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Emerald Article: E-learning and the University of Huelva: A study of WebCT and the Technological Acceptance Model

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Article Title Page

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Structured Abstract:

Purpose- The purpose of this paper is to investigate the factors that determine the acceptance of the WebCT learning system among students of the faculties of Business and Education Sciences at the University of Huelva, and to verify the direct and indirect effects of these factors.
Design/methodology/approach- A total of 226 students at the University of Huelva completed a survey questionnaire measuring their responses to six constructs which explain the system usage in the context of e-learning: technical support (TS), computer self-efficacy (CSE), perceived ease of use (PEOU), perceived usefulness (PU), attitude (A) and system usage (SU). Structural equation modelling (SEM) was employed for modelling and data analysis.
Findings- The most significant results point to the need to rethink the original structural model in terms of the relations of certain variables, although we also establish the importance of the direct effect of technical support on perceived ease of use and perceived usefulness among the students. We also confirm that WebCT usage and acceptance is directly influenced by perceived usefulness and indirectly by perceived ease of use.

Originality/value- The findings in this study have implications for the virtual learning systems managers at the University of Huelva, and for other universities that use online tuition systems. This paper reflects a lack of technical support which students need to use WebCT more efficiently. We must extend training courses and technical assistance for students

Keywords: Technology Acceptance Model, WebCT, Virtual Learning Platforms.

Article Classification: Research paper

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Running Heads:

E-learning and the University of Huelva: A study of WebCT and the Technological Acceptance Model

Abstract

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Introduction

The new Information and Communication Technologies (ICT) have been seamlessly assimilated into university teaching, mainly at the behest of specific groups of motivated academics.

There are two approaches currently competing in education, the modern and the postmodern (Uzun, 2012).

The modern approach in education places the teacher and the content of the material at the centre, while the postmodern approach puts the students and their needs and interests first.

The understanding of education in our digital age as centered on the student and not the teacher could have become reality. The argument over learning as formal versus informal or individual versus social has raged in educational circles. Learning for anybody, anywhere, anytime as well as lifelong learning and the concepts of distance learning form part of this ongoing argument in virtually every educational forum. So we could say that education is bearing witness to a transition away from the modern towards the postmodern educational system (Uzun, 2012).

The information and communication technologies (ICT) have acquired enormous power and gained considerable ground since their emergence in 1980, opening up a huge divide which is growing daily between the generation brought up in the past 30 years

and the one that came before. Prensky (2003) states that young people spend an inordinate amount of time in front of the computer screen in the modern age and children's brains are evolving to incorporate the new technologies that take up so much of their time. With this in mind, it is not simplistic to presume that the new generation of students has already taken the first step towards becoming autonomous and lifelong learners.

The Web 2.0 platforms and other sources of information on the Internet provide learning environments that can no longer be ignored; they are increasingly consulted and used by students all over the world. Any computer user can upload and download documents, images, programs, etc, in order to create, integrate and reuse them in other applications. In other words, any skill or basic information can be possessed and put into practice by today's youth. This leads to a predisposition towards receiving education via digital platforms, in which case there is a need for teachers who can guide and help them.

As a result, Internet technology in higher education has now become a means to disseminate course material, communicate and evaluate course work and to improve the educational processes that support collaborative learning. (Maloney, 2007; Nelson, Christopher and Mims, 2009; Augustsson, 2010). Web 2.0 technology, also called the Social Web, includes blogs, wikis (Wikipedia), social networks and markers, and these are built to support collaborative learning (Ajjan and Hartshorne, 2008; Boulos and Wheeler, 2007; Burden and Atkinson, 2008; O'Reilly, 2005). Web 2.0 technology is highly appropriate for collaborative learning, the construction and management of collective knowledge, and social networks and social interaction, which leads to course participants and teachers becoming more active and personally involved (Ajjan and

Hartshorne, 2008; Greenhow, Robelia and Hughes, 2009; Hain and Back, 2008; Kok, 2008; Ullrich et al. 2008).

Today there are countless terms that refer to the teaching-learning processes and online tuition networks, such as e-learning, virtual learning environments (VLE), e-training, e-education, blended learning, Web-based learning, distance education, distance learning, etc. These terms are related but nuanced.

We understand e-learning or virtual learning environments to be electronic information systems for the administrative and didactic support of learning processes in higher education or vocational training settings which provide students with sufficient resources for completing tasks systematically (Fry, Ketteridge and Marshall, 2009; Strohmeier, 2008; Weller, 2007; Šumak et al. 2011; Bhuasiri et al. 2012).

The development and application of virtual learning environments flow from their obvious advantages, such as fomenting greater collaboration and communication, convenience (reduced costs, better teaching and learning), efficacy, the user's ability to control his VLE, personalization, ubiquity, task orientation and the opportunity to promote VLE-guided teaching-learning (Ozkan and Koseler, 2009; Sitzmann, Kraiger, Stewart and Wisher, 2006).

Information technologies have radically altered the way we teach and learn (Hogo, 2010). Electronic learning offers a new perspective on education and is a shift in emphasis towards the student with teaching-learning now a permanent process (Sun, Tsai, Finger, Chen and Yeh, 2007).

Learning becomes a critical strategic resource for organizations that needs to be handled correctly. ICT provide new tools that endow organizations with the necessary mechanisms to manage tuition without ever forgetting that the learning is done by the people who constitute the organization; the human factor determines the success of learning strategies and knowledge management (Bahtt, 2001). So, our initial reflection on "e-learning" is to avoid emphasizing technological aspects and focus on the proper integration of technology in the learning processes.

ICT and the Internet alone cannot educate, or replace the teacher. They are powerful tools whose inclusion necessarily implies a change in the role of the teacher, and an overhaul of content, study plans and assessment systems.

The integration of new technologies within the educational framework is one of the main objectives of the new European higher education environment, which means a re-evaluation of existing educational programmes and managing the changes that are taking place. When the potential of technology is applied to university education, traditional teaching is strengthened by the Net, not substituted by it.

The effects of the new communications technologies are most keenly felt in distance learning; that is, e-learning or Internet-assisted learning. Some university degrees can now be studied in part or entirely on the Net. This new concept of teaching affects regulated education, and especially lifelong learning and post-graduate studies.

Indeed, e-learning has a decisive role to play in innovation at universities (Schneckenberg, 2004) since it can contribute to the design and integration of

pioneering educational interventions in the teaching-learning process at the start and throughout the individual's professional career (Franceschi, Lee, Zanakis and Hinds, 2009), although long-term planning is often haphazard.

The online learning platforms are of utmost importance in the virtual teaching and learning environments, acting as a space within which teachers and students can interact.

Students can communicate in two different ways in these spaces: asynchronically (communication that takes place in a different space and time), for example via blogs, wikis and e-mails; synchronically (communication occurring at the same time in different spaces) via live chat, webcams and video conferences.

Most of the world's universities now have computer systems that make it easy to consult course material and relevant publications, do online tests and receive course updates, submit tasks, and enable teachers and students to communicate, all thanks to the growth of information technologies. The teacher must be sufficiently skilled in the design and creation of course activities, making the best use of the widest range of tools in order to improve learning and increase communication, with all the possibilities that the Net offers.

There are several course systems on the market for setting up these virtual learning environments; they vary in sophistication but all share a common methodology.

According to (Brusilovsky, 2001; Tsolis *et al*., 2010) the most widely used systems are:

Commercial Platforms.

WebCT - Web Course Tools (http://www.WebCT.com) was originally developed at Canada's University of British Columbia by computer engineer Murray Goldberg. In 1995, Murray began searching for Web-based systems that could be applied to education. His research showed that the level of student satisfaction and academic performance could be improved by deploying educational resources based on Internet websites. He set about constructing a system to enable the creation of educational settings based on Web pages, and came up with the first version of WebCT.

This virtual teaching platform enabled the creation of flexible learning environments on the Web with versatile, easy to learn and connected solutions.

Blackboard (http://www.blackboard.com). Blackboard Inc. is a software company based in Washington D.C. (USA) that was founded in 1997 as a consultancy with a contract with the non-profit IMS Global Learning Consortium.

In 2006, Blackboard merged with the rival WebCT company, and the product previously called *WebCT* became known as the Blackboard Learning System.

Free research and collaboration platforms.

Moodle - Modular Object-Oriented Dynamic Learning Environment (http://www.moodle.org)

Moodle is a free course management system that helps teachers to create their own online learning communities. It was created by WebCT administrator Martin Dougiamas who based his design on ideas of collaborative learning. It is a website on which all the pedagogical activities related to the transmission and distribution of course content and material needed for one or various subjects can be done.

Instructors can add tools such as live chat, discussion board, feedback systems and provide statistics for groups and the educational community in general.

The importance of understanding the motivational factors behind students' acceptance of e-learning systems is evident if these teaching platforms are to succeed.

TAM is the most widely used information systems theory among researchers who model individual usage and acceptance of the new technologies (Davis, Bagozzi and Warshaw, 1989). This tool and others such as the upgraded TAM2 (Venkatesh and Davis, 2000) are recognized as robust and reliable instruments for predicting user acceptance of a broad range of new technologies.

The main aim of this study is to take a model based on the upgraded version of the TAM proposed by Davis, Bagozzi and Warshaw (1989) to investigate the factors that determine the acceptance of the WebCT learning system among students of the faculties of Business and Education Sciences at the University of Huelva, and to verify the direct and indirect effects of these factors.

The results will enable us to adapt our teaching system to the new demands of the economy and above all to the educational needs of our students.

This article is structured as follows: we start with a review of the literature as way of introducing TAM, and look back at research into the uptake of the various educational systems based on e-learning processes over the years; we then develop the acceptance model and present our hypotheses, followed by a description of our data gathering

technique; we make a statistical analysis of the data and show the results, and re-evaluate the hypotheses. Finally, we discuss the results and model limitations, and offer ideas for future lines of investigation.

Literature review

Although many tertiary education institutions now use the Web for learning and tuition, few studies have researched the factors that influence the student's decision to use and accept the WebCT platform.

In 1989, Davis proposed the Technology Acceptance Model (TAM) as an instrument to explain and predict the adoption and usage of information technology.

Following previous research into information systems (Swanson, 1974; Benbasat and Dexter, 1986; Franz and Robey, 1986; Markus and Bjorn-Anderson, 1987; Swanson, 1987), Davis extended the Theory of Reasoned Action to centre his model on the behavioural elements at work in the intention to use new technology. This theory focussed specifically on the analysis of the effect of external factors on beliefs, attitudes and intentions (Davis, Bagozzi and Warshaw, 1989).

TAM identifies two specific measures that fundamentally affect the decision to adopt new technology: perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989; Davis, Bagozzi and Warshaw, 1989).

TAM echoes the Theory of Reasoned Action by posing that the use of any new computer technology is determined by behavioural intention. However, TAM differs in that it incorporates two direct measures of intention: attitude towards the technology and perceived usefulness. At the same time, perceived usefulness affects attitude. Both theories concur in that the perceived ease of use of a technology conditions the attitude toward that technology and the perceived usefulness that comes from using it. The effect of the external variables is seen in the individual's beliefs in terms of perceived usefulness and perceived ease of use.

Although the direct effect of a measure such as perceived usefulness on behavioural intention runs contrary to the Theory of Reasoned Action, empirical evidence and various alternative models based on intention (Triandis, 1977; Brinberg, 1979; Bagozzi, 1982) justify this relation. So, perceived usefulness is a cognitive element that conditions behavioural intention while attitude is an affective component (Davis, Bagozzi and Warshaw, 1989).

Numerous investigators have used and developed TAM, including Armenteros *et al.* (2013), Lee and Lehto (2012), Chow *et al.* (2012), Yeh and Teng (2012), Mathieson (1991), Szajna (1996), among others.

Armenteros et al. (2013) explore the behavioural intentions of FIFA instructors towards education using multimedia material. The conclusions reveal that perceived usefulness followed by perceived enjoyment, perceived ease of use and quality of the multimedia instruction marked the instructors' behavioural intentions to a large degree when using multimedia teaching material.

Lee and Lehto (2012) use the Technology Acceptance Model (TAM) to identify the determinants that affect behavioural intention of use with YouTube. This research highlights the motives for using YouTube in learning tasks.

The results show that behavioural intention was significantly influenced by perceived usefulness and user satisfaction.

Chow et al. (2012) use TAM to describe the development and evaluation of the Second Life (SL) online 3D world, a virtual environment for learning.

Yeh and Teng, (2012) study the conceptualization of perceived usefulness and state that the usefulness of the system can be formulated beyond merely improving its functioning; the authors explore various other usefulness constructs based on well-established management concepts and the theory of human needs. The study's empirical results validate most of the proposed constructs.

Mathieson (1991) compared TAM and the Theory of Planned Behaviour (TPB), both of which predict the individual's intention to use an information system. The results showed that TAM has a slight empirical advantage over TPB.

Research by Szajna (1996) resulted in an empirical confirmation of the original TAM. The results confirm that the original TAM is still a valuable tool for predicting intention to use information systems.

Research on the usage and acceptance of virtual online tuition systems is scarce but currently on the increase due to the relevance of e-learning in attempts to improve our educational system. They provide innumerable tools for a wide range of subjects, such as document and Web page consultation, discussion board, live chat and videoconferencing, etc.

The most recent studies on the adoption of e-learning systems come from Zhang et al. (2012) who propose that we extend our knowledge to enable student participation in online forums by studying the role played by a communication environment. The results reveal that the psychological safety communication climate influences student intention to continue to participate directly.

Saadé et al. (2012) describe the results of critical thought in a virtual learning environment. The results indicate the importance of interactivity which is perceived by students as directed critical thought versus materials online as resources.

Yoo et al. (2012) study the role of intrinsic and extrinsic motivators in the promotion of e-learning systems in the workplace in South Korea. The results show that the intrinsic motivators (the expected effort required, attitude and anxiety) affect the intentions of the workers in the use of workplace e-learning more strongly than the extrinsic motivators (performance expectations, social influence and facilitating conditions).

Escobar-Rodriguez and Monge-Lozano (2012) analyze the intention of students to use the Moodle platform and thus as a way of improving the teaching-learning process.

They use TAM to specify causal relations, and this theory suggests a significant positive relation between perceived ease of use and perceived usefulness.

Varol, Tarcan and Ozmen (2010) who studied the acceptance and use of e-learning systems in Turkey. This field study aimed to understand the beliefs, attitudes and intentions of students and their interrelations, with the results showing that TAM is valid for explaining e-learning systems usage. Liu, Chen, Sun, Wible and Kuo (2010) studied the factors that affected Taiwanese students in their intention to use an online learning community. They extended TAM by adding variables such as Online Course Design, User-interface Design, Previous Online Learning Experience and Perceived Interaction.

Park (2009) constructed a model with the following variables: self-efficacy in e-learning, subjective norm, system accessibility, perceived usefulness, perceived ease of use, attitude and behavioural intent to use e-learning systems. The author concluded that the most important construct in the model was self-efficacy in e-learning, followed by subjective norm, when explaining the model's causal processes.

Ngai, Poon and Chan (2007) applied TAM to factors that determine WebCT usage in higher education institutions in Hong Kong. They extended the model to include a new factor, technical support, with the results showing that it has a direct, significant effect on the sensations of perceived ease of use and usefulness.

Other research into e-learning systems has studied the relevance of technical support (Martins and Kellermanns, 2004; Sánchez and Duarte, 2010), various aspects of system

quality (Pituch and Lee, 2006), encouragement by others (Martins and Kellermanns, 2004), and computer efficacy and experience (Martins and Kellermanns, 2004; Ong, Lai and Wang, 2004).

Research model and hypotheses

Since TAM was first proposed by Davis, it has been widely accepted by the scientific community as a reliable instrument for modelling attitudes towards usage of information systems and predicting intent to use and adopt them. Several investigations with differing approaches have deployed TAM to measure the degree of technology adoption (Cheng et al. 2011; Lee et al. 2011; Lee et al. 2009).

Our study proposes a TAM extension that examines the constructs that affect adoption of the WebCT system. The study includes variables such as technical support and computer self-efficacy but excludes intention to use since Ngai *et al.* (2007), when testing the validity and reliability of the constructs, demonstrated that teachers' insistence that students use Web-based learning systems has a considerable impact on the use of learning systems.

The variables in our model are: technical support, computer self-efficacy, perceived usefulness and ease of use, attitude and system usage (Figure 1).

We expected our model to contain variables and relations that would significantly affect the adoption of WebCT, and we predicted that technical support and computer self-efficacy would be both extrinsic and intrinsic factors that would influence the students' acceptance of the online tuition system.

Ralph (1991) defined technical support as "people assisting the users of computer hardware and software products" that can include telephone hotlines, online support services, automated telephone voice response systems and fax. Igbaria (1990) described technical support as two-dimensional, the first consisting of support for users via the system's development tools, user manuals and relevant documents while the second relates to management support in which the leaders offer maximum encouragement and resources.

Figure 1. Near Here

Evidently, demonstrable organizational support, including technical support, foments a more receptive attitude that enhances acceptance and the success of personal computing systems (Igbaria, 1990; Sánchez and Duarte, 2010).

Chau (1996) states that technical support affects perceived ease of use, and Compeau and Higgins (1995) report that it also has a positive influence on information technology usage. In this way, technical support is directly related to the lowering of computer-related anxiety and helps to develop a more favourable attitude towards new computing systems. The lack of proper technical support can be a considerable obstacle to the effective use of new information technology.

With this in mind, we propose the following hypotheses:

H1: Technical support has a positive influence on computer self-efficacy towards using of WebCT.

H2: Technical support has a positive influence on the perceived ease of use of WebCT.

H3: Technical support has a positive influence on the perceived usefulness of WebCT.

Self-efficacy refers to the levels of confidence individuals have in their ability to carry out specific courses of action (Bandura, 1982, 1997). The same author hypothesized (1986) that self-efficacy expectations affect the initiation of an activity, and the effort and persistence required to successfully carry that activity out. Self-efficacy acts a self-motivating force (Kankanhalli et al. 2005).

Compeau and Higgins (1995) and Compeau and Huff (1999) define perceived computer self-efficacy as individuals' judgement of their capabilities in using a computer within various information technology contexts. Low confidence in the ability to use new ICT makes individuals more prone to frustration in the face of obstacles, which in turn dampens expectations and their capacity to use new technologies. However, those with a higher estimation of their abilities persevere when faced with difficulties and are not easily put off by setbacks (Compeau and Higgins, 1995).

In terms of perceived self-efficacy, Albion (2001) showed that this is vital when explaining teachers' use of technology in the classroom. The study carried out by Liaw et al. (2007) showed that the instructors have positive attitudes towards e-learning, and included variables such as perceived self-efficacy, enjoyment, and usefulness and behavioural intention of use.

This leads us to propose the following hypotheses:

H4: Computer self-efficacy has a positive influence on the perceived ease of use of WebCT.

H5: Computer self-efficacy has a positive influence on the perceived usefulness of WebCT.

H6: Computer self-efficacy has a positive influence on attitude towards using of WebCT.

According to TAM, behavioural intention to use technology is affected by two mediators: perceived ease of use and perceived usefulness, with the former influencing the latter. If users feel that the system is easy to use, they will see the usefulness of the learning platform and will be willing to engage with the technology.

Davis (1989) defined perceived usefulness as "the degree to which a person believes that using a particular system will enhance his or her job performance" (Hsu and Lin, 2008)

Perceived usefulness has two dimensions: the perceived usefulness for the organization and for the individual. The former relates to the financial benefits (product quality and savings in teaching costs) that the organization can obtain by adopting a new

technology. For the individual, the benefits derive from better work performance and motivation to use the technology (Robey and Farrow, 1982).

In our study, perceived usefulness of the WebCT learning system is defined as the degree to which the users believe that use of this system will improve their academic performance.

Davis (1989) defines perceived ease of use as "the degree to which a person believes that using a particular system would be free from effort". Individuals who perceive that a system is easy to use are more inclined to believe in its usefulness (Robey and Farrow, 1982) and in the ease with which they can access the system (Amoako-Gyampah, 2007)

Our study defines perceived ease of use of WebCT as the degree to which the user considers that WebCT usage will not require any great effort (Davis, 1989).

Many researchers have used TAM in their e-learning studies and have found that perceived ease of use and perceived usefulness have significant effects on the individual's behavioural intention to use an e-learning system (Liu, Liao and Pratt, 2009; Ong, Lai and Wang, 2004; Sheng, Jue and Weiwei, 2008).

TAM proposes that perceived usefulness and ease of use have a direct influence on attitudes towards new technology usage. Attitude is the degree to which a user is interested in specific systems, and has a direct effect on intention to use these systems in the future (Bajaj and Nididumolu, 1998).

Finally, the use of specific computer systems is affected by perceived usefulness and ease of use (Davis *et al*. 1989; Igbaria *et al.* 1997; Selim, 2003).

Based on this, we propose the following hypotheses:

H7: Perceived ease of use has a positive influence on the perceived usefulness of WebCT.

H8: Perceived ease of use has a positive influence on attitude towards the use of WebCT.

H9: Perceived ease of use has a positive influence on the use of WebCT.

H10: Perceived usefulness has a positive influence on attitude towards the use of WebCT.

H11: Perceived usefulness has a positive influence on the use of WebCT.

H12: Attitude to use has a positive influence on the use of WebCT.

Method

Measurements

We used a two-part questionnaire in our study: the first part requires the participant to fill in personal and academic data; the second part consists of 28 items (Annex 1) to be

used to evaluate the six constructs of the model proposed – technical support (TS), computer self-efficacy (CSE), perceived ease of use (PEOU), perceived usefulness (PU), attitude (A) and system usage (SU).

The items were adapted from previous studies: technical support was measured on a scale adapted from Igbaria (1990), computer self-efficacy was calculated with measurements taken from Compeau and Higgins (1995); the perceived ease of use and perceived usefulness variables were based on a Davis (1993) register with modifications, and attitude was measured on a gradation proposed by Ajzen and Fishbein (1980). These five variables were measured on a 7-point Likert scale ranging from 1 ("totally disagree") to 7 ("totally agree").

To measure the degree of WebCT acceptance, the participants were asked classify how often they used the system, on a scale of 1 ("never") to 7 ("very often").

Sample and Data Collection

The object of this study was the WebCT learning system in place at the University of Huelva. WebCT, as already mentioned, is an Internet-accessible course management system for higher education. The study subjects were students on the Business Management and Administration degree course at the Faculty of Business Sciences, and students on the Infant and Primary Education teaching degree course at the Faculty of Educational Sciences, both at the University of Huelva.

We developed a questionnaire based on our research model to measure the variables; the questionnaire was completed in class. Following a pre-test, some questions were rewritten for clarification.

The questionnaire was completed by 266 students from academic year 2008/09, in April and May 2009, of which 226 completed questionnaires (85%) were deemed valid.

The sample profile of participants appears in Table 1, which shows that 66.8% of those surveyed were women and 33.2% were men.

The table also shows that 54.4% of participants were third-year students, and 28.3% were aged 21.

Table 1. Near Here

Table 2. Near Here

Table 2 shows the frequency response to each of the items and the mean and standard deviation for the WebCT system.

We observe that the item with highest mean is PEOU2, “It is easy to get course material from the platform”, with 5.38, it being the item that the students are most satisfied with. The lowest mean was recorded for TS2, “the support technicians are available for consultation at all times”, with 3.26, the item that the students are least happy with. They find that technical support is insufficient to enable them to improve their usage of WebCT.

The highest standard deviation is 1.78, for item PU4, "using the platform makes it easier to learn at university", which is the item that produced the widest or narrowest dispersal of opinion among the students; and the lowest is 1.3, for item PU1, "using the platform improves my academic performance", this being the item that produced the narrowest and widest dispersal of opinion among the students.

Analysis and results

Firstly, the psychometric properties were analysed with the SPSS statistical program, and the testing of the model and the checking of the psychometric properties were done with Amos 6.0 and Lisreal 8.80, the most widely used structural equation software programs on the market. The analysis process followed recommendations by Hair, Anderson, Tatham and Black (1998) and was carried out in two parts:

1. Exploratory analyses to check the validity of the variables proposed and compare the initial reliability of the scales.
2. A causal and confirmatory factor analysis to verify the dimensionality in the exploratory study and to allow the established scales to be purged. This analysis makes it easier to check the psychometric properties of the factors that constitute the model and to contrast the structural relations proposed.

Our study randomly divided the sample of 226 students into two sub-samples, S1 with 30% of the data, and S2 containing 70% (Ngai *et al*., 2007). The first analysis examined

S1, using the SPSS program. Then Amos 6.0 and Lisreal 8.80 software programs were used on S2 for the second causal and confirmatory analysis.

Analysis of the measurement model

This study examined the validity and reliability of the variables by means of an exploratory analysis.

The SPSS program was used to test the variables' validity by analysing the main components with Kaiser's Varimax rotation, as recommended in the literature (Kaiser, 1970 and 1974; McDonald, 1981; Hair, Anderson, Tatham and Black, 1999).

The initial analysis of the main components showed that we had to extract five components: technical support (TS), perceived ease of use (PEOU), perceived usefulness (PU), attitude (A) and system use (SU). This was due to the fact that the computer self-efficacy (CSE) variable loaded on perceived ease of use (PEOU), so we eliminated CSE from our model. The items TS3, TS4, TS5 and TS6 were also eliminated as they loaded on a new component that did not coincide with the rest of the items in the technical support (TS) construct. This could be because those surveyed did not realise that the WebCT platform provided tools (fax, mail systems, etc) which could be used to request assistance on technical issues.

Table 3. Near Here

Table 4. Near Here

We then carried out a second analysis of the main components without the computer self-efficacy variable and items TS3, TS4, TS5 and TS6 of the technical support construct, resulting in a new hypothesis, H13, which proposed that technical support had a positive influence on attitude to use WebCT.

In the second WebCT factor analysis, the KMO (Kaiser-Meyer-Olkin) index stood at 0.843, suggesting that the factor analysis was feasible. Five components were extracted, which explains the 79.36% in the survey's response variance, using the Kaiser-Guttman rule for eigenvalues above 0.82.

The results of the new analysis of the main components in Table 3 show that the load values of each variable item are above 0.4 (Nunnally, 1978), except the 0.35 for item 2 of the Attitude construct (A2) but which is still close enough to the recommended value. As a result we verify that the mean points are sufficiently valid.

The discriminant validity technique was used to test validity and enable the correct interpretation of relations between the constructs. This concept refers to the accuracy by which the measure used does not correlate too closely to the measures of other constructs from which it is supposed to differ theoretically.

The discriminant validity evaluation in this study found that there is no value of 1 in the correlation between each pair of constructs, with a confidence interval of between 95% and 99%. This allows us to deduce that each variable represents a different concept since they are not perfectly correlated.

In the correlations matrix of the data set in Table 4, the correlations above 0.3 were statistically significant at 0.01. The majority of the correlations between the items were significant at values equal to or higher than 0.3, significance registering at 0.1.

The correlations are stronger between items that measure the same variable than between items that measure different variables, demonstrating the convergent and discriminant validity of our model.

The reliability of each construct and dimension was measured, based on the notion that reliability is the required, though not absolute, condition for the validation of a construct.

Reliability, according to George and Mallery (1995), is related to the fact that the instrument used for measurement produces the same results whenever it is applied to the same person and in the same circumstances. Thus, the instruments normally used in Social Sciences are considered reliable if they obtain similar results, regardless of who administers them and how. We tested the reliability of the variables with Cronbach's alpha, the most widely used tool for this type of analysis.

In our study, the Cronbach alpha coefficients for each of the five variables are greater or equal to the 0.7 threshold acceptable for determining reliability. Table 3 shows the coefficients ranging from 0.70 to 0.93, which indicates that the instrument is reliable and internally coherent.

Test of structural model

After eliminating the computer self-efficacy variable and items TS3, TS4, TS5 and TS6, we tested the proposed structural model with Structural Equation Models (SEM), which were chosen for their capacity to examine relations between constructs with multiple measurement scales (Jöreskog and Sörbom, 1996).

Amos 6 and Lisreal 8.80 software programs were used in a confirmatory factor analysis of the second sample (S2). The maximum likelihood method of estimation was used (Hu and Bentler, 1995).

We tested the model's goodness-of-fit by using goodness-of-fit indexes recommended by Hu and Bentler (1995), Hair, Anderson, Tatham and Black (1995), and Hu, Chau, Sheng and Tam (1999), such as the Chi-square test, the Goodness-of-Fit Index (GFI), the Adjusted Goodness-of-Fit Index (AGFI), the Normed Fit Index (NFI), the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA).

Table 5 shows that the goodness-of-fit of all the statistics is within an acceptable range, except the GFI which is sufficiently close to the recommended score to be acceptable.

Table 5. Near Here

The results of the structural model are shown in Tables 6 and 7, and in Figure 2. Table 6 shows the results of the coefficient of the determination R^2 for each endogenous

variable. It is important to underline the explanatory power of the perceived usefulness, attitude and system usage variables, with R^2 values of 43%, 75% and 27% respectively.

Figure 2 and Tables 6 and 7 show the important structural relation between the variables studied. All the hypotheses were considered significant except Hypothesis 13, 9 and 12. The results for Hypothesis 13 (H13) reveal that the relation between technical support and attitude is not significant (β= 0.06. p> 0.05). However, it is noticeable that perceived usefulness and ease of use have a strong indirect effect on attitude (β= 0.33. p< 0.01).

Hypothesis 9 (H9) posed a relation between perceived ease of use and WebCT usage, was also rejected. Our study differs from others in that the relation between both variables is insignificant (β=0.09. p>0.05), although perceived ease of use has a moderate indirect effect on WebCT usage via perceived usefulness and attitude (β=0.28. p<0.05).

Hypothesis 12 (H12) proposed that attitude influences WebCT usage. Our study, like others (Ngai *et al*. 2007), found that attitude has no significant influence on platform usage (β=0.14. p>0.05).

Our study also rejected Hypotheses 1, 4, 5 and 6 due to the elimination of the computer self-efficacy variable.

Figure 2. Near Here

Table 6. Near Here

Table 7. Near Here

Discussion

E-learning systems represent an alternative to traditional face-to-face educational methods. Many institutions have now installed these systems to satisfy the needs of students who can now study without the hindrances imposed by space and time.

The aim of this investigation was to examine the factors that motivated students at the University of Huelva to accept the WebCT platform. Our study proposed a research model to analyse the variables affecting WebCT acceptance via an extension of TAM. The variables in our model were technical support, perceived self-efficacy, perceived usefulness, perceived ease of use, attitude and end-usage.

We expected our model to produce variables and relations that were significant. We also believed that technical support and perceived self-efficacy would be intrinsic and extrinsic factors that would affect WebCT acceptance. The data on the students were gathered via questionnaire and analysed by structural equation modelling. The results suggest that most of the hypotheses were proven. The discussion now turns to the results relating to each hypothesis.

Our research highlights the importance of our extrinsic variable (technical support) which is closely related to perceived ease of use and, as in other studies (Ngai *et al.* 2007; Sánchez and Duarte, 2010), to perceived usefulness. It also has a considerable indirect effect on attitude, showing that when students have good technical backup, understood as personal assistance via the Web, fax or e-mail, etc, they are much more

motivated and are keener to learn, and much more receptive to using the WebCT system.

In other words, the better the technical service or assistance provided to students to help solve their problems, the more useful and easier WebCT platform usage is considered to be.

We believe that our research results make a contribution to the teaching aspects of ICT. The University of Huelva is constantly evolving, and despite its small size, its vitality and potential is underlined by the priority it gives to the constant improvement of online tuition systems.

This improvement is due to the support provided by the University of Huelva for its teachers in WebCT usage. But our study also reveals the lack of tuition and support for students in e-learning. The University of Huelva needs to dedicate more time, resources and personnel to strong technical support for students in order to motivate them to use e-learning platforms.

The results of our study also show that platform usage is directly affected by perceived usefulness and indirectly by perceived ease of use. Usage is also influenced by attitude, albeit slightly, which could be due to pressure from teachers which conditions students' attitude in that it obliges them to use these virtual teaching platforms to study and pass certain subjects.

The importance of the perceived usefulness variable through its direct or indirect effects (via attitude) on WebCT usage suggests that teachers must make the most of the

platform, since they do not normally use all the tools available to them, so that the students see that the online learning system can be useful.

The perceived ease of use variable evaluated in our study, in accordance with Selim (2003), has no direct relation to WebCT usage, although an indirect and significant relation does exist via perceived usefulness and attitude. The insignificant relation of the direct effects is consistent with other recent studies (Chau and Hu, 2002; Szajna, 1996; Wu and Wang, 2005). Further investigating the issue, Venkatesh, Morris, Davis and Davis (2003) did not find any direct post-implementation effects of perceived ease of use, only pre-implementation effects. The significant relation by means of indirect effects suggests that when we have an ill-informed, preconceived idea that using a system is difficult, we might really believe that the system is complicated to use and that the potential benefits are not worth the effort required to achieve them, without even having tried to use the system. Therefore, teachers need to design learning strategies that enable students to gain confidence and competence in carrying out particular activities, and system designers must focus on creating intuitive, user-friendly environments to make it easier for students to use the platform. If students encounter a lot of difficulties in using the platform, they will abandon it.

Following previous studies, we initially used the computer self-efficacy intrinsic variable in our investigation. The results of the exploratory analysis show that this variable had to be eliminated because it loaded on to the same component as perceived ease of use, that is, they were indistinguishable as variables.

Conclusions

The traditional role of the student in education is to be the passive reader and listener, and to cram for exams. However, theories on how we learn show that real knowledge, which the student never forgets, is acquired when the learner plays an active role, constructs things and puts them into practice, resolves problems, analyses situations and searches for answers, etc.

This teaching-learning process has received a significant boost from Internet usage in education. The student actively participates in the construction of his own knowledge. Tools and resources are now on hand, such as course tutors, mutual support from fellow students, discussion boards, live chat, course content, etc, and all of it whenever and wherever the student logs on to his course.

The worldwide development of Web resources for higher education has increased rapidly in recent years, providing students with an ever wider range of educational resources in various formats: video, photography, audio, text, etc (Zhang and Zhou, 2003).

At the same time, with the growth in the quantity and quality of Internet connections, more and more people, students especially, are demanding access to online course management systems. As a result, we need to understand the factors that prompt students to adopt and use WebCT in order to include them in the development of this technological tool.

The findings in this study have implications for the virtual learning systems managers at the University of Huelva, and for other universities that use online tuition systems. We must extend training courses and technical assistance for students whether by email, live chat, discussion boards, direct personal assistance, etc. The proposed model is revealing for the importance of the technical support variable, which the statistics show to have the lowest mean as it registered the most student dissatisfaction.

We also suggest that teachers show greater commitment to using these e-learning systems, since it goes without saying that the acquisition of the relevant skills by the teacher is the key to the success of the teaching-learning process.

The significance of the perceived usefulness variable in WebCT acceptance implies that the teacher becomes a determining factor, because he has direct contact with the students and is aware of the obstacles that hinder usage and the support needed for the integration of these tuition systems in the classroom. The teacher must motivate the students to use this tool more efficiently and effectively.

Like all studies our research has its limitations, such as the age of the data used, but even so we believe this study is still relevant since it gives a very clear picture of student motivation in the use and acceptance of WebCT e-learning; and since the age range of the students involved in these educational processes remains the same over the academic years, it is admissible that their perception of technology oriented to e-learning systems is very similar, which could help future research to clarify other possible student motivations towards these systems and the new ones that will surely appear in the future to facilitate e-learning.

In addition, the differences in student experience with the system and the time spent using it. The coefficient of determination R^2 of system usage (R^2=0.27) is moderately good but always susceptible to improvement, meaning that there are other variables, apart from those proposed, that could influence system usage and thus improve this determination coefficient. This study included only two non-TAM variables (technical support and perceived usefulness), and other variables that might have significantly influenced the acceptance of WebCT were not considered for the sake of brevity. The small sample size together with the rigorous requirements of the structural equation modelling techniques could have also influenced the results.

Future investigations should study other variables that might affect WebCT usage, such as teacher support, mutual support among students, previous computer knowledge, teachers' demands, etc. Other complimentary or comparative studies with other universities that use e-learning systems could also be carried out.

Annex

Questionnaire statements used in the study	
Technical Support	
TS_1	The platform provides assistance when you have technical problems.
TS_2	Technical support staff is available at any time.
TS_3	I can contact support staff via fax when there is a technical problem.
TS_4	I can contact support staff via e-mail when there is a technical problem.
TS_5	Technical assistance can be called up via Web request forms.
TS_6	In general, the platform provides good technical support.
Perceived Usefulness	
PU_1	My learning is more effective when using the platform.
PU_2	Using the platform improves my academic performance.
PU_3	Using the platform enhances the efficacy of my learning.
PU_4	Using the platform makes it easier to learn at university.
PU_5	Using the platform I have more control over my learning.
PU_6	In general, I find the platform to be an advantage for my learning.
Computer Self-efficacy	
CSE_1	I can access course content on the platform.
CSE_2	I can navigate freely for course content on the platform.
CSE_3	I can use the platform without detailed instruction on its use.
CSE_4	I can overcome obstacles that occur when I use the platform.
CSE_5	I can use the platform if system manuals are available.
CSE_6	In general, I am competent in using the platform.
Perceived Ease of Use	
PEOU_1	Learning how to use the platform is easy for me.
PEOU_2	It is easy to obtain course material from the platform.
PEOU_3	It is clear and easy to understand how to use the platform.
PEOU_4	In general, I believe the platform is easy to use.
Attitude	
A_1	Learning on the platform is fun.
A_2	Using the platform is a good idea.
A_3	The platform is an attractive system on which to learn.
A_4	In general, I like using the platform.
System usage	
SU_1	I connect to the platform. (1- never to 7- very often)
SU_2	The hours I spend using the platform per week range from: (1- none to 7- many hours)

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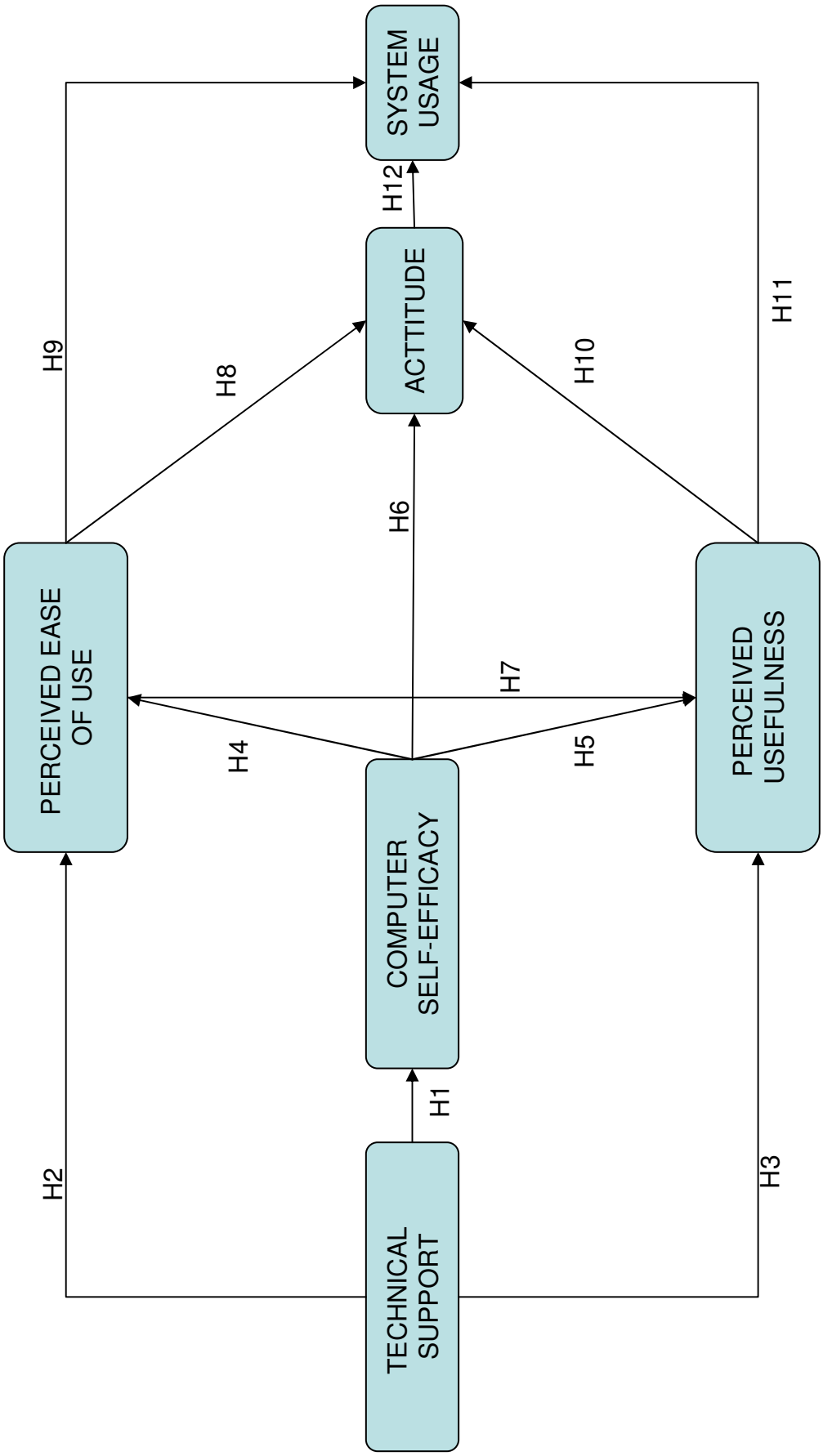

Figure 1. The proposed model for the acceptance of the WebCT virtual learning environment system.

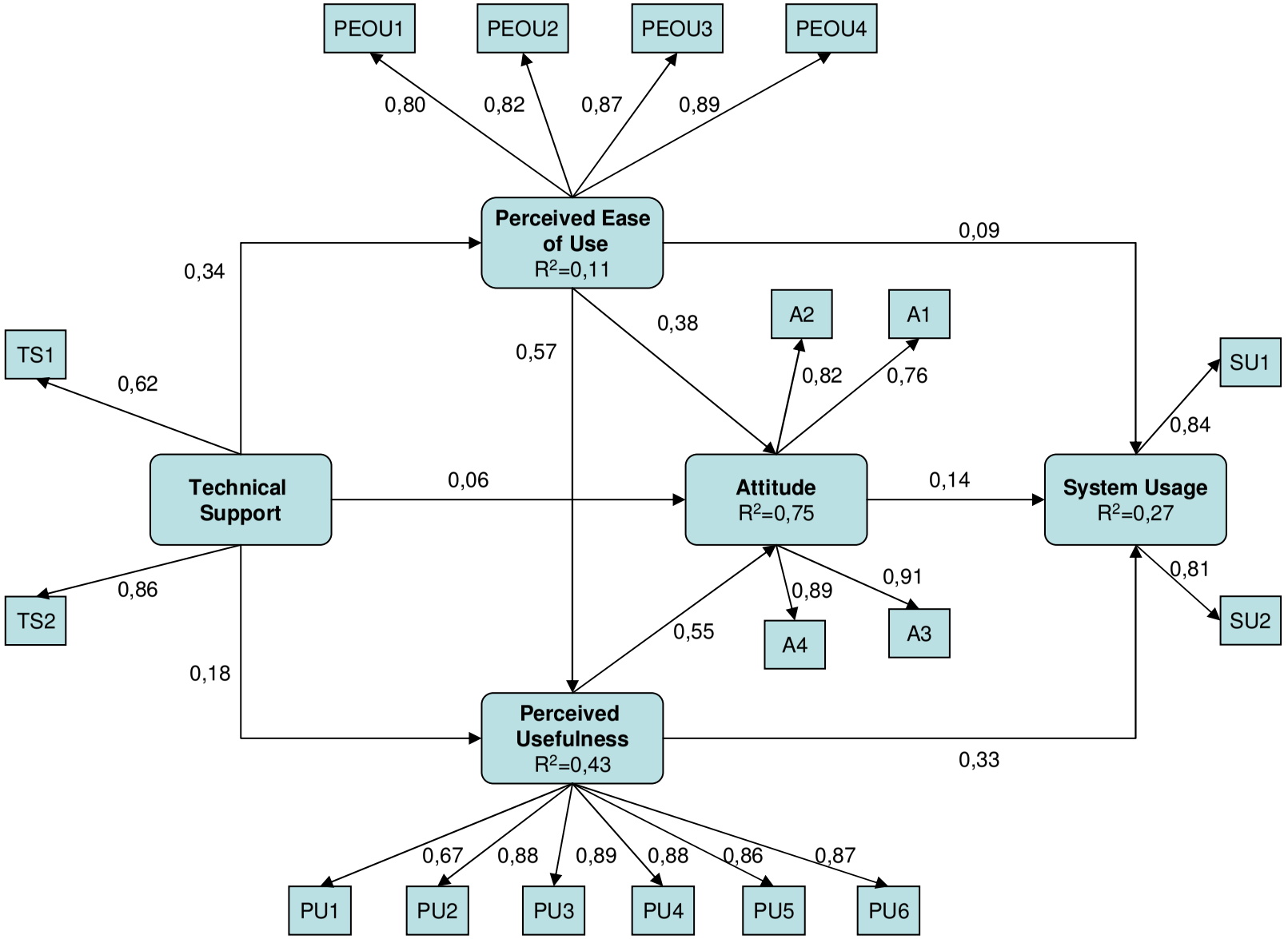

Figure 2.The result of the structural model

Table 1. Demographic information of the participants *(N= 226)*

	Frequency	Percentage
SEX		
Male	75	33.19
Female	151	66.81
TOTAL	226	100.00
Current Academic Year		
First	1	0.44
Second	25	11.06
Third	123	54.42
Fourth	77	34.07
TOTAL	226	100.00
OCCUPATION		
Student	226	100.00
AGE		
19	6	2.65
20	44	19.47
21	64	28.32
22	44	19.47
23	28	12.39
24	20	8.85
25	9	3.98
26	7	3.10
29	2	0.88
32	1	0.44
37	1	0.44
TOTAL	226	100.00
DEGREE COURSE		
Business Management & Administration	146	64.40
Infant & Primary Education	80	35.40
TOTAL	226	100.00
	Frequency	**Percentage**
MATRICULATION TYPE		
Official	226	100.00
Erasmus	0	0
TOTAL	226	100.00

Table 2. A statistical description of the item in the questionnaire

WEBCT		1 %	2 %	3 %	4 %	5 %	6 %	7 %	MEAN	S.D.
Technical Support									**3.44**	**1.18**
TS1	The platform provides assistance when you have technical problems.	8.0	11.9	19.0	39.4	14.6	6.2	0.9	3.63	1.31
TS2	Technical support staff is available for consultation at any time.	12.8	19.9	21.7	26.1	14.2	4.4	0.9	3.26	1.42
Perceived Usefulness									**4.45**	**1.40**
PU1	I learn more efficiently when I use the platform	1.3	4.9	9.3	20.8	32.3	25.2	6.2	4.78	1.30
PU2	Using the platform improves my academic performance.	8.0	10.6	10.6	22.1	24.8	14.6	9.3	4.26	1.69
PU3	Using the platform makes me a more efficient learner.	6.2	8.0	10.7	23.1	23.1	20.9	8.0	4.44	1.61
PU4	Using the platform makes it easier to learn at university.	8.8	11.1	13.7	18.6	20.8	15.9	11.1	4.23	1.78
PU5	Using the platform gives me more control over my learning.	7.1	8.4	13.8	23.1	22.7	13.3	11.6	4.32	1.68
PU6	In general, I find that the platform is advantageous for my learning.	3.5	7.5	14.2	17.3	22.6	19.5	15.5	4.68	1.65
Perceived Ease of Use									**5.33**	**1.31**
PEOU1	I find it easy to use the platform.	1.8	2.7	5.3	16.4	20.4	27.4	26.1	5.38	1.44
PEOU2	It is easy to get course material from the platform.	2.2	3.1	4.0	15.0	21.7	27.4	26.5	5.39	1.46
PEOU3	The platform is simple and easy to understand.	1.8	3.1	10.2	15.1	20.4	25.3	24.0	5.21	1.52
PEOU4	In general, I believe the platform is easy to use.	1.8	3.1	3.1	19.1	20.0	27.1	25.8	5.37	1.43
Attitude									**4.44**	**1.42**
A1	Learning on the platform is fun.	10.2	8.8	16.4	29.2	18.6	11.5	5.3	3.93	1.60
A2	Using the platform is a good idea.	5.3	4.4	7.5	15.0	23.0	23.9	20.8	5.01	1.67
A3	The platform provides a pleasant way to learn.	4.9	5.3	15.9	23.5	23.5	18.1	8.8	4.45	1.54
A4	In general, I like using the platform.	8.0	8.0	13.8	16.5	25.0	17.0	11.6	4.40	1.74
System Use									**4.35**	**1.52**
SU1	I use the platform. (1- never to 7- very often)	5.3	4.0	10.2	19.5	22.1	20.8	18.1	4.84	1.65
SU2	The number of hours I spend on the platform per week is: (1-none to 7-many hours)	8.0	15.1	17.8	22.2	20.9	9.3	6.7	3.88	1.64

Table 3. Results of the analysis of the main WebCT components

	Components				
	Factor 1 Perceived Usefulness	Factor 2 Perceived Ease of Use	Factor 3 System Usage	Factor 4 Technical Support	Factor 5 Attitude
PU1	0.69				
PU2	0.75				
PU3	0.88				
PU4	0.86				
PU5	0.82				
PU6	0.77				
PEOU1		0.81			
PEOU2		0.84			
PEOU3		0.87			
PEOU4		0.84			
SU1			0.83		
SU2			0.96		
TS1				0.81	
TS2				0.79	
A1					0.68
A2					0.35
A3					0.60
A4					0.54
Cronbach's α	0.93	0.92	0.80	0.70	0.83
Eigenvalues	8.32	2.14	1.73	1.27	0.82
Accumlated explained variance (%)	46.24	58.12	67.74	74.80	79.36

Extraction method: analysis of main components. Rotation method: Kaiser's Normalization Varimax.

Table 4. WebCT Correlations Matrix

	TS1	TS2	PU1	PU2	PU3	PU4	PU5	PU6	PEOU1	PEOU2	PEOU3	PEOU4	A1	A2	A3	A4	SU1	SU2
TS1	1																	
TS2	.385(**)	1																
PU1	0.077	0.036	1															
PU2	-0.012	0.076	.567(**)	1														
PU3	0.086	0.013	.673(**)	.744(**)	1													
PU4	-0.047	-0.122	.606(**)	.670(**)	.796(**)	1												
PU5	0.039	0.018	.649(**)	.728(**)	.657(**)	.733(**)	1											
PU6	-0.115	-0.087	.718(**)	.580(**)	.708(**)	.651(**)	.701(**)	1										
PEOU1	0.038	0.005	.588(**)	.480(**)	.432(**)	.417(**)	.531(**)	.489(**)	1									
PEOU2	0.07	0.104	.661(**)	.482(**)	.388(**)	.440(**)	.557(**)	.534(**)	.738(**)	1								
PEOU3	0.132	0.114	.460(**)	.382(**)	.257(*)	.277(*)	.418(**)	.294(*)	.719(**)	.741(**)	1							
PEOU4	0.14	0.191	.534(**)	.463(**)	.304(*)	.327(**)	.423(**)	.405(**)	.687(**)	.789(**)	.760(**)	1						
A1	.294(*)	.342(**)	.406(**)	.393(**)	.423(**)	.268(*)	.303(*)	.318(*)	.410(**)	.447(**)	.506(**)	.557(**)	1					
A2	-0.018	-0.05	.640(**)	.571(**)	.576(**)	.488(**)	.495(**)	.614(**)	.721(**)	.643(**)	.622(**)	.600(**)	.512(**)	1				
A3	-0.039	0.039	.592(**)	.612(**)	.679(**)	.571(**)	.555(**)	.657(**)	.493(**)	.493(**)	.316(*)	.428(**)	.548(**)	.611(**)	1			
A4	-0.093	-0.077	.607(**)	.549(**)	.572(**)	.544(**)	.565(**)	.742(**)	.456(**)	.495(**)	.385(**)	.481(**)	.469(**)	.582(**)	.690(**)	1		
SU1	-0.215	-0.084	.287(*)	.346(**)	.336(**)	.405(**)	.308(*)	.274(*)	.343(**)	.316(*)	.310(*)	0.231	0.081	.302(*)	.257(*)	.377(**)	1	
SU2	-0.169	-0.085	0.019	0.246	0.186	.308(*)	0.163	0.003	0.196	0.104	.336(**)	0.076	0.145	0.133	0.054	0.191	.749(**)	1

*The correlation is significant at 0.05.
** The correlation is significant at 0.01.

Table 5. Statistical Summary of the Model's Goodness-of-Fit

Goodness-of-fit index	Recommended value	Results in the study
Chi-squared/degrees of freedom	≤3	1.9
Goodness-of-Fit Index (GFI)	≥0.90	0.85
Adjusted Goodness-of-Fit Index (AGFI)	≥0.80	0.80
Comparative Fit Index (CFI)	≥0.90	0.98
Normed Fit Index (NFI)	≥0.90	0.96
Root Mean Square Error of Approximation (RMSEA)	≤0.08	0.08

Table 6. The effects of the variables on the acceptance of the WebCT learning system

	Perceived Ease of Use		Perceived Usefulness		Attitude		System Usage	
	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects
Technical Support	0.34**		0.18*	0.19**	0.06	0.33**		0.20**
Perceived Ease of Use			0.57**		0.38**	0.31**	0.09	0.28*
Perceived Usefulness					0.55**		0.33*	0.07
Attitude							0.14	
R^2	0.11		0.43		0.75		0.27	

*p<0.05
**p<0.01

Table 7. Results of the Hypotheses

WEBCT HYPOTHESES	H	β	Statistic	Valuation
Technical support has a positive influence on computer self-efficacy in the use of WebCT.				
Technical support has a positive influence on the perceived ease of use of WebCT.	H1			Eliminated
Technical support has a positive influence on the perceived usefulness of WebCT.	H2	0.34**	3.54	Accepted
Computer self-efficacy has a positive influence on the perceived ease of use of WebCT.	H3	0.18*	2.23	Accepted
Computer self-efficacy has a positive influence on the perceived usefulness of WebCT.	H4			Eliminated
Computer self-efficacy has a positive influence on attitude to use WebCT.	H5			Eliminated
Perceived ease of use has a positive influence on the perceived usefulness of WebCT.	H6			Eliminated
Perceived ease of use has a positive influence on attitude to use WebCT.	H7	0.57**	6.36	Accepted
Perceived ease of use has a positive influence on usage of WebCT.	H8	0.38**	4.85	Accepted
Perceived usefulness has a positive influence on attitude to use WebCT.	H9	0.09	0.69	Rejected
Perceived usefulness has a positive influence on usage of WebCT.	H10	0.55**	6.17	Accepted
Attitude to using the system has a positive influence on usage of WebCT.	H11	0.33*	2.10	Accepted
Technical support has a positive influence on attitude to use WebCT.	H12	0.14	0.76	Rejected
	H13	0.06	1.04	Rejected

*$p<0.05$
**$p<0.01$