# Assessing the acceptance of a blended learning university course

**Nikolaos Tselios, Stelios Daskalakis and Maria Papadopoulou**
ICT in Education Group, Dept. of Educational Sciences and Early Childhood Education
University of Patras, 26500 Rio, Patras, Greece // nitse@ece.upatras.gr // stdask@nurs.uoa.gr // marpapado@upnet.gr

**ABSTRACT**

Usefulness and ease of use proved to be key determinants of the acceptance and usage of e-learning. On the contrary, little is known about students' perceptions in a blended learning setting. In this paper, a TAM based model was constructed, in order to investigate Greek university students' attitudes toward blended learning. The goal of the study was twofold. First, to investigate whether the students' perceptions in a blended learning setting were comparable with other studies reporting perceptions in the context of distant learning. Second, to investigate variation in students' perceptions before and after actual system use. A sample of 130 students before actual system use and 102 students after the end of the semester was used. As derived from the model analysis using partial least squares, the e-learning system was well accepted and the majority of our hypotheses were confirmed. The most notable difference between pre- and post- use scenario was that perceived usefulness did not prove to have a significant effect on behavioral intention before system use, whereas, in the end, it appeared to be significant. The results are compared with similar studies focused on e-learning acceptance. The implications, both for the designer of a blended learning course as well as for the educational community are discussed.

**Keywords**

Technology adoption, technology acceptance model, blended learning, perceptions, usefulness, ease of use, e-learning, partial least squares.

## Introduction

During the recent years, a significant volume of research on the effective use and integration of Information and Communication Technologies (ICT) in education practices is observed. The main feature that differentiates the e-learning systems from the 'traditional' learning environments is the degree of technology usage and the gradual shift of control and responsibility of the learning process to the learners, giving them the opportunity to learn anytime, anywhere. This shift of control seems to positively influence the learning effectiveness of learners (Chou & Liu, 2005). In this context, sociocultural theories influence considerably the learning procedure and have strengthened the perceptions of the educational community towards adoption and effective integration of open and distance learning (ODL) systems in the educational process (Duffy & Kirkley, 2004).

In the latter, a series of important questions emerge, mainly related to the study of the appropriate teaching methods, the effective design of the technological infrastructure and the appropriate design of the interaction of students with the e-learning platform (Duffy & Kirkley, 2004, Soloway, Guzdial, & Hay, 1994, Tselios, Avouris, Dimitracopoulou, & Daskalaki, 2001; Tselios, Katsanos, Kahrimanis, & Avouris, 2008a; Tselios, Avouris, & Komis, 2008b). The last dimension depends largely on the earlier representations, attitudes and perceptions of the learning community's members. In particular, students' personal beliefs and attitudes towards web-based education constitute a critical factor to the successful incorporation and adoption of such systems in the learning practices of an institution. Not surprisingly, an increasing number of studies have examined various factors that influence users' attitudes towards using an e-learning system (Liaw, 2008; Liaw, Huang, & Chen, 2007; Lin, 2007; Selim, 2003; Ong & Lai, 2006; van Raaij & Schepers, 2007). The *technology acceptance model* (TAM, Davis 1989), adapted from the *theory of reasoned action* (TRA, Fishbein, 1980), has been used as the theoretical basis for many empirical studies of user technology acceptance (Behrens, Jamieson, Jones, & Cranston, 2005; Loukis, Georgiou, & Pazalos, 2007; Ngai, Poon, & Chan, 2007). According to TAM the acceptance of an e-learning system could be assessed by examining the perceived *usefuleness* and *ease of use*. Davis (1989, p. 320) defined perceived usefulness as '*the degree to which a person believes that using a particular system would enhance his/her job performance'*. Perceived ease of use is defined as '*the degree to which a person believes that using a particular system would be free of physical and mental effort*' ( Davis, 1989, p. 320).

Venkatesh and Davis (1996) observed that computer self-efficacy acts as a strong predictor of perceived ease of use both before and after actual system use. However, measured systems' usability was found to be a predictor of perceived ease of

use only after direct experience with a system. As a result, they concluded that users based their perceptions regarding ease of use on computer self-efficacy before hands-on system use. Usability was also found to be a fundamental factor towards success and adoption of an e-learning system (Liaw, 2008). However, e-learning is relatively new and electronic learners constitute a stakeholder group with specific characteristics. In addition, e-learning has fundamental differences compared to typical productivity software (Soloway et al., 1994). Thus, existing variables of TAM cannot fully reflect learners' motives, requiring an investigation for additional intrinsic motivation factors. The learners are not domain experts, therefore cannot assess precisely the utility of an e-learning system. Furthermore, even the learners' motivation to learn should not be taken for granted (Soloway et al., 1994). The latter was investigated by Roca & Gagne´ (2008) which examined the relationships between Self Determination Theory (Ryan & Deci, 2000) and TAM factors. Their model used perceived autonomy, perceived competence and perceived relatedness as determinants of perceived usefulness, perceived playfulness and perceived ease of use. The major implication of their study is that those factors contribute to the learning process while also *"when individuals participate in an event or task because it is interesting and enjoyable, they show more engagement in the activity*" (Roca & Gagne´, 2008, pp. 1599).

Ong, Lai, and Wang (2004), by using an extended model of TAM and taking into account the dimension of perceived credibility, showed that computer self-efficacy has a significant effect on behavioral intention to use e-learning. In addition, Ong and Lai (2006) surveyed 67 female and 89 male employees in Taiwan to examine influence of gender differences towards e-learning acceptance. They found that men's perception of perceived usefulness was more significant and more salient than womens' in determining behavioral intention to use e-learning. In addition, they observed that mens' rating of perceptions with respect to computer self-efficacy, perceived usefulness, perceived ease of use, and behavioral intention to use e-learning are higher than womens'. In addition, they report that computer self-efficacy and perceived ease of use were more salient to women. As the findings from Ong and Lai (2006) research suggest, e-learning may be perceived differently by women and men. Sun, Tsai, Finger, Chen, and Yen (2008), proposed a model comprised of 6 dimensions: learners, instructors, courses, technology, design, and environment. A related questionnaire comprised of 13 variables was completed by 295 participants. According to the results reported in Sun et al. (2008) using stepwise multiple regression analysis, 66,1% of the perceived e-learner satisfaction variance can be explained by the following variables: learner computer anxiety, instructor attitude toward e-learning, e-learning course flexibility, quality, perceived usefulness, perceived ease of use, and diversity in assessments. Furthermore, it seems that familiarity with Internet usage is a strong positive predictor of the ODL's acceptance (Liaw et al., 2007).

Surprisingly, despite the increasing number of studies related to e-learning acceptance, little research has been done in the context of blended learning (Pituch & Lee, 2006, Keller, Hrastinski, & Carlsson, 2007; Park, 2009). The concept of blended learning provides the opportunity to integrate the advances offered by online learning with the best practices and benefits of traditional learning. Preliminary findings suggest that in general the learners' perceptions of ODL as a means of distant learning are no different than the learners' perception of ODL as a complementary tool for teaching a lesson in the context of a blended learning (Pituch & Lee, 2006). However, students' attitudes towards usage were substantially affected by the perceived functionality of the system (Pituch & Lee, 2006). In addition, there is a need to conduct studies in various countries to investigate possible cultural and individual differences as well as different educational approaches and goals. For instance, Teo, Lim, and Lai (1999) examined perceived ease of use, enjoyment, and usefulness using TAM related to the World Wide Web in Singapore. Their results found to be consistent with TAM applications in North America. However, Park (2009) in a similar study in higher education of South Korea found that neither perceived usefulness nor perceived ease of use had a significant direct effect on behavioral intention to use e-learning. This result, according to Park (2009), is possibly explained due to high internet skills and self-efficacy of Korean students, which is not always the case in other countries. Moreover, Keller et al. (2007) conducted cross-cultural study exploring the implementation of e-learning environments in the frame of a master course in public health education offered in Sweden and Lithuania. They report that "*Lithuanian students were found to experience a substantially higher degree of acceptance of e-learning environments than Nordic students at the Swedish university*" (p.395). In addition, the study findings of Keller et al.(2007) revealed that "*Lithuanian male students experienced a lower degree of perceived usefulness of the e-learning environment than Lithuanian female students*". Keller et al. (2007) emphasize on the key role of "*cultural and organizational*" aspects towards acceptance of e-learning initiatives from students (Keller et al., 2007, p.395).

Given the fact that little is known about students' perceptions in a blended learning setting, especially in the context of Greek higher education, a relative study was designed. The goal of the study was to validate the original TAM in a blended learning setting, by using an open-source e-learning technology platform, Moodle (www.moodle.org). The goals of the study were (a) to investigate whether the students' perceptions on the use of course websites in a university course offered in a blended learning setting were comparable with other studies reporting perceptions in the context of e-learning and (b) to investigate

variation in students' perceptions before and after actual system use. It is argued that examination of students' views about specific blended learning approaches could support effective course and learning technology redesign.

The rest of the paper is organized as follows. First, a detailed discussion on the theoretical framework adopted and the procedure is presented, followed by description of the results obtained. Subsequently, the results are discussed. It is argued that the findings of the presented study will provide a deeper understanding of the critical factors leading to an effective and efficient adoption of e-learning systems in the frame of blended learning.

## Method

### Theoretical framework and hypotheses

The research framework of the study was based on the technology acceptance model (TAM), as formulated and proposed by Davis (1989). TAM has been widely utilized in past research works from a diversity of disciplines in order to empirically investigate beliefs and attitudes of various stakeholder groups (Katharaki, Daskalakis, & Mantas, 2009; Masrom, 2007; Saadé, Nebebe, & Tan, 2007). Furthermore, a plethora of research efforts attempt either to extend TAM or perform a synthesis with other frameworks, towards new theoretical propositions (Lee, Cheung, & Chen, 2005; Ngai et al., 2007; Ong et al., 2004; Saadé & Bahli, 2005; Selim, 2003).

In this study, the aim is to validate the original TAM in a blended learning setting, by using the Moodle Learning Content Management System (LCMS). Thus, we formulated the set of hypotheses which are closely related with TAM model (Table 1).

**Table 1**. TAM Hypotheses

| Hypothesis | Description |
|---|---|
| H1 | Attitude toward use will have a positive effect on behavioral intention |
| H2 | Perceived usefulness will have a positive effect on behavioral intention |
| H3 | Perceived ease of use will have a positive effect on attitude toward use |
| H4 | Perceived usefulness will have a positive effect on attitude toward use |
| H5 | Perceived ease of use will have a positive effect on perceived usefulness |

### Procedure and Measures

The study attempted to systematically investigate the factors which affect the attitudes, perceptions and practices of students in the context of blended learning. The participants were students of the Educational Sciences and Early Childhood Education department at the University of Patras, Greece. They attended a compulsory second year course entitled "ICT in Education". The goal of the course is to familiarize the students with the main models and approaches of ICT integration in the educational process. The course includes a theory and a laboratory section. Both are supported by the Moodle (LCMS). The students were informed for the course's goals and the skills that they were expected to acquire at the beginning of the course. The online resources provided to the students through the Moodle infrastructure, were web pages, documents, presentations and educational software (animations, simulations, interactive hypermedia, encyclopedias, glossary and exercises), analysis grids and self-assessment modules. Communication tools, such as forum and chat were also provided as well as complementary services such as calendar indicating course's events, projects' submission deadlines, etc. The students had access to the Moodle's resources both in the laboratory session as well as from their homes throughout the assignment completion process.

A problem based pedagogical framework (Duffy & Kirkley, 2004) was developed. Each week a different mini-project was presented to each student. Related theory was also presented in a three hour lecture. Subsequently, the students attended a weekly 2 hour lab session. In the lab session, representative examples related to the project were discussed. The students had to understand the goals of the project and to identify the useful learning content required to complete it. Each laboratory section consisted of approximately 20-22 students. Each student had to complete an individual project report and submit it through the Moodle environment.

The study comprised of two phases. In the initial phase, the students were asked to participate in the survey before attending the course. In specific, the students were given a 20 minute presentation explaining the basic features of the Moodle environment and how it was integrated to the course, since the students did not have any previous Moodle experience. Similarly, after course completion, students were asked to participate again. The questionnaires were completed during the first and the last session, accordingly.

The formulation of the questionnaire (see Table A.1-Appendix) was based on the original TAM constructs. For each dimension, characteristics were adopted from previous research works, in an attempt to formulate a standardized instrument. In cases where such an adaptation was not applicable, or emphasis on specific aspects had to be given, self-developed questions were introduced, based on the objectives of the study. In addition, the initial part of the instrument contained demographic items such as academic year, gender, the number courses related to ICT currently being taken, skills in using specific ICT applications and the availability of Internet at home. All metrics were modeled in a seven-scale Likert approach and translated from English to Greek accordingly. In order to adjust on the specific study context, relative language customizations occurred, where applicable. The survey was migrated into a Web based environment through the use of the SurveyMonkey tool (www.surveymonkey.com) and students were informed on the Web location of the study. Participation was voluntary.

**Data analysis approach**

Both scenarios were analyzed using Partial Least Squares (PLS) path modeling. The software package used was SmartPLS version 2.0 M3 (Ringle, Wende & Will, 2005). The predictive nature of PLS (Gefen, Straub, & Boudreau, 2000, p. 27; Roldán & Leal, 2003, p.75) in conjunction with the limited requirements in terms of sample size (Chin, 1998), signify PLS as a well established data analysis method in the literature, utilized in a plethora of empirical studies related with TAM and its variations or other theoretical frameworks in a diversity of domains (Katharaki et al., 2009; Saadé & Bahli, 2005; Saadé et al., 2007).

## Results

**Demographics**

Regarding the pre-Moodle scenario, 130 (127 female, 3 male, aged 18-32, with a mean age of 19.2) students participated. Concerning the post-Moodle scenario, a total of 102 (99 female, 3 male) students participated, aged 18-32 with a mean age of 19.1 years. The reduced participation at the second phase of the research may be explained by the voluntary nature of the study.

**Partial Least Squares analysis**

Results interpretation with PLS is related with the investigation of the measurement and the structural model respectively (Roldán & Leal, 2003, p.75). In particular, the measurement model is investigated in the basis of individual item loadings, construct reliability, convergent validity and discriminant validity (Roldán & Leal, 2003, p.75). Subsequently, the structural model is assessed, in order to deduce observations regarding the causal relationships and their significance.

**Pre-Moodle Experience**

*Measurement model*

With respect to individual item loadings (Table 2), values should exceed 0.7, as proposed by Chin (1998). The majority of the items exceeded 0.7. Exceptions include the items PU3 and PEOU4 which, however, produced values greater than 0.5, thus considered acceptable (Chin, 1998; Shepherd, Tesch, & Hsu, 2006, p.208). A key finding is the extremely low value of PU2 (0.252).

**Table 2.** Individual item loadings

| Item Loadings | Value | Item Loadings | Value |
|---|---|---|---|
| PU1 | 0.755 | A1 | 0.795 |
| PU2 | 0.252 | A2 | 0.786 |
| PU3 | 0.553 | A3 | 0.837 |
| PU4 | 0.786 | A4 | 0.868 |
| PU5 | 0.821 | | |
| | | | |
| PEOU1 | 0.815 | BI1 | 0.924 |
| PEOU2 | 0.797 | BI2 | 0.874 |
| PEOU3 | 0.82 | BI3 | 0.779 |
| PEOU4 | 0.624 | | |

| | |
|---|---|
| PEOU5 | 0.703 |
| PEOU6 | 0.815 |

Construct reliability was assessed in terms of Cronbachs alpha and composite reliability (Roldán & Leal, 2003), with Henseler et al. (2009) to emphasize mainly on composite reliability (p.299). According to Nunnally (as cited in Roldán & Leal, 2003, p.75), a value of 0.7 should be used as a threshold. All constructs produced satisfactory values for composite reliability while the majority of the constructs exceeded 0.7 in terms of Cronbachs alpha (Table 3), except perceived usefulness (0.6491). Continuously, convergent validity was investigated with regards to the values of the Average Variance Extracted (AVE), being greater than 0.5, as proposed by Fornell and Larcker (1981). In terms of convergent validity, all items produced values greater than 0.5 with the exception of perceived usefulness (0.4463).

**Table 3.** Construct Reliability and covergent Validity

| Construct | Cronbach's Alpha (α) | Composite Reliability | AVE |
|---|---|---|---|
| Attitude towards Use (ATT) | 0.84 | 0.8928 | 0.6758 |
| Behavioral Intention (BI) | 0.824 | 0.8955 | 0.7416 |
| Perceived Ease Of Use (PEOU) | 0.8666 | 0.9016 | 0.6071 |
| Perceived Usefulness(PU) | 0.6491 | 0.7837 | 0.4463 |

The assessment of discriminant validity was based on the Fornell and Larcker (1981) "*criterion*" (Henseler et al., 2009, p.300). As outlined at Table 4, the pre-Moodle scenario produced satisfactory results.

**Table 4.** Discriminant Validity

| | ATT | BI | PEOU | PU |
|---|---|---|---|---|
| **ATT** | **0.822** | 0 | 0 | 0 |
| **BI** | 0.7202 | **0.8611** | 0 | 0 |
| **PEOU** | 0.5158 | 0.4381 | **0.7791** | 0 |
| **PU** | 0.6357 | 0.508 | 0.5722 | **0.668** |

(ATT=Attitude towards Use, BI=Behavioral Intention, PEOU=Perceived Ease of Use, PU=Perceived Usefulness)

*Structural Model*

In order to assess the structural model, a bootstrapping technique was applied (Chin, 1998; Gefen et al.,2000, p.27) (500 resamples). The examination of the t-values was based on a two-tail test with statistically significant levels of $p<0.05$ (*), $p<0.01$ (**) and $p<0.001$ (***). Results are presented at Figure 1. Dotted lines highlight the insignificant paths.

In particular, the outcomes of the structural model in terms of direct effects, bootstrapping and t-statistics confirmed the majority of hypotheses, at various significance levels (Figure 1). In specific, perceived ease of use (PEOU) is associated with a very strong significant relationship with perceived usefulness (H5 at $p<0.001$ level). In addition, the relationship (H4) between perceived usefulness (PU) and attitude towards use (ATT) along with the relationship (H1) of attitude towards use and behavioral intention (BI) to use Moodle as an e-learning platform were confirmed with high significance as well ($p<0.001$). Moreover, perceived ease of use affects positively the attitude towards use with a significant relationship (H3 at $p<0.05$). Finally, the relationship between perceived usefulness and behavioral intention (H2) did not confirm in the context of the pre-Moodle investigation.

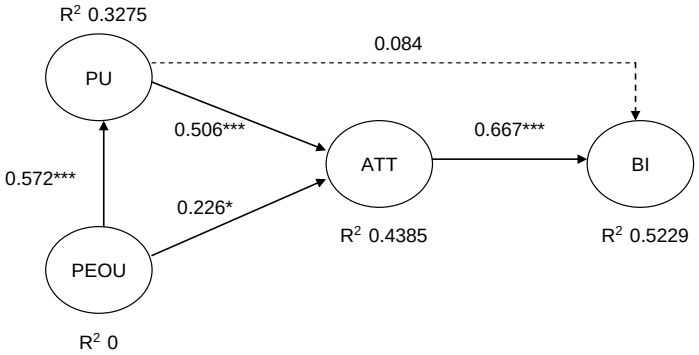


**Figure 1.** Structural model for the pre-Moodle scenario

**Post-Moodle Experience**

*Measurement Model*

With regards to individual item loadings, the majority of the items produced values greater than 0.7 (Chin, 1998) while item PU2 produced a low value (0.307), putting its reliability under further investigation. Slight variations are also related with the values for PU1, PU3, PEOU4 and BI3 but these are above the value of 0.5 for acceptable results (Shepherd et al., 2006, p. 280) while also either tend to reach or are very close to 0.7 (Table 5).

**Table 5.** Individual item loadings

| Item Loadings | Value | Item Loadings | Value |
|---|---|---|---|
| PU1 | 0.643 | A1 | 0.777 |
| PU2 | 0.307 | A2 | 0.749 |
| PU3 | 0.699 | A3 | 0.832 |
| PU4 | 0.771 | A4 | 0.824 |
| PU5 | 0.776 | | |
| | | | |
| PEOU1 | 0.808 | BI1 | 0.868 |
| PEOU2 | 0.887 | BI2 | 0.879 |
| PEOU3 | 0.819 | BI3 | 0.689 |
| PEOU4 | 0.684 | | |
| PEOU5 | 0.859 | | |
| PEOU6 | 0.815 | | |

With regards to internal consistency (Table 6), all constructs produced values greater than 0.7 for both Cronbachs alpha and composite reliability, according to Nunnally (as cited in Roldán & Leal, 2003, p.75) with the exception of perceived usefulness which retains a value below 0.7 for Cronbach's alpha (0.6539). In terms of convergent validity, the values of the AVE exceeded 0.5, as proposed by Fornell and Larcker (1981), with the exception of perceived usefulness (0.4386).

**Table 6.** Construct Reliability and Convergent Validity

| Construct | Cronbach's Alpha (α) | Composite Reliability | AVE |
|---|---|---|---|
| Attitude towards Use (ATT) | 0.8077 | 0.8738 | 0.6342 |
| Behavioral Intention (BI) | 0.7429 | 0.8558 | 0.6668 |
| Perceived Ease Of Use | 0.9056 | 0.9279 | 0.6835 |

| | | | |
|---|---|---|---|
| (PEOU) | | | |
| Perceived Usefulness(PU) | 0.6539 | 0.7844 | 0.4386 |

At last, the generated results pinpoint satisfactory discriminant validity, based on the Fornell and Larcker (1981) "*criterion*" (Henseler et al., 2009, p.300) for the post-Moodle scenario, as outlined at Table 7.

**Table 7.** Discriminant Validity

| | ATT | BI | PEOU | PU |
|---|---|---|---|---|
| **ATT** | **0.7963** | 0 | 0 | 0 |
| **BI** | 0.5966 | **0.8165** | 0 | 0 |
| **PEOU** | 0.6036 | 0.5762 | **0.8267** | 0 |
| **PU** | 0.5506 | 0.4815 | 0.6067 | **0.6622** |

(ATT=Attitude towards Use, BI=Behavioral Intention, PEOU=Perceived Ease of Use, PU=Perceived Usefulness)

*Structural Model*

Similarly to the pre-Moodle scenario, the assesment of the structural model was based on a bootstrapping technique (Chin, 1998; Gefen et al.,2000, p.27) (500 resamples) . The t-statistics values were also based on a two-tail test with the same significance levels: $p<0.05$ (*), $p<0.01$ (**) and $p<0.001$ (***). Results are presented at Figure 2. Based on the outcomes, all hypotheses were confirmed in various significant levels. Emphasis should be given, however, to the very strong significant relationship ($p<0.001$ level) between perceived ease of use and perceived usefulness (H5) and also between attitude towards use and behavioral intention to use Moodle as an e-learning platform (H1). In addition, perceived usefulness proved to have a positive effect on behavioral intention (H2) (significant at $p<0.05$ level) while also perceived ease of use affects positively the attitude towards use with a significant relationship (H3) ($p<0.05$). At last, perceived usefulness proved to have a positive effect on attitude toward use (H4) at ($p<0.05$) level as well.

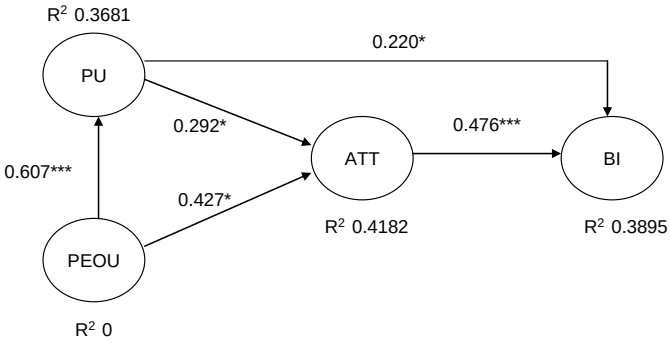


**Figure 2**. Structural model for the post-Moodle scenario

**Comparative analysis and remarks**

The study findings produce certain similarities and differences for the two scenarios, in terms of the assessments of the measurement and the structural model. With regards to the measurement model, the majority of the 17 items produced reliable results in both scenarios. Some items produced certain differentiations but were still considered acceptable whereas a major observation is related with item PU2. This item produced extremely low values at both scenarios, putting its reliability under question and being a candidate for exclusion. However, according to Henseler et al. (2009), special caution is needed in the case of rejecting indicators with low values while such actions should be performed only when achieving "*substantial increase of composite reliability*" (Henseler et al., 2009, p.299). A subsequent decision was to leave item PU2 intact, by focusing on the already achieved high values of PU in terms of composite reliability for both scenarios (Tables 3 and 6). At last, with regards to convergent validity, the AVE of PU in both scenarios produced values which were relatively close but below the threshold limit whereas discriminant validity results were satisfactory. Subsequently, the structural model per scenario was assessed, with the assumption that the PU insufficiency at the AVE level is a notable exception amongst satisfactory results for both scenarios (in terms of constructs overall AVE values, satisfactory discriminant validity,

composite reliability and individual item loadings). However, the inadequacy observed in relation with PU and its measures is notable and contributes to future work in terms of analysis and experimentation.

In terms of the structural model, observations were deduced in relation to the similarities and differences of the results produced at the two scenarios (Figure 1 and 2). In particular, H1 and H5 were proved to be highly significant (at $p<0.001$ level) at both scenarios, whereas H3 also retained a significant level of $p<0.05$ at both pre- and post-Moodle assessments. On the contrary, H4 was characterized by a very strong significant level ($p<0.001$) at the pre-Moodle session but proved to be significant at $p<0.05$ at the post-Moodle session. H2 also performed differently between the two sessions, with a non-significant level at the first scenario and a significant level of $p<0.05$ at the second one respectively.

In terms of predictive strength, the pre-Moodle scenario produced a value of 0.5229 for the $R^2$ of behavioral intention, thus explaining 52.29% of the variance in BI. For the post-Moodle scenario, $R^2$ was found to be 0.3895, explaining 38.95% of the variance in behavioral intention. Both values provide consistency with previous results. In specific, Saadé et al. (2007) utilizing TAM for evaluating a multimedia environment, produce a value of 0.38 for the $R^2$ of BI. Other studies that enrich and extend TAM produce values varying from 0.26 (Saadé & Bahli, 2005) to 0.44 (Ong et al., 2004; see also Table 8).

## Discussion

As shown previously, in both scenarios students perceived the relation of ease of use and usefulness as a key factor for adopting Moodle (H5). The post-Moodle attitude of students remains intact, providing similarities of the outcomes amongst a variety of research works (Lee et al., 2005; Masrom, 2007; Ngai et al., 2007; Ong et al., 2004; Saadé & Bahli, 2005; Saadé et al.,2007, see Table 8).

**Table 8.** Findings from previous research works

| Author(s) | Theoretical model & Data analysis approach | Confirmed hypotheses | Rejected Hypotheses |
|---|---|---|---|
| Lee et al. (2005) | Extended TAM with the addition of "Perceived Enjoyment" (coded as ENJOY). Data analysis performed with co-variance based SEM (LISREL) | PU→BI, EOU→ PU, PU→ATT<br>ATT→BI, ENJOY→ATT,<br>ENJOY→ BI<br>EOU→ ENJOY *<br>$R^2$ of BI: 0.35 | EOU→ATT |
| Saadé & Bahli (2005) | Extended TAM, excluding "Attitude towards Use". Data analysis performed with PLS. | PU→ BI,PEOU→PU<br>PEOU→ BI *<br>$R^2$ of BI 0.262 | |
| Saadé et al. (2007) | TAM. Data analysis performed with PLS. | PU→BI, PU→ATT, PEOU→PU<br>ATT→BI<br>$R^2$ of BI: 0.38 | PEOU→BI * |
| Masrom (2007) | TAM. Data analysis performed using separate linear regression analysis. | PEOU→PU, PEOU→ATT<br>PU→BI, PU→ATT<br>$R^2$ of BI: 0.399 | ATT→BI |
| Ong et al. (2004) | Extended TAM, excluding "Attitude towards Use". Data analysis performed with co-variance based SEM (LISREL) | PEOU→PU, PU→BI, PEOU→BI *<br>$R^2$ of BI: 0.44 | |
| Ngai et al., (2007) | Extended TAM. Data analysis performed with SPSS and AMOS4 | PEOU→ATT, PEOU→PU<br>PEOU→USE *<br>PU→ATT, PU→USE *<br>$R^2$ of BI: n.a. | PU→BI,ATT→BI<br>ATT→USE * |
| Katharaki et al., | TAM. Data analysis performed with | PU→ATT, PEOU→ATT, | PEOU→PU |

| | | | |
|---|---|---|---|
| (2009) | PLS. | ATT→BI<br>$R^2$ of BI: 0.467 | PU→BI |

PU=Perceived Usefulness, PEOU/EOU=(Perceived)Ease of Use, ATT=Attitude Towards Use, BI=Behavioral Intention, USE= Use, ENJOY=Enjoyment, n.a.=not applicable, *= not tested at the current study.

Furthermore, the impact of attitude towards using Moodle in behavioral intention proved to have a very strong significant relationship (H1) in both pre-Moodle and post-Moodle settings. Such a finding underlines the fact that if students have an overall positive view of the system, then they intent to use it. This finding is also aligned with outcomes from other researchers (Katharaki et al., 2009; Lee et al., 2005; Saadé et al., 2007; see also Table 8).

Another notable observation is the relation between perceived ease of use and attitude towards use (H3). A significance level of $p<0.05$ was observed in both scenarios, highlighting the role of ease of use in the attitude towards using a system, in accordance with similar studies (Katharaki et al., 2009; Masrom, 2007; Ngai et al., 2007). However, the relationships of perceived usefulness and behavioral intention along with the one of perceived usefulness and attitude towards use, produced discontinuities in terms of results at the two scenarios. Perceived usefulness did not prove to have a significant effect on behavioral intention at the pre-Moodle setting whereas at the post-Moodle context, it appeared to have a significance at $p<0.05$ level. Such a finding may be explained by the hypothetical nature of the pre-Moodle assessment. Students did not anticipate the actual e-learning implementation, thus they did not associate usefulness with intention to use. However, such finding contradicts the results obtained for the relationship of perceived usefulness and attitude towards use. At the pre-Moodle scenario, students seem to highly appreciate this relationship whereas at the second scenario, this relationship still remains significant but at a lower level. A possible interpretation may include the deduction that in the pre-Moodle scenario students could not assess the effect of usefulness to actual intention to use, since they did not have an actual Moodle implementation in mind in order to assess it. However, perceptions regarding usefulness positively influence the attitude towards using such a technology. With regards to the post-Moodle implementation, students' assessment is based on beliefs and opinions gained through the actual use of the system. Consequently, their observations are pragmatic and provide a more realistic view. This stress the importance of further dissemination of blended learning's benefits to encourage increased adoption. Overall, the diversity of the findings in terms of the effect of usefulness to behavioral intention and the attitude towards use may be also related with the inadequacies, in terms of reliability, observed for the dimension of perceived usefulness (mainly related with the low value of PU2 item and the produced AVE values for PU at both scenarios) in the context of the current study, putting this under further investigation.

## Conclusions and future work

In this paper, LCMS acceptance in the context of a university course offered using a blended learning approach is investigated. The findings obtained show that both ease of use and perceived usefulness have a positive effect on attitude toward use. The students' perceptions in a blended learning setting found to be comparable with other studies reporting perceptions in the context of distant learning, with certain differentiations. For instance, Lee et al. (2005) report that perceived ease of use did not posit a significant impact on Hong Kong students' attitude toward LCMS usage. In the present study, relationships were confirmed for both pre-Moodle and post-Moodle scenarios, except of the effect of perceived usefulness to behavioral intention, resulting as significant only after real experience from the students. Such an observation seems absolutely valid as the actual use of a system is a key determinant of its usefulness by users, despite any hypothetical clauses prior to use. This could be also partially attributed to the finding that perceived ease of use seems to be more salient to women, since 126/130 and 99/102 of the participants in the study were females (Ong & Lai, 2006).

The current study is not without limitations. In the pre-Moodle scenario, despite the extensive description and the detailed presentation of features, students could not fully anticipate the added value of such initiatives before they actually use them. Moreover, the mandatory nature of Moodle use during the course, may influence students' attitudes. Also, the participants were mainly female students and from one university department related to Educational Sciences. Students' attitudes may vary if a more balanced sample in terms of gender and study objective is taken into account. However, the context of the current study produced certain observations about the relationships of the TAM model in a blended learning setting. The importance of the results obtained is increased by taking into account the consideration that little is known about students' perceptions in such settings, especially in the context of Greek higher education.

Further studies including more aspects such as credibility, privacy and computer anxiety (Ong et al., 2004; Sun et al., 2008) should be conducted to obtain a deeper understanding of the factors influencing attitudes towards blended learning adoption. For instance, students' privacy concerns and perceived risks in interacting with LCMS have received little attention. Such an

issue requires further research since technological advances offer rich learning possibilities but the educational community may develop privacy concerns during use, thus constraining the aimed benefits (Corritore, Marble, Kracher & Wiedenbeck, 2005; Joinson, Mckenna, Postmes & Reips, 2007). In addition, as derived from this study as well as from related works examining acceptance of e-learning, deep understanding of all learners' personal cognitive strategies or information processing behaviors is required in order to provide a suitable information architecture that promotes the learning process (Tselios & Avouris, 2003). Future work will focus on the above issues as well as on understanding of the several attitudes and beliefs with regards to computer-literal participants opposed to people with limited technology background. A series of moderating factors may also be introduced, such as gender, age differences (Venkatesh, Morris, Davis, B., & Davis, D., 2003) and organizational issues.

## References


Behrens, S., Jamieson, K., Jones, D., & Cranston, M. (2005). Predicting System Success using the Technology Acceptance Model: A Case Study. In *Proceedings of the 16th Australasian Conference on Information Systems*, 9 Nov-2 Dec 2005, Sydney, Australia.

Carmines, E.G., & Zeller, R.A. (1979). Reliability and validity assessment (Sage University Paper Series on Quantitative Applications in the Social Sciences. no. 07-017). Newbury Park, CA: Sage.

Chin, W.W. (1998). The partial least squares approach for structural equation modeling. In Marcoulides, G. A. (ed.) *Modern methods for business research*. Mahwah, NJ: Lawrence Erlbaum Associates, 295-358.

Chou, S.-W., & Liu, C.-H. (2005). Learning effectiveness in a Web-based virtual learning environment: a learner control perspective. *Journal of Computer Assisted Learning*, 21(1), 65-76.

Corritore, C.L., Marble, R., Kracher, B., & Wiedenbeck, S. (2005). Measuring Online Trust of Websites: Credibility, Perceived Ease of Use, and Risk, In *Proceedings of the 11th Americas Conference on Information Systems* (2005), Omaha, NE, USA, 2419-2427.

Danielson, D. R. (2005). Web credibility. In C. Ghaoui (Ed.), *Encyclopedia of human–computer interaction* (pp. 713–721). Hershey, PA: Idea Group.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.

Duffy, T.M., & Kirkley, J.R. (2004). Learning Theory and Pedagogy Applied in Distance Learning: The Case of Cardean University. In Duffy, T. & Kirkley, J. (Eds.) *Learner-centered theory and practice in distance education: Cases from higher education* (pp.107-143). Mahwah, NJ: Lawrence Erlbaum.

Fishbein, M. (1980). *A theory of reasoned action: some applications and implementations*. Lincoln, NB, USA: University of Nebraska Press.

Fornell, C., & Larcker, D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18 (1), 39-50.

Gefen, D., Straub, D.W., & Boudreau, M.C. (2000). Structural Equation Modeling and Regression: Guidelines for Research Practice, *Communications of the Association for Information Systems*, 4(7), 1-79.

Henseler, J., Ringle, C.M., & Sinkovics, R.R. (2009). The use of partial least squares path modeling in international marketing, In Sinkovics, R.R., & Ghauri, P.N. (Eds..), *Advances in International Marketing (AIM)* (pp.277-320), Vol. 20, Bingley.

Joinson, A., Mckenna, K.Y.A., Postmes, T., & Reips, U.D., (Eds.) (2007). *Oxford Handbook of Internet Psychology* (Oxford Handbook Series). Oxford University Press, USA.

Katharaki, M.**,** Daskalakis, S., & Mantas, J. (2009). Towards the implementation of Web based courses in postgraduate

healthcare curricula: An empirical assessment. In *Proceedings of the 7th International Conference in Information & Communication Technologies in Healthcare* (ICICTH' 09), July 16-18, Samos, Greece, 82-93.

Keller, C., Hrastinski, S., & Carlsson, S.A. (2007). Students' Acceptance of E-learning Environments: A Comparative Study in Sweden and Lithuania. In *Proceedings of the 15th European Conference on Information Systems*, June 7-9, St. Gallen, Switzerland, 395-406.

Lee, K.O.M, Cheung, C.M.K., & Chen, Z. (2005). Acceptance of internet-based learning medium: The role of extrinsic and intrinsic motivation. *Information & Management*, 42(8), 1095–1104.

Legris, P., Ingham, J., & Collerette P. (2003).Why do people use information technology? A critical review of the technology acceptance model. *Information and Management*, 40(3), 191-204.

Liaw, S.S., Huang, H.M., & Chen, G.D. (2007). Surveying instructor and learner attitudes toward e-learning. *Computers & Education*, 49(2), 1066-1080.

Liaw, S.S. (2008). Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of the Blackboard system. *Computers & Education*, 51(2), 864–873.

Lin, H.F. (2007). Measuring Online Learning Systems Success: Applying the Updated DeLone and McLean Model. *CyberPsychology & Behavior*, 10(6), 817-820.

Loukis, E., Georgiou, S., & Pazalos, K. (2007). A value flow model for the evaluation of an e-Learning service. In *Proceedings of the European Conference on Information Systems*, June 7-9, St. Gallen, Switzerland, 370-382.

Masrom, M. (2007). Technology Acceptance Model and E-learning. In *Proceedings of the 12th International Conference on Education*, May 21-24, Brunei Darussalam: Universiti Brunei Darussalam, , 1-10.

Ngai, E.W.T., Poon, J.K.L., & Chan, Y.H.C. (2007). Empirical examination of the adoption of WebCT using TAM. *Computers & Education*, 48(2), 250–267.

Ong, C.S., & Lai, J.Y. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behavior*, 22(5), 816–829.

Ong, C.S., Lai, J.Y., & Wang, Y.S. (2004). Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies. *Information & Management*, 41(6), 795–804.

Park, S.Y. (2009). An Analysis of the Technology Acceptance Model in Understanding University Students' Behavioral Intention to Use e-Learning. *Educational Technology & Society*, 12(3), 150–162.

Pituch, K., & Lee, Y. (2006). The influence of the system characteristics on e- learning use, *Computers and Education*, 47(2), 222–244.

Ringle, C.M., Wende, S., & Will, A. (2005). SmartPLS 2.0 (M3) Beta, University of Hamburg. Retrieved July 2, 2009, from: http://www.smartpls.de.

Roca, J.C., & Gagne´, M. (2008). Understanding e-learning continuance intention in the workplace: A self-determination theory perspective. *Computers in Human Behavior*, 24(4), 1585–1604.

Roldán, J.L., & Leal, A. (2003). A validation test of an adaptation of the DeLone and McLean's model in the Spanish EIS Field, In J. J. Cano (Eds.), *Critical reflections on information systems: a systemic approach*. IGI Publishing.

Ryan, R.M., & Deci, E.L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25(1), 54–67.

Saadé, R.G., Nebebe, F., & Tan, W. (2007).Viability of the technology acceptance model in multimedia learning

environments: A comparative Study. *Interdisciplinary Journal of Knowledge and Learning Objects*, 3(1), 175-184.

Saadé, R.G., & Bahli, B. (2005). The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: an extension of the technology acceptance model. *Information & Management*, 42(2), 317-327.

Selim, H.M. (2003). An empirical investigation of student acceptance of course websites. *Computers & Education*, 40(4), 343-360.

Shepherd, M.M., Tesch, D.B. & Hsu, J.S.C. (2006). Environmental traits that support a learning organization: The impact on information system development projects. *Comparative Technology Transfer and Society*, 4(2), 196-218.

Soloway, E., Guzdial, M., & Hay K.E. (1994). Learner-centered design: The challenge for HCI in the 21st century. *Interactions*, 1(2), 36-48.

Sun, P.C., Tsai, R.J., Finger, G., Chen, Y.Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education*, 50(4), 1183–1202.

Teo, T.S.H., Lim, V.K.G., & Lai, R.Y.C. (1999). Intrinsic and extrinsic motivation in internet usage. *OMEGA, The International Journal of Management Science*, 27(1), 25–37.

Tselios, N.K., & Avouris, N.M. (2003). Cognitive Task Modeling for system design and evaluation of non-routine task domains. In Hollnagel, E., (Editor), *Handbook of Cognitive Task Design* (pp.307-332), Lawrence Erlbaum Associates:Amsterdam.

Tselios, N., Avouris, N., Dimitracopoulou, A., & Daskalaki, S. (2001). Evaluation of Distance-learning Environments: Impact of Usability on Student Performance. *International Journal of Educational Telecommunications*, 7(4), 355-378.

Tselios, N., Katsanos, C., Kahrimanis, G., & Avouris, N. (2008a). Design and Evaluation of Web-based Learning Environments using Information Foraging Models. In Pahl, C., *Architecture Solutions for E-Learning Systems*, 320-339, Hershey, PA, USA: Information Science Reference.

Tselios, N., Avouris, N., & Komis, V. (2008b). The effective combination of hybrid usability methods in evaluating educational applications of ICT: Issues and challenges. *Education and Information Technologies Journal*, 13(1), 55-76.

van Raaij, E.M., & Schepers, J.L. (2008). The acceptance and use of a virtual learning environment in China, *Computers & Education*, 50(3), 838-852.

Venkatesh, V. & Davis, F.D. (1996). A model of the antecedents of perceived ease of use: development and test. *Decision Sciences*, 27, 451–481.

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

## APPENDIX

**Table A.1** – Study Questionnaire

| Constructs & Items | Question |
|---|---|
| **Perceived Usefulness (PU)** | |
| **PU1** | The use of Moodle will enable me/enables me to accomplish tasks more quickly* |
| **PU2** | Using Moodle will reduce/reduces my performance at the lab sessions* |
| **PU3** | Using Moodle will enhance/enhances my effectiveness at the lab sessions* |
| **PU4** | By using Moodle it will be easier/ it is easier for me to follow and study the course material** |
| **PU5** | Overall, I find Moodle useful* |
| | |
| **Perceived Ease Of Use (PEOU)** | |
| **PEOU1** | Learning to operate Moodle will be/is easy for me* |
| **PEOU2** | Navigating within Moodle will be/is easy for me** |
| **PEOU3** | My interaction with Moodle will be /is clear and understandable* |
| **PEOU4** | I think that Moodle will be /is flexible to interact with* (modeled as a reverse question) |
| **PEOU5** | It will be/it is easy for me to become skillful at using Moodle* (modeled as a reverse question) |
| **PEOU6** | Overall, I find Moodle easy to use* |
| | |
| **Attitude Towards Use (ATT)** | |
| **ATT1** | The idea of using Moodle is: (very bad _ very good) |
| **ATT2** | The idea of using Moodle is: (very foolish _ very wise) |
| **ATT3** | Using Moodle would be/is: (very unpleasant _ very pleasant) |
| **ATT4** | Using Moodle is an idea: (dislike very much _ like very much) |
| | |
| **Behavioral Intention (BI)** | |
| **BI1** | Assuming Moodle availability in other courses, I will use it |
| **BI2** | I intend to use frequently Moodle in the frame of other courses using blended learning |
| **BI3** | I intend to choose more courses using Moodle in the next semesters |

* Davis (as cited in Legris, Ingham & Collerette, 2003, pp. 197-199)

** Self developed

*** Lee et al. (2005, p.1100)

**** Self-developed, influenced by Venkatesh et al. (2003, p.460) and Lee et al. (2005, p.1100)