Factors Affecting Acceptance and Use of Moodle: An Empirical Study Based on TAM

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Keywords: e-learning, Moodle, acceptance, TAM

Received: September 19, 2009

Advancements in web technologies and the increased influence of the World Wide Web are leading to new and innovative ways of learning. New e-learning system technologies and services enable activities that allow users to be active learners, actively participating in the on-line learning process. When an e-learning system with new technologies and services is presented, it needs to be adopted by its users. The acceptance and use of an e-learning system can be influenced by different factors. The objective of this research is to examine the factors that have an impact on students' perceptions about the use and acceptance of Moodle - an open source e-learning system. In this study, the technology acceptance model (TAM) was used as an underlying theory. The data, collected from 235 students, was used to test the hypothesized research model. A data analysis was performed using structural equation modelling (SEM). The results of the analysis have revealed that the actual use of Moodle depends on two main factors: behavioural intentions and attitudes toward using Moodle. Perceived usefulness was found as the strongest and the most important predictor of attitudes toward using Moodle. Several practical and theoretical implications of the present study are discussed at the end of the paper.

Povzetek: Analizirana je uporaba sistema Moodle, odprtokodnega sistema za e-učenje.

1 Introduction

An e-learning system is a system that provides services that are necessary for handling all aspects of a course through a single, intuitive and consistent web interface. Such services are, for example: (1) course content management, (2) synchronous and asynchronous communication, (3) the uploading of content, (4) the return of students' work, (5) peer assessment, (6) student administration, (7) the collection and organization of students' grades, (8) online questionnaires, (9) online quizzes, (10) tracking tools, etc. With the advent of Web 2.0 technologies and services (like wikis, blogs, RSS, 3D virtual learning spaces, etc) e-learning systems will provide services that enable students to shift from passive to active learners where they can actively participate in the on-line learning process. E-learning environments that provide access to synchronous and asynchronous learning resources and activities are going to continue growing [1].

In addition to educational organizations, business organizations are also using e-learning technologies and services for cost-effective online training for their employees. In spite of the fact that educational and/or business institutions are investing a lot of money and resources in implementing e-learning systems, such systems will not be fully utilized if the users fail to use the system. When a new e-learning environment is presented, it needs to be adopted by its users. User's perceptions regarding the use and acceptance of an e-learning system can be affected by different factors, which can be combined into two main groups: (a) technological characteristics (like reliability, responsiveness, efficiency, security, etc.) and (b) individual characteristics (like age, gender, e-learning experience, etc.). The main challenge for e-learning system developers is to provide an e-learning system with appropriate services that will positively affect a user's experience. E-learning content providers must attract learners with appropriate e-learning content and they have to adequately incorporate e-learning services and technologies in the e-learning process. For these reasons, developers, designers and purchasers of e-learning systems must carefully consider the needs, trends and values of e-learning users and ensure that the system will meet their demands.

This study aimed to investigate the factors that affect the acceptance and use of an e-learning system, namely Moodle. Moodle provides different activity modules (like Assignments, Forums, Wikis, Blogs, Quizzes, Tracking, etc.), and can therefore be applied in different ways. Moodle can be used as a tool for delivering content to students and assess learning using assignments or quizzes and, more interestingly, it can be used to build rich collaborative learning communities. At the Faculty of Electrical Engineering and Computer Science, students

use Moodle to enroll in courses, download learning materials, communicate with other participants using forums, write blogs, contribute in content creation using wikis, communicate with professors and teaching assistants through a built-in messaging system, finish their activities and upload files, check grades, etc. Professors and teaching assistants use Moodle to manage learning content materials, manage students and their grades, check the uploaded students' work, prepare quizzes, create content using Wikis, aggregate news from different RSS feeds, etc. To understand students' perceptions about using Moodle, the technology acceptance (TAM) research model and hypothesized relationships between TAM constructs were empirically tested using the structural equation modelling (SEM) approach.

This paper is organized as follows: In the next section, theoretical backgrounds and a summary of the literature review in the field of e-learning system acceptance are given. In section three, the research model and the causal hypotheses are stated. In the section that follows, the research methodology that guided this study is described. In section five, data analysis and results are given. The last section concludes the paper with the implications and limitations of the study.

2 Theoretical backgrounds

Adoption of an e-learning system by learners may be treated as technology adoption. The most common theory in the field of IT/IS (information technology/information system) adoption is the Technology Acceptance Model – TAM. Davis [2] proposed TAM to explain the potential user's behavioural intentions when using a technological innovation, because it explains the causal links between beliefs (the usefulness of a system and ease of use of a system) and users' attitudes, intentions, and the actual usage of the system. The principal TAM concepts are (see Figure 1):

- perceived ease of use (PEOU) – the degree to which a person believes that using a particular system would be free of effort,
- perceived usefulness (PU) – the degree to which a person believes that using a particular system would enhance his or her job performance, and
- the dependent variable behavioural intention (BI) – the degree to which a person has formulated conscious plans to perform or not perform some specified future behaviour.

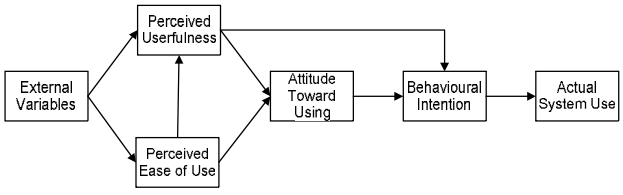

Figure 1: Technology Acceptance Model (TAM) [2].

Davis et al. [3] stated that one purpose of TAM is to serve as a starting point for examining the impact that external variables can have on behavioural intentions. Over time, TAM has progressed through a rigorous development process, since its enormous flexibility allows it to be extended. TAM has become one of the most widely used models in IS research because of its understandability and simplicity [4]. Because of TAM's demonstrated adaptability [5], it can also be used as a model for investigating user requirements and factors important for e-services, or specifically, the usefulness and simplicity of e-learning.

When doing a research about acceptance and use of an information technology, authors usually perform one of the following two types of studies: (1) an empirical validation of TAM (or other theory) in the context of a specific information technology, and (2) an extension of the theoretical model (for example the TAM model) with user specific factors. In existing literature, we can find mixed results (see also Table 1) about the importance of these determinants. For example, in [6] the PEOU was not a significant predictor of attitudes toward use (ATU) and intent of using an e-learning system. Van Raaij and Schepers [7] also did not find a significant connection between PEOU and intention of using the e-learning system. On the other hand, in the study performed by Ngai, Poon, & Chan [8], PEOU demonstrated it to be a dominant determinant of the attitude of students using an e-learning system. The statistical significance of the path between the PEOU and attitudes towards using an e-learning system was also found by Liu, Liao, & Pratt [9] where the authors studied a user's acceptance of streaming media for e-learning. Results across different studies revealed several antecedent factors to PU and PEOU. In TAM2 [10] the subjective norm, image, job relevance, and result demonstrability were found to be significant determinants of PU. It was also shown that subjective norms, PU and PEOU were direct determinants of intentions of use. We performed a meta-analysis of existing literature in the field of e-learning acceptance, where TAM was used as a ground theory. The goal of the literature review was to analyze the findings about the causal links between the main TAM constructs. The literature review in the field of e-learning acceptance showed that PEOU is the factor that mostly affects PU. PU is also an important determinant of BI. ATU is mostly positively affected by PU and PEOU.

Table 1 summarizes the positive and negative causal links between main TAM constructs together with some user specific factors, which were shown to be a direct determinant for a specific TAM construct in several studies. The list of all user-specific factors is actually larger, but because of the space limit we enlisted only those that were discussed in two or more studies. These factors are: computer self efficacy (CSE), confidentiality (CONF), computer anxiety (CANX), self efficacy (SEFF), subjective norms (SN), and enjoyment (ENJ).

Table 1: The results of existing research in the field of e-learning acceptance.

Causal Relationship					
Independent Variable	**Dependent Variable**	**Positive**	**Positive ^{NS}**	**Negative**	**Negative ^{NS}**
PEOU	PU	14	1	0	0
PU	BI	13	0	0	0
PEOU	BI	6	2	0	0
PU	ATU	6	0	0	0
PEOU	ATU	5	1	0	0
ATU	BI	4	0	0	0
BI	U	2	0	0	0
ATU	U	0	1	0	0
User specific or contextual factors affecting TAM constructs					
CSE	PEOU	6	0	0	0
CSE	PU	2	2	0	0
CONF	PU	3	0	0	0
CANX	PEOU	0	1	2	0
SN	PU	3	0	0	0
SEFF	PU	3	0	0	0
ENJ	BI	3	0	0	0
ENJ	ATU	2	0	0	0
ENJ	PU	2	0	0	0

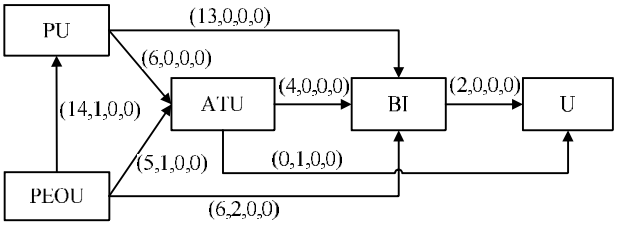

Figure 2: Meta-analysis of e-learning acceptance literature.

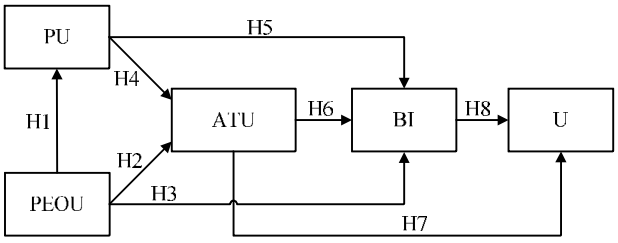

Figure 3: The research model.

Figure 2 is a summary of the literature review where links between TAM constructs are described with four values (x1, x2, x3, x4) indicating: (x1) number of positive relations, (x2) number of non-significant positive relations, (x3) number of negative relations, and (x4) number of non-significant negative relations.

3 Research model and hypotheses

The main reasons why TAM was used as a ground theory in this study are: (1) TAM is focused on information technology, (2) TAM has been used by different researchers, (3) TAM is a simple and generic model that can be used to study initial and continued intention, and (4) so far, TAM has not been used in the context of Moodle.

The main purpose of this study is to empirically validate the model TAM in the context of Moodle, therefore the research model (see Figure 3) was adapted from TAM. In the following sub-sections, the variables, their relationships and consequent causal links are hypothesised.

3.1 E-learning system ease of use

Ease of use refers to the effort required by the user to take advantage of the application. PEOU can have impact on a user's belief about PU when using a system [2]. In case of e-learning, a positive link between PEOU and PU was found in several studies [11-13],[9],[7],[14-16],[8],[6],[17],[18]. However, Ya-Ching Lee [17] showed that this link is not significant when an e-learning system is being used voluntarily. We propose the following hypothesis:

H1: PEOU will have a positive effect on PU.

In existing literature, PEOU was shown to be a positive determinant on ATU [9],[16],[8],[6]. We therefore propose the following hypotheses:

H2: PEOU will have a positive effect on student's attitudes towards using Moodle.

The use of a system is theorised to be influenced by PEOU [2]. BI can be influenced by PEOU as has been demonstrated by different authors [11-15],[17]. In case of the voluntary use of an e-learning system these results can differ, as has been shown by [18] and [17]. We propose the following hypothesis:

H3: PEOU will have a positive effect on Moodle usage intention.

3.2 E-learning system usefulness

Among the many variables that may influence system use, PU has been demonstrated as the main precondition for BI and system acceptance. According to the results of the meta-analysis, PU is the most important predictor of BI. The positive effect between PU and BI was found in different studies [11-13],[9],[19],[14],[15],[6],[17],[18]. It was also shown that PU has a positive effect on ATU [9],[16],[8],[6]. We therefore suggest the following hypotheses:

H4: PU will have a positive effect on student's attitudes towards using Moodle.

H5: PU will have a positive effect on student's intention to use Moodle.

3.3 Attitude toward using an e-learning system

An attitude is "a summary evaluation of a psychological object captured in such attribute dimensions as good-bad, harmful-beneficial, pleasant-unpleasant, and likable-dislikable" [20]. A learner's BI can be caused by their feelings about the system. If the learners don not like an e-learning system or if they feel unpleasant when using it, they will probably want to replace the system with a new one. Liu et al. [9] and Matthew K.O. Lee et al. [6] have demonstrated that ATU is a direct determinant of BI. We propose the following hypotheses:

H6: ATU will have a positive effect on a student's intention to use Moodle.

H7: ATU will have a positive effect on a student's actual use of Moodle.

3.4 Behavioural intentions for using an e-learning system

BI is an indication of an individual's readiness to perform a given behaviour. It is assumed to be an immediate antecedent of behaviour. Existing studies [11],[14] have demonstrated that BI can be a determinant for the actual use of an e-learning system. Thus, we propose the following hypothesis:

H8: Students' BI will have a positive effect on his or her actual use of Moodle.

4 Research methodology

Quantitative research in the form of an online questionnaire based survey was performed to test the stated hypotheses. In this section, the development of the measurement instrument, the sampling process and data analysis approach are described.

Table 2: Profile of the respondents.

Demographic characteristics		Frequency	Percentage
Gender	Male	188	80.0
	Female	47	20.0
Age	18 – 20 years	45	19.1
	21 – 22 years	124	52.8
	23 – 24 years	48	20.4
	25 – 26 years	15	6.4
	more than 26 years	3	1.3
Internet experience	No experience	0	0.0
	Some experience	2	.9
	Experienced	117	49.8
	Very experienced	116	49.4
Moodle experience	No experience	1	0.4
	Some experience	33	14.0
	Experienced	164	69.8
	Very experienced	37	15.7
Number of courses where Moodle is used (for the present academic year)	1	4	1.7
	2	28	11.9
	3-5	127	54.0
	5-8	61	26.0
	8-13	16	6.8
	13-21	3	1.3
Frequency of Moodle use	A couple times a year	2	0.9
	A couple times a month	4	1.7
	Weekly	81	34.5
	Daily	148	63.0

4.1 Instrument development

Empirical data were collected by means of an online questionnaire containing 22 questions. The questions were organized into the following two groups: (1) demographic questions about the respondents' gender, age, years of study, internet experience, Moodle experience, voluntariness, etc. (see Table 1 for the characteristics list); and (2) measures for the TAM constructs. The TAM constructs were adapted into the context of Moodle (see in Appendix A). The TAM measuring items were Likert-like items on a 7-point scale from ''strongly agree" to ''strongly disagree". To reduce measurement error, the development of the online questionnaire involved the following steps. First, a pre-test of the questionnaire was performed. The main goal of the pre-test was to improve the content of the measuring items, therefore colleagues from the faculty were asked to examine the questionnaire for meaningfulness, relevance and clarity. According to the feedback, few measurement items were refined in wording. After the pre-test, a pilot test of the questionnaire was performed with a non-random sample of twenty-five volunteers constituting faculty staff and students. The main goal of the pilot test was to empirically validate the reliability of the questionnaire – to check whether the measurement instrument lacked accuracy or precision. Data collected from the pilot test was analysed using SPSS to conduct internal consistency of the measurement items. The statistical test results confirmed a solid reliability for all measurement items.

4.2 Sampling process

Moodle is an open-source system and can be downloaded, deployed and used for free. Therefore, it is hard to identify the exact number of Moodle users. The number increases by approximately 1,300 new registered users every month. The statistical report from April 2010 [21] indicates that at the time of this report, 44,171 Moodle sites from 207 countries had been registered and validated. So far, over three million online courses using Moodle have been established and there are more than 31 million registered Moodle users. Our sample frame was limited to students that use Moodle at the Faculty of Electrical Engineering and Computer Science in Maribor. Our sample frame covered full-time students of technical studies. At the time of our research, 115 online courses were established and 1,566 users were registered. A systematic random sampling process, where every member of the sample frame had an equal chance of being selected, produced a sample of 800 Moodle users. The students that participated in the pilot test were excluded from the sample frame in the random sampling process. A request form for participation in the online survey was sent to the selected students. 284 online surveys were started, of which 235 were successfully finished and 49 returned incomplete. The usable response rate was thus 29%.

4.3 Statistical analysis

To describe the main features of an average participant in this study, descriptive statistics was used on the respondents' characteristics data. Structural equation modelling (SEM) was used to test the fit of the proposed theoretical model (Fig. 3) with empirical data. The measurement model was estimated using confirmatory factor analysis to test whether the proposed constructs possessed sufficient validation and reliability. To assess the reliability and validity of the measurement instrument used in this study, internal consistency, composite reliability and convergent validity were demonstrated. After assessing the reliability and validity of the measurement instrument, the measurement model was estimated. After the final measurement model passed the goodness-of-fit tests, the structural part of the research model was estimated using SEM on the structural model. The structural model was also tested for a data fit with appropriate goodness-of-fit indices. A statistical analysis was performed using the SPSS statistical package together with AMOS 17.0 software.

5 Data analysis and results

In this section, the data analysis and results are given. In the first subsection, the profile of the respondents is presented using descriptive statistics. In the following subsection, the methods for measurement instrument validity and reliability assessment are explained. Finally, the measurement and structural model analysis are used to explain the results of the study.

5.1 Demographic characteristics

The characteristics of the respondents are presented in Table 2. The typical respondent is a 21-22 year old male with less than a year of 1-2 years of study. The respondent has solid internet experience and already has had experience with Moodle. 63% of the respondents use Moodle daily and more than a half use Moodle for 3-5 courses.

5.2 Measure reliability and validity

Before testing the hypotheses, measurement items in the questionnaire were first assessed for content and construct reliability and validity. The results of the tests for unidimensionality, reliability and convergent validity provided evidence of the internal and external validity of the measurement instrument and scales. Table 3 summarizes the results of internal reliability, composite reliability and convergent validity for measurement instrument constructs. The internal consistency of the constructs was assessed by Cronbach's α, which is used for estimating the extent to which multiple indicators for a latent variable belong together. All the estimated Cronbach's α values for TAM constructs exceeded the cut-off value of 0.70 [22] , thus the constructs showed a reasonable level of reliability. Composite reliability was estimated using the following equation:

$$Cr = \frac{(\sum factor\ loading)^2}{(\sum factor\ loading)^2 + \sum measurement\ error}$$

The composite reliability measures for all of the constructs exceeded the recommended level of 0.70 [23]. As the third indicator of convergent validity, average variance extracted (AVE) was estimated. If the AVE is less than 0.5, then the variance due to measurement error is greater than the variance captured by the respective construct [23]. AVE was estimated using the following equation:

$$AVE = \frac{\sum(factor\ loading)^2}{\sum(factor\ loading)^2 + \sum measurement\ error}$$

Table 3: Instrument reliability and validity.

Construct	Item	Factor loading	Internal consistency Cronbach α >= 0.70	Composite factor reliability >= 0.70	Convergent validity Average Variance Extracted >= 0.50
Perceived Usefulness	PU2	0.77	0.815	0.821	0.605
	PU3	0.84			
	PU4	0.72			
Perceived Ease of Use	PEOU1	0.82	0.899	0.902	0.755
	PEOU2	0.89			
	PEOU3	0.90			
Behavioural Intention	BI1	0.77	0.848	0.865	0.682
	BI2	0.89			
	BI3	0.81			
Attitude Toward Using	ATU2	0.77	0.848	0.850	0.654
	ATU3	0.85			
	ATU4	0.80			

5.3 The measurement model

According to the modification indices provided by AMOS, some indicators (PEOU4, PU1 and ATU1) have been cut off from the initial measurement model and then the overall fit model for the final measurement model was estimated to ensure a good data fit with the model. A variety of fit indices were assessed to identify model goodness-of-fit as proposed by Rainer and Miller [24]. These indices include $\chi 2$, the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the comparative fit index (CFI), the root mean squared residual (RMSR), the root mean square error of approximation (RMSEA), the normed fit index (NFI), the non-normed fit index or Tucker Lewis index (NNFI) and the parsimonious fit index (PNFI).

Table 4 provides a summary of estimated fit indices for the final measurement model.

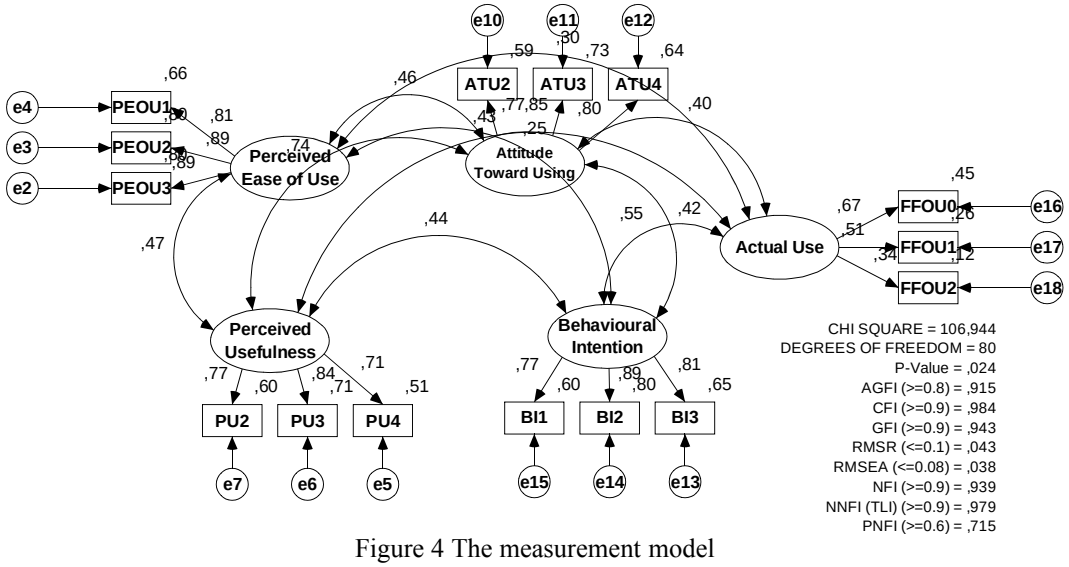

Figure 4 The measurement model

Table 4: Model fit summary for the final measurement and structural model.

Fit index	Recommended value [25]	Measurement model	Structural Model
χ^2	Non-significant	106.944	109.309
Degrees of freedom (df)	n/a	80	82
p		0.024	0.024
χ^2/df	< 3.00	1.337	1.318
Goodness-of-fit index (GFI)	> 0.90	0.943	0.942
Adjusted Goodness-of-fit index (AGFI)	> 0.80	0.915	0.915
Comparative fit index (CFI)	> 0.90	0.984	0.983
Root mean square residuals (RMSR)	< 0.10	0.043	0.044
Root mean square error of approximation (RMSEA)	< 0.08	0.038	0.038
Normed fit index (NFI)	> 0.80	0.939	0.938
Non-normed fit index (NNFI)	> 0.90	0.979	0.979
Parsimony normed fit index (PNFI)	> 0.60	0.715	0.732

5.4 The structural model

The estimated values of fit indices have proven the good structural model fit to the data. The values of fit indices are presented in

Table 4: The results of the final structural model (see

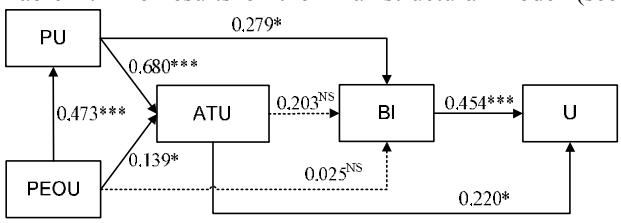

Figure 6) provide support for H1, meaning that PEOU (β=0.473; p<0.001) positively influences the PU. The final structural model results also show that PEOU (β=0.139; p<0.05) and PU (β=0.680; p<0.001) positively affect attitudes toward using Moodle. These results provide support for hypotheses H2 and H4. Students' behavioural intentions using Moodle are also positively affected by perceived usefulness (β=0.279; p<0.05), thus the hypothesis H5 was supported. Actual use of Moodle is positively affected both by attitudes toward using Moodle (β=0.220; p<0.05) and students' behavioural intentions (β=0.454; p<0.001), meaning that hypotheses H7 and H8 were supported. However, there was statistically insufficient evidence regarding the impact of PEOU and ATU on BI. This means, that the results did not provide support for hypotheses H3 and H6. Table 5 summarizes the hypothesis testing results and the results of the multiple-group analysis.

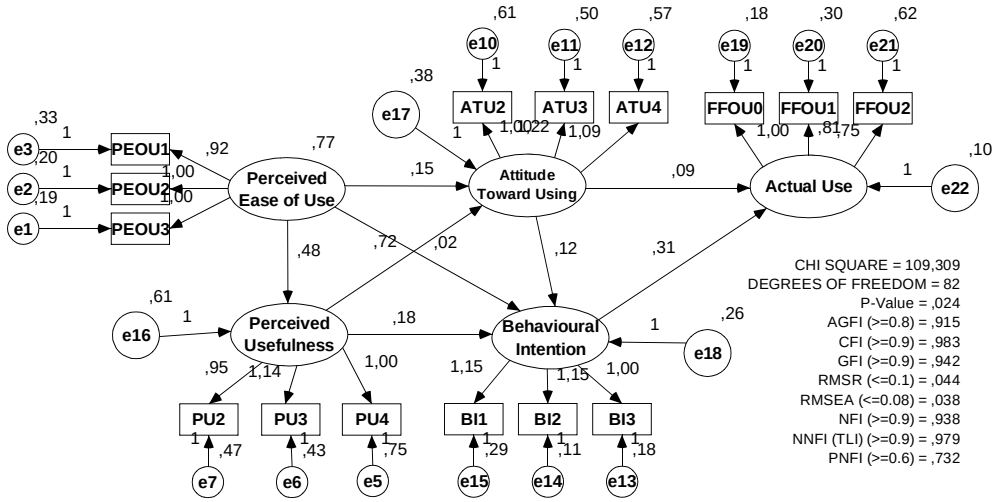

Figure 5: The final structural model.

Table 5: Hypothesis testing results.

Hypothesis	Effects	Path coefficient	Remarks
H1	PEOU → PU	0.473***	Supported
H2	PEOU → ATU	0.139*	Supported
H3	PEOU → BI	0.025^{NS}	Not Supported

H4	PU → ATU	0.680***	Supported
H5	PU → BI	0.279*	Supported
H6	ATU → BI	0.203^{NS}	Not Supported
H7	ATU → U	0.220*	Supported
H8	BI → U	0.454***	Supported

Notes: * p< 0.05; ** p< 0.01; *** p < 0.001; ^{NS} p > 0.05

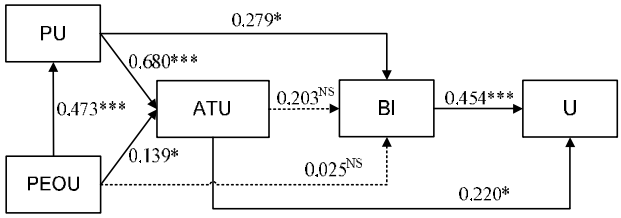

Figure 6: The research model results.

The final hypothesis results are also presented in Figure 6, where the values of size and the significance of individual causal links are written above the arrows between TAM constructs. A dotted arrow between two constructs means that there was no significant relationship found between these two constructs.

Table 6 summarizes the results of the study, where the discovered relationships are added to existing knowledge in the field of e-learning acceptance. The questionnaire and the items were confirmed with adequate discriminant and convergent validity metrics. For the measurement and structural model, several data fit indices were estimated in order to test the fit of the data with the proposed research model.

Table 6: The contribution of the study to existing knowledge.

Causal Relationship					
Independent Variable	**Dependent Variable**	**Positive**	**Positive ^{NS}**	**Negative**	**Negative ^{NS}**
PEOU	PU	14***(+1)***	1	0	0
PU	BI	13***(+1)***	0	0	0
PEOU	BI	6	2***(+1)***	0	0
PU	ATU	6***(+1)***	0	0	0
PEOU	ATU	5***(+1)***	1	0	0
ATU	BI	4	0***(+1)***	0	0
BI	U	2***(+1)***	0	0	0
ATU	U	0***(+1)***	1	0	0

6 Conclusion

The present study resulted in the empirical validation of the TAM research model in the context of Moodle and therefore contributes to the body of research in the field of e-learning acceptance based on the state-of-the-art theory: TAM.

The results of the study revealed that the perceived usefulness and perceived ease of use are factors that directly affect students' attitudes toward using Moodle, whereas perceived usefulness is the strongest and most significant determinant of students' attitudes toward using Moodle. This means that students like to use Moodle if they have good feelings about the usefulness of Moodle in getting better grades and knowledge. Several existing studies have also revealed that perceived usefulness can play an important role in affecting students' attitudes towards using an e-learning system [6],[9],[8],[26]. Students' perceptions regarding the "likeness" of using the system are also reflected by their comprehensions about how easy it is to use the system. The same results were also demonstrated in several other studies [9],[8],[26]. Perceived ease of use has a strong and significant impact on perceived usefulness. Students' intentions for using Moodle is not a result of students' perceptions about how much they like to use it. The SEM analysis also did not show a direct causal link between perceived ease of use and students' intention of using Moodle. The students' intention of using Moodle is mainly prompted by its perceived usefulness, meaning that students will use the e-learning system if they find it useful in their learning process. According to the results, the actual use of Moodle is a result of two factors: attitudes toward using and behavioural intention, where the latter is the most significant and strongest predictor of actual use of Moodle.

The results of this study have implications that are important to different e-learning stakeholders. As was discovered in this research, in the majority of cases, students are experienced internet users that are not worried about dealing with new technologies. Students mostly like to use an e-learning system because they find it useful for their studies, meaning that the e-learning system has to provide all the necessary e-learning services that a modern student needs in his or her learning process. E-learning system developers have to keep up with new web technologies and properly build them into the e-learning system. The usefulness of the e-

learning system is also closely connected to the content of e-learning materials that students are downloading from it. Learning content providers have to take advantage of an e-learning system to make the best of it when providing students with learning materials, news, asynchronous and synchronous communication, etc. We believe that students would find the e-learning system more useful if they would get adequate learning materials. The findings, presented in this study, can also be a direction for researchers in their future work. The research model should be extended in order to find external variables to investigate which factors have a significant influence on students' perceptions regarding ease of use and the usefulness of the e-learning system.

As in all empirical research, this study has limitations that need to be identified and discussed. First, the sample is limited to students at a faculty that is more or less technically oriented. Although the results from this study are useful for describing the characteristics of a large population of students, the generalizations of the results are limited to full-time undergraduate students. The students that participated in this study are mostly obliged to use Moodle in their studies. An average student is male and already possesses technical skills when it comes to internet use. Next, this study is only limited to a particular e-learning system. Although Moodle is a modern and well accepted e-learning system, the generalization of the results is limited to the characteristics and features provided by it. Moodle is an open-source product and therefore extensions can be implemented. The actual implementation and deployment of Moodle can affect different students' perceptions, such as usefulness and easiness. Because Moodle deployments' primary objectives are not the same in every case, this is another variable that will have to be addressed in future work as well.

In our future work, we will try to examine new variables that could be used to extend the TAM model for the e-learning domain. Together with future internet developments, new technologies and services will enable the creation of new and innovative e-learning system extensions and modules. We believe there are many constructs related to the user, technology and service domain characteristics. Such constructs can have a direct or indirect (but significant) impact on users' attitudes and intention for using the system. Our future research will therefore be dedicated to finding and evaluating such potential constructs.

7 References

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8 Appendix A. TAM items and scales

Item	Question	I strongly agree	I agree	I somewhat agree	Can't decide	I somewhat disagree	I disagree	I strongly disagree
Perceived Usefulness (PU)								
PU1	I would find Moodle useful for learning.	☐	☐	☐	☐	☐	☐	☐
PU2	Using Moodle enables me to accomplish tasks more quickly.	☐	☐	☐	☐	☐	☐	☐
PU3	Using Moodle for learning increases my productivity.	☐	☐	☐	☐	☐	☐	☐
PU4	If I use Moodle, I will increase my chances of getting knowledge.	☐	☐	☐	☐	☐	☐	☐
Perceived Ease Of Use (PEOU)								
PEU1	My interaction with Moodle would be clear and understandable.	☐	☐	☐	☐	☐	☐	☐
PEU2	It would be easy for me to become skilful at using the system.	☐	☐	☐	☐	☐	☐	☐
PEU3	I would find Moodle easy to use.	☐	☐	☐	☐	☐	☐	☐
PEU4	Learning to operate Moodle is easy for me.	☐	☐	☐	☐	☐	☐	☐
Attitude Toward Using Technology (ATU)								
ATU1	Using Moodle is a bad idea (negative).	☐	☐	☐	☐	☐	☐	☐
ATU2	Moodle makes learning more interesting.	☐	☐	☐	☐	☐	☐	☐
ATU3	Working with Moodle is fun.	☐	☐	☐	☐	☐	☐	☐
ATU4	I like working with Moodle.	☐	☐	☐	☐	☐	☐	☐
Behavioural intention (BI)								
BI1	I intend to use Moodle in the next 6 months.	☐	☐	☐	☐	☐	☐	☐
BI2	I predict I would use Moodle in the next 6 months.	☐	☐	☐	☐	☐	☐	☐
BI3	I plan to use Moodle in the next semester.	☐	☐	☐	☐	☐	☐	☐