asked

Table 1 Summary of construct loadings

Item	Loading	Item	Loading
PE_4	0.858	PU_1	0.863
PE_5	0.704	PU_2	0.857
PE_6	0.718	PU_3	0,790
PE_7	0.707	AT_1	0.852
PE_8	0.720	AT_2	0.809
PE_9	0.698	AT_3	0.799
PE_10	0.737	BI_1	0.834
PE_11	0.615	BI_2	0.892
PE_12	0.731	SE_1	0.852
PE_13	0.721	SE_2	0.840
SA	1	SN_1	0.821
Y	1	SN_2	0.808
		SN_3	0.732

Table 2 Discriminant validity

	AT	BI	Y	PE	PU	SE	SN	SA
AT	0.820							
BI	0.504	0.863						
Y	0.006	0.049	0.857					
PE	0.436	0.461	0.303	0.653				
PU	0.627	0.484	−0.029	0.410	0.38			
SE	0.326	0.352	0.246	0.545	0.282	0.753		
SN	0.447	0.515	0.241	0.632	0.414	0.390	0.846	
SA	0.587	0.515	−0.040	0.411	0.630	0.329	0.425	0.788

the - approximately 2000- members to participate. To avoid the possibility of participating twice in the study, the students were asked to fill in their student id.

2.5 Survey instrument

The questionnaire mainly comprises closed-ended multiple choice questions and its objective is to assess the acceptance of a learning system. It comprised 27 questions or statements related to the proposed model. In addition, it contained demographic questions, such as gender, age, year of study, high school major, and average score. More specifically, it contains questions about the acceptance of the eClass platform, based on the questionnaire proposed by Park (2009), the questions which are based on the key variables of an extended TAM with appropriate configuration factors for e-learning and finally responses to the systems are given in Likert scale.

3 Results

The obtained data were analyzed by using the Partial Least Squares path modeling method. The method includes the construction of two models: the measurement and the structural equation modeling (SEM) in conjunction with the limited requirements

Table 3 Heterotrait-monotrait ratio of correlations (HTMT)

	AT	BI	Y	PE	PU	SA	SE	SN
AT								
BI	0.698							
Y	0.078	0.064						
PE	0.509	0.600	0.354					
PU	0.814	0.663	0.092	0.479				
SA	0.370	0.433	0.246	0.575	0.318			
SE	0.649	0.813	0.314	0.860	0.600	0.504		
SN	0.802	0.745	0.116	0.519	0.841	0.400	0.654	

Table 4 Reliability (α, AVE, Composite Reliability)

	Cronbach's Alpha (α)	rho_A	Composite reliability	Average Variance Extracted (AVE)
AT	0.758	0.759	0.861	0.673
BI	0.722	0.750	0.854	0.745
Y	1.000	1.000	1.000	1.000
PE	0.746	0.758	0.856	0.665
PU	0.786	0.786	0.876	0.702
SA	1.000	1.000	1.000	1.000
SE	0.715	0.710	0.834	0.716
SN	0.699	0.705	0.830	0.620

arising on the sample size (Chin 1998) based on the analysis performed. The Partial Least Squares method is appropriate when the sample is small and when the distribution is asymmetrical (for example a group with many women). The technique is a modeling method of complex relationships and can be considered as an extension of the regression and factor analysis, but which also addresses the relationship of one or more dependent variables, and between two or more independent variables. More specifically, it analyzed the relations and influences between variables and loadings based on the model. The types of analysis performed were the Exploratory and Confirmatory multivariate analysis.

3.1 Measurement model

Validity and reliability were tested for the data. All loadings had a value above 0.7 except PE_11 which was 0.615 (Table 1).

Discriminant validity: results from the correlations between the variables are shown in Table 2, according to the Fornell-Larcker criterion.

Table 5 VIF among factors

	AT	BI	Y	PE	PU	SA	SE	SN
AT		1.947						
BI								
Y	1.175	1.179		1.139	1.169			
PE	1.583	1.592			1.582			
PU	1.747	2.027						
SA	1.411	1.419		1.281	1.406			
SE	1.601	1.638		1.404	1.540			
SN	1.856	1.970		1.325	1.359			

Table 6 VIF among items

PE_4	1.762	AT_1	1.833	SE_1	1.23
PE_5	1.834	AT_2	1.656	SE_2	1.23
PE_6	1.275	AT_3	1.366	SN_1	1.388
PU_1	1.951	BI_1	1.323	SN_2	1.433
PU_2	1.895	BI_2	1.323	SN_3	1.277
PU_3	1.413	E	1	SA_1	1

In addition, Henseler et al. (2015) developed an additional criterion for discriminant validity, namely the "heterotrait-monotrait ratio of correlations" (HTMT), shown in Table 3. This criterion accepted values of less than 0.90 and substantially is a correlation estimate between two variables.

For the purpose of this study, a reliability analysis has been performed by using 2 tests. Cronbach Alpha (a) in all variables was found to be above 0.70 except social norm in which value is quite close 0.699 therefore it could also be considered as satisfactory. In addition to that, a second test called Average Variance Extracted (AVE) should unveil values more than 0.50 for each variable. Based on the data obtained in this assessment, it was found that the recommended levels of AVE values belong to the interval from 0.67 to 1 (see Table 4).

The VIF index is used to describe the strength of the correlation between model parameters which has been developed. The acceptable limits to be considered as a satisfactory correlation range from 1 to 5 (Zuur et al. 2010). It was found that all

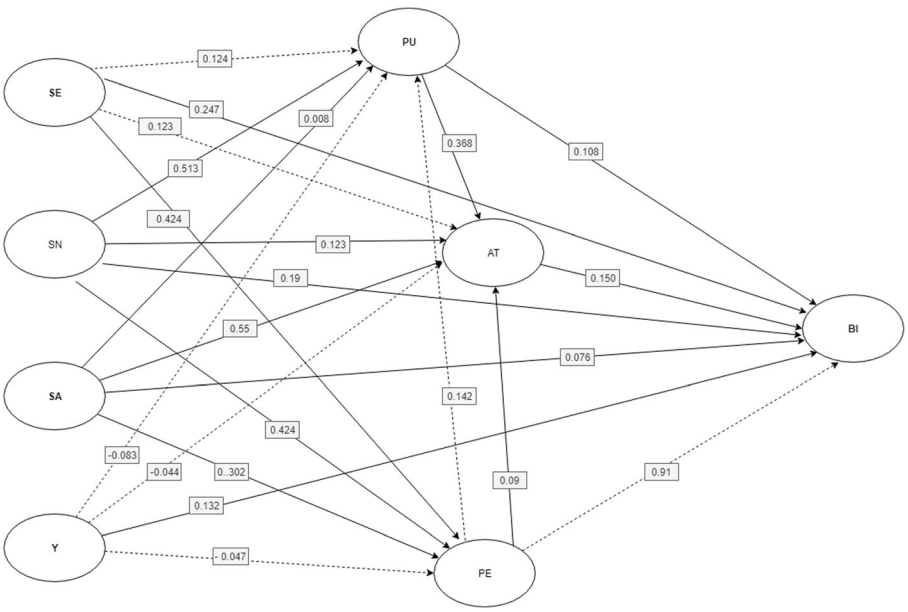

Fig. 3 Structural model of behavioral intention

correlations, that is the correlations between variables and between questions of each variable, are within the acceptable intervals (see Table 5 and Table 6).

4 Structural model

In order to realize the model (see Fig. 3), the bootstrapping technique was applied (two-tailed test) as well as the examination of t-statistics values (significance level $p < 0.05$ and t-statistics >1.96). With respect to the data obtained, it was found that eventually the majority of relationships are statistically significant with strong effects. The comparison of the results obtained in the present study and the study conducted by Park (2009) are summarized in Table 7.

As far as behavioral intention is concerned, five hypotheses were confirmed. In specific perceived usefulness, system access, social norm, attitude to eClass and self-efficacy have statistically significant effects. The hypotheses for year and perceived ease of use were not supported. In particular, the effects of self-efficacy (0.247) and social norm (0.19) were very strong. On the contrary, the effect of system access was rather weak (0.076).

Table 7 Parameter estimates, *t*-value, results of hypotheses and comparison of the current research and the results reported by Park (2009)

	Direct effect	t-value	Indirect effect	Total Effect	*p*	Result of hypothesis	Park (2009)
AT- > BI	0.150	2.350	–	0.150	*0.019*	Supported	Supported
Y- > AT	−0.044	1.261	0.015	0.056	0.208	Not supported	N/A
Y- > BI	−0.047	1.151	0.018	−0.051	0.250	Not supported	N/A
Y- > BI	0.132	3.464	–	0.132	*0.001*	Supported	N/A
Y- > PU	−0.083	1.498	0.002	−0.065	0.135	Not supported	N/A
PE- > AT	0.09	2.196	−0.004	0.142	*0.029*	Supported	Supported
PE- > BI	0.91	1.723	0.009	0.127	0.086	Not supported	Not supported
PE- > PU	0.142	1.921	–	0.142	0.055	Not supported	Supported
PU- > AT	0.368	6.826	–	0.368	*0.000*	Supported	Supported
PU- > BI	0.108	2.179	0.06	0.163	*0.030*	Supported	Not supported
SE- > AT	0.123	1.758	0.090	0.228	0.079	Not supported	Not supported
SE- > BI	0.247	2.172	0.053	0.340	*0.030*	Supported	Supported
SE- > PE	0.424	5.018	–	0.424	*0.000*	Supported	Supported
SE- > PU	0.124	0.838	−0.003	0.184	0.403	Not supported	Supported
SN- > AT	0.246	3.508	0.09	0.454	*0.000*	Supported	Supported
SN- > BI	0.19	5.448	0.053	0.328	*0.000*	Supported	Supported
SN- > PE	0.137	7.556	–	0.137	*0.000*	Supported	Not supported
SN- > PU	0.513	3.057	−0.002	0.532	*0.002*	Supported	Supported
SA- > AT	0.55	8.632	0.039	0.101	*0.000*	Supported	Not supported
SA - > BI	0.076	5.468	0.018	0.124	*0.000*	Supported	Supported
SA- > PE	0.302	2.806	–	0.302	*0.005*	Supported	Supported
SA- > PU	0.008	8.647	−0.003	0.051	*0.000*	Supported	Not supported

P-values less than 0.05 are italicized

Regarding the effects of the parameters on attitude to eClass, it was found that four hypotheses were supported, compared with the model provided by Park (2009) which supported three. Precisely, the hypotheses which were confirmed to have significant effects are perceived usefulness, system access, social norm and perceived ease of use. In contrast, the underlying assumptions for the year and self-efficacy were not verified. Perceived usefulness (0.308) and social norm (0.246) had particularly strong influence on attitudes towards eClass, whilst system access did not have such a strong effect (0.055).

As far as perceived usefulness is concerned, it has been found that several hypotheses were confirmed. In specific system access and social norm are proved to have statistically significant effects, whereas this does not apply to the underlying assumptions for students' year, self-efficacy and perceived ease of use, all of which had minor, insignificant effects. A strong effect was established with social norm (0.513), which is by far the largest in this model, while the effect of system access is insignificant, reaching only (0.008).

Finally, all effects on perceived ease of use were validated (year, self-efficacy, system access and social norm) with those of self-efficacy (0.424) and system access (0.302) having stronger effect, while that of year was not that strong (0.132). The index values (R2) for each of the dependent variables are ranging from 0.53 up to 0.71 (AT: 61.7%, BI: 70.9%, PE: 52.8%, PU: 55.3%). Thus, it is indicated that the percentage of the dependent variable explained by behavioral intention is quite high with 70.9%.

5 Conclusions

In this paper, the assessment of acceptance and behavioral intention to use LMS using a modified version of TAM has been examined. It was found that the factor of self-efficacy appeared to have a significant impact not only on perceived ease of use, but also on behavioral intention. Furthermore, it should be stressed that this finding was put forward by Park (2009) who came to the conclusion that this factor affects behavioral intention the most, an effect which is also supported by the original TAM theory (Venkatesh and Davis 2000). One possible explanation for the influence of self-efficacy could be given through incentive theory (Bandura 1994) and the theory of intrinsic motivation, which support that higher self-efficacy leads to better results in the learning process and in this case, the use of the eClass. Therefore, self-efficacy is related to behavioral intention to use as well as to perceived ease of use of the eClass platform. On the contrary, there are is no statistically significant relation between self-efficacy and attitude towards eClass and perceived usefulness.

Perceived usefulness has statistically significant effects on both attitude towards eClass and behavioral intention to use. More specifically, in agreement with the TAM theory, perceived usefulness was proved to affect behavioral intention an ascertainment which was not verified in the study conducted by Park (2009). This may be attributed to the fact that in Korea, students are already familiar with using the Internet in their daily life and, as a consequence, their familiarization with it is a great facilitator in their academic life, while in Greece the use of educational technologies and specifically the use of LMS constitutes a rather novel practice for students who are not fully accustomed to using them while learning a specific subject. Moreover, this study proves that perceived usefulness influences attitude towards eClass, an effect which is also supported in the study conducted by Park (2009).

As far as social norm is concerned, it appears to have statistically significant effect on behavioral intention to use, attitude, perceived ease of use and perceived usefulness. Social influence can affect the way users accept a technology and shape their behavior towards it (Grandon et al. 2005). This ascertainment has also been reported by Park (2009) who confirmed statistically significant effects between social norm and attitude, behavioral intention to use and perceived usefulness. As mentioned previously, social factors affect significantly students in Korea, because in this country, everybody is encouraged to use educational technologies in education.

In Greece, confirmation of these relationships may be explained by the model of modern society, in which technologies play a significant role. Besides this, the fear of exclusion from social environment in case where someone is not technology literate is a factor which plays an important part in young people's behaviors. Subsequently, young people encourage each other to use educational technologies either because they influence each other, or because they do not want to be regarded as 'digitally illiterate', or because they believe that it is this approach will help themselves in their future career path.

System access found to have a significant mediation effect among behavioral intention, attitude, perceived ease of use and perceived usefulness. The findings for this factor differ with those reported by Park (2009) since the only relationship confirmed was with perceived ease of use. In South Korea, a modern web infrastructure has been already developed, thus being very common to students in universities. In consequence, they do not worry about system access, since they know that the appropriate facilities are widely available. However, in Greece, technology dissemination is less developed in comparison to South Korea and this is ascribed to the fact that system access plays an important role in technology acceptance as well as in shaping perceptions about the technology.

Moreover, the effect of attitude towards behavioral intention effect was confirmed, further verifying Park's ascertainment, as the attitude of students to educational technology can shape behavior towards it and eventually lead them to accept it or not. Lastly, the factor of student's academic year, which was introduced for examination in this study, was found to be affected only by perceived ease of use at a significant level. This can be interpretable by the degree to which a person believes that the eClass will be easy το use is influenced by their age, and their accumulated experience with the LMS technology, a finding which is in line with the findings reported by Orfanou et al. (2015).

Moreover, it has been shown that perceived ease of use has statistically significant effect on perceived ease of use and attitudes towards eClass. This effect was also found by Park, as it can be explained through TAM theory, as based on how easy the students believe the system use is, students can accordingly shape an attitude to it altogether. To summarize, the findings were:

H1: According to the analysis, behavioral intention to use is greatly affected by social influence and system access but also by perceived usefulness, self-efficacy and perceived ease of use. However, students' academic year was not found to influence behavioral intention to use eClass.

H2: The factor of attitude towards eClass was found to be mainly influenced by system access and then social influence and perceived usefulness but seemed not to be influenced by students' academic year and perceived ease of use.

H3: University students' perceived usefulness of eClass is affected mainly by social norm and system accessibility. However, the effects of perceived ease of use, e- self-efficacy and students' academic year was not supported.
H4: Finally, the hypotheses about students' perceived ease of use were supported. It was found to be affected by students' e-learning self-efficacy, social norm, system accessibility as well as the academic year.

Moreover, the conclusions underline the usefulness of this research in the educational process. The reported findings could help those who develop or manage specific learning management systems, since they provide important information as to whether students accept or not such systems and their intention for future use. For this reason, teachers and those engaged in the field of LMS should pay attention to factors related to the explanation of behavior and intention of such systems. Moreover, based on the findings of the reported research, e-learning stakeholders could identify both pre-implementation and post-implementations interventions which maximize students' acceptance and use.

This study is not without limitations. The sample consisted of a single student population with certain characteristics. Thus, participants from other departments and universities located in Greece could participate in order to collect more representative data. Other learning management systems should be also investigated, thus enabling a systematic comparison between them. Finally, these factors could be considered in relation to some characteristics of participants, i.e. using the Big Five Personality Test (Rothmann and Coetzer 2003). However, a deeper understanding of all learners' cognitive strategies and information processing behaviors is required to provide a suitable information architecture that promotes the learning process (Altanopoulou et al. 2015; Katsanos et al. 2008; Tselios et al. 2002; Tselios and Avouris 2003).

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