Evaluating e-learning initiatives: A literature review on methods and research frameworks

Abstract. Purpose: The evaluation aspects, in relation to e-learning initiatives, are gaining substantial attention nowadays. As technology continuously influences the way learning is conducted, technical as well as organizational requirements need to be thoroughly investigated across a variety of stakeholders. Methodology: In this paper, an outline of those aspects occurred from an accompanying literature review on methods and research frameworks utilized toward the evaluation of e-learning initiatives is presented. The review identified a series of studies that take advantage of well-established theories in the area of users’ acceptance of technology combined with additional, e-learning context-specific, factors. Findings: Results of the review are presented to the reader according to the adopted research model, in order to ease the process of locating and retrieving e-learning evaluation paradigms per theoretical model. Value: Research findings are discussed and future implications for e-learning evaluation initiatives as well as potential stakeholders are highlighted.

Keywords: e-learning, evaluation, research frameworks, literature review,

1. Introduction
Nowadays, the continuous penetration of web technology characterises everyday aspect of life (Lee et al., 2005, p.1095). Some researchers characterize the web as an active learning environment that supports creativity (Becker and Dwyer, 1994). According to Thuring et al. (1995), the web encourages exploration of knowledge and browsing behaviours that are strongly related to learning. Reasonably, the potentially use of e-learning is increasingly explored and it has been widely accepted that the hyper-medial structure of the web could promote learning (US department of education, 2009).

The introduction of e-learning platforms is evolving rapidly across a wide area of applications and domains of today's e-economy (Lee, 2008, p.34), with the educational sector as a key candidate domain of applicability. In this context, e-learning initiatives continue to grow as they expand into a wide range of educational needs, with a variety of teaching and learning modes, approaches and styles, underlining the broad range of both its use and “complexity” (Ozkan et al., 2008, p.1). The above mentioned technological evolution created a variety of learning alternatives which go beyond the traditional classroom settings, and are identified as “e-learning” initiatives. Johnson et al. (2008) defines those initiatives as “training or educational initiatives which provide learning material in online repositories, where course interaction and communication and course delivery are technology mediated.” (p.357).
It is becoming evident that the evaluation of e-learning initiatives is not a straightforward process. Many factors contribute to the success of e-learning systems in general and Learning Content Management Systems (LCMS) in particular. Such a technological learning environment should present innovative learning opportunities thus extending and not just replicating traditional learning approaches. Control and responsibility of the learning process should be gradually shifted from the educators to the learners. In this context, socio-cultural theories influence considerably the learning procedure and have strengthened the perceptions of the educational community towards adoption and effective integration of open and distance learning (ODL) systems in the educational process (Duffy and Kirkley, 2004).

Moreover, the challenge in designing and evaluating appropriate LCMS systems is to include usable tools which provide appropriate degree of learning utility. The balance between usability and learning utility has to be carefully determined and included in both the design principles and evaluation procedures. Nowadays, this is a challenging decision, as there are many innovative designs often overloaded with functions of questionable pedagogical value. Learning technology needs to facilitate manipulation tasks from the students, while at the same time it is necessary to trigger the process of learning through those manipulation activities (Sedig et al., 2001; Soloway et al., 1994).

Although the key requirement still remains the quality of the instructional design itself, this should not be treated as an excuse to overcome the aforementioned issues. Nevertheless, LCMS design should provide novel possibilities to learn. As a result, learners themselves will seek and acquire needed elements of information. Independently of the pedagogical model adopted, this process requires knowledge acquisition, integration of usually heterogeneous knowledge “segments”, evaluation of the information, goal reformulation and actions selection, leading to deeper understanding and knowledge construction (Tselios, Katsanos, Kahrmanis and Avouris, 2008). Designers should seek to improve the learners’ abilities to manage and navigate knowledge resources and create environments that increase the capacity of learners to function and forage for their own knowledge. As a result, interaction with a LCMS should be transparent and intuitive and should not interfere with the learning ‘processes’. Therefore, educators and developers should be concerned about determining their role and developing adequate techniques to diminish any negative influence of the tools’ design on the educational process (Tselios et al., 2001; Tselios, Avouris and Komis, 2008). Moreover, an LCMS should effectively communicate those design elements to the intended users in order to encourage its adoption.

As a result, a multifaceted approach is needed, beyond the abstract use of past theories that identify e-learning evaluation from a ‘high-level’ perspective (Loukis et al., 2007, p. 374). In line with this ascertainment, equal attention should be paid in the transition from theoretical underpinnings to practical implications during the evaluation of “effectiveness” of e-learning environments (Ozkan et al., 2008, p.1). The encapsulation of several factors under consideration will assist in the formulation of a “holistic” view with regards to e-learning evaluation (Sela and Sivan, 2009, p. 164) with a major aim the “enhancement of student learning” (Mandinach, 2005, p. 1825). In this context, Keller (2005) formulates the proposition that the implementation of Virtual Learning Environments (VLE) is oriented in “three main perspectives”: “implementation as technology acceptance, implementation as diffusion of innovations and implementation as a learning process” (Keller, 2005, p.299)
In concordance with the above statements, from initial studies based on models of technology such as TAM (Technology Acceptance Model, Davis, 1989) it became evident that students’ personal beliefs and attitudes towards web-based education constitute a critical factor to the successful incorporation of an IS in the learning practices of an institution. Aspects such as the perceived usefulness and perceived ease-of-use were typically examined. Davis (1989, p. 320) defined perceived usefulness as ‘the degree to which a person believes that using a particular system would enhance his/her job performance’. Perceived ease of use is defined as ‘the degree to which a person believes that using a particular system would be free of physical and mental effort’ (Davis, 1989, p. 320).

Gradually, new concepts, such as the perceived enjoyment (Lee et al., 2005; van der Heiden, 2004) while interacting with the e-learning system, are increasingly becoming important. Subsequently, a wealth of studies has examined various factors that influence users’ attitudes towards using an e-learning system, such as gender and computer self-efficacy (Corritore et al., 2005; Liaw et al., 2007; Ong and Lai, 2006; Selim, 2003). Such studies could greatly inform educators and designers of LCMS for successful approaches and possible areas of improvement. However, the increased proposition of different models and their application in different learning contexts and cultures created the necessity for meta-studies, to become evident which factors and to what extend influence consistently e-learning adoption. At the moment, such efforts are mainly limited in range and usually cover specific models such as TAM (Selim, 2003) and UTAUT (Venkatesh et al., 2003).

The goal of the survey presented in this paper is to present the factors found to influence or inhibit adoption in e-learning. Since the volume of related research is constantly increasing, such a research will assist in identifying several aspects that contribute to a deeper understanding on the acceptance of e-learning within academic or professional working environments. This paper will also attempt to emphasize on diverse study contexts along with the methodologies and research models used. Furthermore, an investigation on both technological and cognitive features of e-learning environments will be conducted, aiming to provide a holistic outline of the issues that correlate during e-learning technology acceptance and effective use. It is argued that the findings of the presented survey of existing modeling approaches will be beneficial both for researchers, designers and educators. The expected outcome is the identification of key theoretical frameworks that have been adopted or formulated in order to adequately meet the challenges of evaluating e-learning initiatives.

The rest of this paper is organized as follows: First, a discussion on the multifaceted nature of e-learning evaluation is provided. Based on previous research, the various axes of interest are presented along with factors that contribute to e-learning initiatives success and effectiveness. Subsequently, a high-level categorization of the surveyed studies is attempted, based on the research frameworks that were identified as most influential in conducting empirical studies around e-learning initiatives. Finally, an overview of the work presented in conjunction with current study limitations is presented. Future work in the current field according to the surveyed research works, as well as further implications in the area of e-learning evaluation are also outlined.
2. Methods
2.1 Towards assessing e-learning acceptance

Several researchers attempt to identify the critical factors that contribute to the success of e-learning initiatives. Sela and Sivan (2009) identified a series of such factors by performing a “necessity/criticality” categorization in terms of “must-have” and “nice-to-have” elements (Sela and Sivan, 2009, p.159). Selim (2007) provided a detailed review on past research works that identify a series of “critical success factors” either in terms of technical, social or pedagogical aspects or stakeholders. Furthermore, Selim (2007) distinguishes on “four main categories for e-learning critical success factors within a University setting: instructor; student; information technology; and university support” (p. 398). In addition, Dutton et al. (2002) perform a research on the differences that distinguish traditional students to online learners along with the aspects that affect their performance. In terms of clear separation of online and traditional student groups, the findings of Dutton et al. (2002) identified several factors (undergraduate status, work status, and computer experience) affecting students following traditional learning methods than those who attended the online course (p.18).

To an extent, e-learning initiatives may be appreciated as generic information systems initiatives. Under this assumption, the notion of measuring success has been well appreciated in generic information systems research (DeLone and McLean, 1992; DeLone and McLean, 2003; Ozkan et al., 2008) and it is receiving a lot of attention in the context of e-learning due to the increased activity in this field (Ozkan et al., 2008, p. 1). In line with the above view, Sela and Sivan (2009) underline the fact that “a typical e-learning project is at the intersection of two error-prone domains: information systems (IS) and human systems” (p. 159). Consequently, an investigation of the various contributing factors that create dependencies on the successful implementation of e-learning leads to a comprehensive examination of social, pedagogical and learning aspects as well as aspects related with the user/stakeholder acceptance of the technology. However, those aspects should not be treated independently or in an isolated manner. In the following, those elements are discussed in detail.

A variety of studies emphasized on behavioral/social aspects that contribute to the appropriate introduction of technology in order to accomplish specific tasks, either in terms of a newly built system where no previous IT experience was in place or in terms of a replacement, through the assessment of the novel as compared with the old situation in terms of information systems infrastructure. With respect to e-learning evaluation, an axis of equal importance is associated with the assessment of the stakeholders’ acceptance of the technology.

Such an assessment should move beyond the technical barriers and peculiarities with the intention to investigate perceptions and beliefs about the technology, not the actual technical implementation details (Sun et al, 2008, Tselios et al., 2001; Tselios et al., 2008). The use of technology as a medium to achieve e-learning is an interesting area under research, since it implies the use of new tools, ways and methods towards learning from the relevant stakeholders. Consequently, the technological part of an e-learning solution should also focus on the stakeholders’ beliefs, not solely on the actual evaluation or comparison of the candidate e-learning platform to use (Pituuch and Lee, 2006; van Raaij and Schepers, 2008). With the continuous growth of available e-learning platforms, the focus should be transitioned from the technical details to the actual needs, both in terms of study settings and context but also in terms
of learning scope, targets and aims. Throughout this process, technical needs will also arise, such
as usability, ease of tasks and other, which will inevitably dictate the selection of a suitable e-
learning platform. In addition, there is no doubt that the final selection of a technically sound
infrastructure will have a subsequent effect on stakeholders’ view of the overall solution (Pituch
and Lee, 2006, p.238). However, the focus should remain on design and learning issues along
with a careful examination of users’ perceptions’ regarding technology. The core technical
aspects will play a secondary role in the whole process. In line with the above ascertainment,
Mandinach (2005, p.1815) underlines the fact that “technology is only a tool. The technology
becomes a necessary but not a sufficient condition”.

The process of identifying effective e-learning evaluation methods will need to bridge the
pedagogical and learning factors with those related with the stakeholders’ beliefs of the
technology, under the assumption that both affect the evaluation process. Regarding the latter, a
variety of established theories on technology acceptance and IS success have been proposed with
dominant the Technology acceptance model (Davis, 1989), the DeLone and McLean model of IS
success in its original form and its updated version (DeLone and McLean, 1992; DeLone and
McLean, 2003), the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh
et al., 2003) and other. From their initial conceptualization until nowadays, a plethora of research
works adopted such research frameworks in order to conduct empirical validations in a variety
of domains and contexts. Furthermore, the use of such research frameworks was often encapsulated
a series of other dimensions that could potentially reflect and measure human, social (Lee et al.,
2005, p.1096), cognitive (Saade’ and Bahli, 2005) or other context-specific aspects. Thus, a
propoion of synthesized models that could map both system-wide and behavioral-wide
characteristics was observed. With regards to e-learning, similar initiatives could potentially
formulate a more complete view for conducting an evaluation. In particular, a synthesis of
constructs from past theories along with the adaptation of dimensions specific to e-learning
cognitive or pedagogical aspects would lead to theoretical propositions that combine a variety of
assessed dimensions along with appropriate causal relationships amongst them. The use of past
research frameworks in the context of e-learning evaluation has been appreciated from other
researchers (Tables 1,2 and 3).

As mentioned earlier, pedagogical and learning aspects of e-learning are of major interest in the
blocks that contribute to a larger set of factors related with e-learning, namely “the human
component, the design component, the instructional component and the performance component”
(p.1722). In addition, Holsapple and Lee-Post (2006) argue on the “online readiness” of students
towards the acceptance and use of e-learning platforms (p.81). In an attempt to formulate a
complete view of such readiness, Holspapple and Lee-Post (2006) identified four specific
measures related with “academic preparedness, technical competence, lifestyle aptitude and
learning preference toward e-learning” (p.81). Mandinach (2005) also refers to “ICT literacy”
and its relation to e-learning, defining it as the “merging and application of cognitive and
technical proficiency in a way that enables the transformation of knowledge and skills” (p.1818).

Undoubtedly, students are the key entity under consideration across all phases of an e-learning
initiative (Mandinach, 2005) but also a series of stakeholders exist. Wagner et al. (2008) focus on
the identification of stakeholders within e-learning in higher education and conclude on a relative
“Stakeholders' Responsibility Matrix” (Wagner et al., 2008). Several other researchers comment and discuss issues related with stakeholders other than students, mainly emphasizing on teachers (Mandinach, 2005), faculty members (Saade’, He and Kira, 2007, p.1736) and employers/employees in cases where e-learning is applied at organizational settings outside the educational sector (Wagner et al., 2008).

2.2 Research Method
The goal of the survey presented in this paper was to collect and present a series of theoretical frameworks that have been utilized, or may be potentially used, in the field of e-learning evaluation. Research concentrated on a variety of well-established models in the area of generic technology acceptance: the Technology Acceptance Model (TAM) (Davis, 1989) and its extensions, the DeLone and McLean model of Information Systems (IS) Success in its original form and its updated version (DeLone and McLean, 1992; DeLone and McLean, 2003), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). Equal attention was also paid to their variants and extensions, applied in a variety of e-learning contexts. In addition, several other theories that are related with social and behavioral aspects and originate from a diversity of scientific fields were also investigated, in an attempt to empirically exploit dimensions that may prove to be useful for e-learning evaluation.

The study attempted to systematically investigate a set of e-learning empirical studies that utilize a research framework in order to observe on specific model dimensions and discuss on the significance of the formulated causal paths. In order to identify research studies of this kind, a literature review is performed by using specific search keywords as “e-learning evaluation”, “e-learning technology acceptance” as well as joint searches in relation to past well known theories such as “e-learning TAM” and “e-learning IS success”. Subsequently, the retrieved research papers were classified according to the used acceptance model. All articles were selected from refereed journals and conference papers. A detailed discussion on the findings is presented in the following section along with a categorization according to the primary acceptance model used.

3. Results
The literature review findings revealed a series of distinct research models categories under which, several empirical studies were conducted. In specific, the key sections identified were related with studies based on the IS Success model, on TAM and its variants, on UTAUT as well as on “synthesized models” that collectively group or extend dimensions defined in a variety of theories in order to formulate new propositions. Typically, a popular approach through the use of theoretical frameworks for their empirical validation is to apply quantitative methods. Findings of the review phase revealed the popularity of structural equation modeling (SEM) as the data analysis approach – both the co-variance based with LISREL and partial least squares (PLS) (Gong et al., 2004; Lee et al., 2005; Lee, 2008; Lin, 2007; Ngai et al., 2007; Park, 2009; Pituch and Lee, 2006; Roca and Gagne’, 2008; Saade’ and Bahli, 2005; Saade’, Nebebe and Tan, 2007; van Raaij and Schepers, 2008; Zhang et al., 2007; Chang and Tung, 2008; Chiu and Wang, 2008; Tung and Chang, 2008). Other statistical methods include the use of principal components factor analysis and varimax (Ngai et al., 2007; Ong et al., 2004; Wang et al., 2007), explanatory factor analysis (Ozkan and Koseler, 2009), CALIS (Ong and Lai, 2006; Ong et al., 2004) and stepwise multiple regression (Liaw, 2008). The results are summarized in Tables 1-3 and discussed in the following.
**3.1 TAM and its variations**

The basic premise of the technology acceptance model (TAM) (Davis, 1989) is that behavioral intention to use a particular technology requires significant attention since it determines actual system adoption and use. Behavioral intention in turn is affected by attitude towards usage, as well as the direct and indirect effects of perceived usefulness and perceived ease of use. According to TAM, perceived usefulness and perceived ease of use affect attitude towards usage, while perceived ease of use affects perceived usefulness (Davis, 1989). The aforementioned effects are validated in the surveyed studies which are summarized in Table 1.

Some notable extensions, in terms of additional factors taken into consideration to further investigate the factors which influence e-learning adoption were self-efficacy (used in various forms) and perceived enjoyment as well as computer anxiety and cognitive absorption. As far as self-efficacy is concerned Gong et al. (2004) point out that, “computer self-efficacy denotes one’s judgment of his or her capability to use a computer” (p.367) and consequently affects his/her perceptions in terms of technology adoption (p.367). In their findings, Gong et al. (2004) underline the effect of computer self-efficacy to perceived ease of use and behavioral intention to use a learning management system. Ong et al. (2004) also stress the importance of “computer self-efficacy” toward e-learning adoption while their empirical findings identify its effect on perceived usefulness and ease of use. Park (2009) utilizes the dimension of self-efficacy in terms of “the personal confidence in finding information and communicating with an instructor within the e-learning system and the necessary skills for using the system” (p.152). In his findings, Park (2009) identifies self-efficacy as the most important construct of the overall model (p.150). Roca and Gagne’ (2008) provide a discussion related with computer and internet self-efficacy as contributing factors of self-efficacy measurement and conceptualize the notion of perceived competence, being related with internet self-efficacy (p.1591). In their findings, Roca and Gagne’ (2008) describe the important role of competence as antecedent and influencer of perceived usefulness, playfulness and ease of use.

Perceived enjoyment seems also to positively influence e-learning usage. Lee et al. (2005) give emphasis on motivational factors with enjoyment at a prominence role. In their findings, Lee et al. (2005) outline the effect of perceived enjoyment to attitude towards use and behavioral intention. Zhang et al. (2007) findings suggest a significant relationship between perceived enjoyment and perceived usefulness.

Saade’ and Bahli (2005) encapsulated the notion of heightened enjoyment as part of cognitive absorption, which proved to have significant effects on perceived usefulness and ease of use. Saade’ and Bahli (2005) utilize the notion of cognitive absorption as a “holistic” grouping of intrinsic factors (p.318), such as temporal dissociation, focused immersion and heightened enjoyment (p.320). In their findings, Saade’ and Bahli (2005) identified the relationships of cognitive absorption with perceived usefulness and ease of use as significant, with the relation with usefulness to be stronger (p. 324). Roca and Gagne’(2008) utilize perceived playfulness in accordance to Saade’ and Bahli (2005) (p. 1592). In their findings, Roca and Gagne’(2008) identified the significant effects of perceived playfulness to perceived usefulness, ease of use and continuance intention (p. 1596). Moreover, van Raaij and Schepers (2008) investigated the
notion of computer anxiety in the sense that “If using IT makes an individual feel uneasy, this may increase perceptions of complexity of a technology” (p. 842). In their findings, the relationship of the negative impact of computer anxiety to perceived ease of use found to be significant.

<table>
<thead>
<tr>
<th>Author(s), study context &amp; study group</th>
<th>Theoretical model &amp; Data analysis approach</th>
<th>Findings *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gong et al. (2004)</td>
<td>Research model: Proposition of a research framework in the basis of TAM and the encapsulation of self-efficacy from SCT (p.366)</td>
<td>PU→BI / PU→ATT / ATT→BI / CSE→BI / CSE→PEOU / PEOU→PU / PEOU→ATT</td>
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<tr>
<td></td>
<td>Data analysis: PLS (p.369)</td>
<td>Authors underline the importance of self-efficacy within the overall model and suggest its future use when assessing the applicability of IT in educational initiatives (Gong et al., 2004, p.371)</td>
</tr>
<tr>
<td>Lee et al. (2005)</td>
<td>Research model: Proposition of an extension of TAM with a “motivational” perspective by incorporating the dimension of perceived enjoyment affecting attitude towards use and behavioral intention and affected by perceived ease of use respectively (pp. 1095-1097).</td>
<td>PENJ→ATT / PENJ→BI</td>
</tr>
<tr>
<td></td>
<td>Data analysis: SEM with LISREL (p.1099)</td>
<td>PU→BI / PU→ATT / PEOU→PU / PEOU→PENJ / ATT→BI</td>
</tr>
<tr>
<td>Ngai et al. (2007)</td>
<td>Research model: Proposition of an extended TAM through the use of the dimension of technical support as external variable to perceived ease of use, perceived usefulness and attitude towards use (p.253).</td>
<td>TS→PU / TS→PEOU</td>
</tr>
<tr>
<td></td>
<td>Data analysis: principal component analysis (PCA) and SEM with AMOS4 (pp.257-258)</td>
<td>PEOU→ATT / PEOU→PU / PEOU→USAGE</td>
</tr>
<tr>
<td>Ong et al. (2004)</td>
<td>Research model: Proposition of an extension of TAM by encapsulating the dimensions of computer self-efficacy and perceived credibility (p.796).</td>
<td>CSE→PEOU / CSE→PCRED / CSE→PU</td>
</tr>
<tr>
<td></td>
<td>Data analysis: Principal component factor analysis and the CALIS procedure of SAS 8.1 (p.799)</td>
<td>PEOU→PU / PEOU→PCRED / PEOU→BI</td>
</tr>
<tr>
<td>Ong and Lai (2006)</td>
<td>Research model: Proposition of an extended TAM with the addition of computer self-</td>
<td>Several differences were identified between the two gender samples. Authors suggest that gender differences should not be neglected</td>
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Table 1. Studies categorization based on the TAM and its variants adaptation
<table>
<thead>
<tr>
<th>Reference</th>
<th>Type</th>
<th>Study group</th>
<th>Research model</th>
<th>Data analysis</th>
<th>Data analysis notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Park (2009)</td>
<td>Educational sector – Generic acceptance of e-learning by university students (p.150)</td>
<td>628 university students (p.150)</td>
<td>Proposition of an extended TAM with the inclusion of e-learning self-efficacy, subjective norm and system accessibility (p.150)</td>
<td>SEM (p.150)</td>
<td>The partially mediated model appeared to perform better than the fully mediated one (p.237). Emphasis on the importance of system characteristics in relation with use beliefs and actual use (p. 238)</td>
</tr>
<tr>
<td>Pituch and Lee (2006)</td>
<td>Educational sector – Acceptance of e-learning as a supplementary learning tool and as a distance learning tool respectively (p.222).</td>
<td>259 college students (p.222).</td>
<td>Proposition of two models (partially mediated and fully mediated respectively, in terms of system characteristics in relation with perceived usefulness, ease of use and intention to use) based on TAM, TRA and literature review (p.224) along with the dimensions of supplementary and distance learning use</td>
<td>SEM with LISREL (p.231)</td>
<td>Acceptance of e-learning as a distance learning tool and supplementary learning tool and as a distance learning tool respectively (p.1593).</td>
</tr>
<tr>
<td>Roca and Gagne’ (2008)</td>
<td>Industry sector – Four agencies of United Nations (p.1593).</td>
<td>166 employees who have participated in at least one e-learning course training(p.1593).</td>
<td>Proposition of a theoretical framework in the basis of (SDT) and TAM (p.1585)</td>
<td>Co-variance based SEM with LISREL. (p.1596)</td>
<td>Perceived playfulness as a means of intrinsic motivation (p.1597). Implications, amongst others, include that “organizations should promote autonomy-supportive conditions, perceptions of competence and relatedness among their workers to increase the acceptation of the IT” (p.1599).</td>
</tr>
<tr>
<td>Saade’ and Bahli (2005)</td>
<td>Educational sector – Acceptance of Internet-based Learning Systems (p.317)</td>
<td>102 undergraduate students (p.322)</td>
<td>Proposition of an extension of TAM by encapsulating the dimension of cognitive absorption (p.317)</td>
<td>PLS (p.317)</td>
<td>Cognitive Absorption proved to be an important factor at the overall model(p.325) while an important implication is the deduction that “creating ILSs that are multimedia based could increase the element of playfulness and hence increase temporal dissociation” (p.326)</td>
</tr>
<tr>
<td>Saadé, Nebebe and Tan (2007)</td>
<td>Educational sector – Multimedia Learning System (MMLS) (p.176)</td>
<td></td>
<td>TAM (p.176)</td>
<td>PLS (p.179)</td>
<td>Outcomes highlight the value of the attitude towards use in relation with intention to use</td>
</tr>
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Learning infrastructure (p.816) efficacy and gender as a mediating factor (p.818) during theories conceptualization and validation with regards to e-learning initiatives (p.816)
3.2 IS Success Model

Despite the fact that TAM based approaches dominate in the presented literature review, an increasing number of recent studies based on the DeLone and McLean model of IS success (DeLone and McLean, 1992) is also observed. Contrary to TAM approaches, the satisfaction factor is present by definition (Table 2). Lin (2007) findings highlight the influence of information quality (content) to satisfaction. Ozkan et al.(2008) describe a series of instructor characteristics as antecedents and influencers of satisfaction. Ozkan and Koseler (2009) findings highlight the influence of perceived enjoyment to satisfaction. Holsapple and Lee-Post (2006) point out that online readiness is affecting e-learning satisfaction (p.81).

Other factors were also proposed and integrated in the proposed IS Success Model based studies. Holsapple and Lee-Post (2006) emphasize on the need to provide a “holistic” view throughout the evaluation of e-learning environments while also pinpoint the importance of an overall “quality perspective” (Holsapple and Lee-Post, 2006, p. 68). Lee (2008) emphasizes on the notion of self-regulatory efficacy, in which “the learner uses the strategic relationship between self-regulation and learning to reach his or her chosen self-learning goal” (p.36). Ozkan and Koseler (2009) incorporated the notion of enjoyment within learning attitudes. In their findings, Ozkan and Koselet (2009) identified enjoyment as a key factor of attitudes and a significant relationship between attitudes and satisfaction (p.1291). Chiu and Wang (2008) encapsulated anxiety, hypothesized to have a negative effect on intention to use Web-based learning (p.197). Chiu and Wang (2008) report a strong significance in the aforementioned relationship.

<table>
<thead>
<tr>
<th>Study group: 362 students (p.175)</th>
<th>Research model: A proposition of a framework based on TAM2, based on review of TAM, TAM2 and UTAUT (p.838)</th>
<th>PINNOV → CANX / CANX → PEOU PINN → PEOU / PEOU → PU SN → PU / PU → USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>van Raaij and Schepers (2008)</td>
<td>Study group: 45 students of an executive MBA program (p.838)</td>
<td>Authors, based on TAM validity in the current study, emphasized that “TAM does hold across cultures” (p.848)</td>
</tr>
<tr>
<td>Type: Educational sector – Acceptance of a virtual learning environment (VLE) (p.838)</td>
<td>Data analysis: PLS (p.838)</td>
<td></td>
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<tr>
<td>Type: Educational sector – English e-learning system(p.123)</td>
<td>Data analysis: PLS (p.126)</td>
<td>COMP → ATT / COMP → NTBI / COMP → LTBI / NTBI → LTBI</td>
</tr>
<tr>
<td>Study group: 121 undergraduate students (p.126)</td>
<td></td>
<td>Emphasis on the dimension of training impression, as it produced a strong effect on perceived ease of use (p.126)</td>
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*Relationships depicted at the Findings column appeared to be significant at various levels*
<table>
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<tr>
<th>Author(s), study context &amp; study group</th>
<th>Theoretical model &amp; Data analysis approach</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holsapple and Lee-Post (2006)</td>
<td>Research Model: Proposition of the “e-learning success model”, based on the updated DeLone and McLean model of IS Success (DeLone and McLean, 2003) (p.70)</td>
<td>The proposed model “posits that the overall success of an e-learning initiative depends on the attainment of success at each of the three stages of e-learning systems development: system design, system delivery, and system outcome.” (p. 67) Emphasis was also given to “action research methodology” in the context of e-learning initiatives and their “success” (p.67)</td>
</tr>
<tr>
<td>Lee (2008)</td>
<td>Research model: Proposition of a theoretical model based on the DeLone and McLean model of IS success (DeLone and McLean, 1992) and encapsulation of a variety of additional dimensions (p.38)</td>
<td>The author stress that “The e-learner’s characteristics such as empathy, self-regulatory efficacy, and self-regulated learning strategy are very important variables in e-learning performance” (p34).</td>
</tr>
<tr>
<td>Lin (2007)</td>
<td>Research Model: Based on the updated DeLone and McLean Model of IS success (DeLone and McLean, 2003) (p.817)</td>
<td>SQ→SATISF / IQ→BI \n IQ→SATISF / IQ→BI \n SRVQ→SATISF / SRVQ→BI \n SATISF→BI / SATISF→ACTUAL \n BI→ACTUAL Based on the study findings, authors emphasize on the content appropriateness of OLS as a key factor for use along with the key effect of information quality to user satisfaction and behavioral intention (p.819).</td>
</tr>
<tr>
<td>Ozkan et al. (2008)</td>
<td>Research Model: Proposition of the Hexagonal e-Learning Assessment Model (HELAM), based on past research models (p.6)</td>
<td>ISE→SATISF / IRR→SATISF \n ICA→SATISF / IFU→SATISF \n SQ→SATISF / IQ→SATISF \n ATTIC→SATISF \n SATISF→NETB The authors highlight that ‘Learners’ perceived satisfaction toward e-learning is positively related to instructor’s rapid Responses (IRR) to student’s needs’ and “instructors’ timely response significantly influences learners’ satisfaction positively” (p. 10)</td>
</tr>
<tr>
<td>Ozkan and Koseler (2009)</td>
<td>Research model: HELAM (see Ozkan et al., 2008)</td>
<td>LATT→SATISF / INSQ→SATISF \n SQ→SATISF / IQ→SATISF \n SRVQ→SATISF / SUPIS→SATISF Perceived enjoyment was found to be the strongest indicator of the relation LATT→SATISF (p.1291)</td>
</tr>
<tr>
<td>Wang et al. (2007)</td>
<td>Research model: Proposition of a “multi-dimensional model for assessing e-learning systems success (ELSS)”, from an “employee” perspective (p.1792), in the basis of the updated DeLone and McLean</td>
<td>Authors highlight the multifaceted nature of e-learning “effectiveness management”, in terms of variety of factors that need to be taken into account (p.1802)</td>
</tr>
</tbody>
</table>
**3.3 UTAUT and synthesized models**

UTAUT (Venkatesh et al., 2003) focus on four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) to explain users’ acceptance of technology and this may be translated into adoption intention and behavior. The theory was developed through a thorough review of eight models (TRA, TAM, Motivational Model, TPB, Combined TAM-TPB, PC Utilization, IDT and Social Cognitive Theory) and thorough examination of their accompanied constructs that earlier research had employed to explain information systems usage behavior. Validation of UTAUT in a longitudinal study found it to explain 70% of the variance in usage intention, a significant improvement over TAM which found to explain around 40% (Venkatesh et. al., 2003).

Chiu and Wang (2008) examined the relation of computer self-efficacy to effort expectancy and intention for continuance use. In their findings, computer self-efficacy proved to have an effect on both the aforementioned dimensions, with the relation of effort expectancy to be very strong (p.200). Chang and Tung (2008) also examined the effect of computer self-efficacy to behavioral intention to use online courses, which was found to be significant (p.82). The aggregate results provided by Chiu and Wang (2008) were very encouraging: “findings implied that positive values or benefits outweighed the costs of Web-based learning” (p. 200). They also underlined the important role of “positive task value” to the participants’ intention to continue to use the Web based system (p.194).

Liaw (2008) encapsulates and measures self-efficacy within “learners’ characteristics” (p.868), whereas, in his findings, Liaw (2008) highlights the influence of self-efficacy to satisfaction and underlines its key role at the overall model. Tung and Chang (2008) examined the effect of computer self-efficacy to behavioral intention to use online courses by nurses. In their findings, this relation proved to be significant. Liaw (2008) findings highlight the influence of self-efficacy to satisfaction.

### Table 3. Studies categorization based on the UTAUT adaptation and other synthesized models

<table>
<thead>
<tr>
<th>Author(s), study context &amp; study group</th>
<th>Theoretical model &amp; Data analysis approach</th>
<th>Findings*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chang and Tung (2008) Type: Educational sector – Acceptance of online learning course websites</td>
<td>Research model: Proposition of a research framework in the basis of TAM and IDT along with the encapsulation of PSQ→BI / CSE→BI</td>
<td>COMPAT→BI / COMPAT→PU \ PU→BI / PEOU→PU / PEOU→BI</td>
</tr>
</tbody>
</table>

*Relationships depicted at the Findings column appeared to be significant at various levels*
4. Discussion

<table>
<thead>
<tr>
<th>Study group</th>
<th>Type</th>
<th>Research model</th>
<th>Data analysis</th>
<th>Raw Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>247</td>
<td>Educational sector-continuance use of Web based learning</td>
<td>Proposition of an extended UTAUT model by encapsulating characteristics related with “subjective task value”</td>
<td>SEM with LISREL</td>
<td>Study suggests the substantial role of computer self-efficacy in relation to behavioral intention to use online web courses.</td>
</tr>
<tr>
<td>286 part-time students with experience in web based courses</td>
<td>Educational sector - Blackboard e-learning system (assisted learning tool)</td>
<td>Proposition of a theoretical research framework influenced from TAM, TAM2 and UTAUT.</td>
<td>stepwise multiple regression</td>
<td>Chiu and Wang (2008) underlined the important role of “positive task value” to the participants' intention to continue to use the Web based system. Also, “findings implied that positive values or benefits outweighed the costs of Web-based learning.”</td>
</tr>
<tr>
<td>95 teaching staff from eight institutions</td>
<td>Educational sector – Learning Management System</td>
<td>Nanayakkara (2007) proposes a theoretical research framework influenced from TAM, TAM2 and UTAUT.</td>
<td>Study findings underlined five factors that contribute to staff perceptions with respect to e-learning, namely “release time for staff, the ease of use of LMS, perceived usefulness of LMS, training and support to develop online content and the reliability of information and communication technology infrastructure”</td>
<td></td>
</tr>
<tr>
<td>386 students in a phased approach</td>
<td>Educational sector – A proposition of a survey tool for e-learning acceptance</td>
<td>Teo (2010) proposes an “e-Learning Acceptance Measure” instrument, based on past research on TAM, UTAUT and course satisfaction.</td>
<td>A survey instrument is proposed and validated</td>
<td></td>
</tr>
<tr>
<td>347 nursing undergraduates with online courses experience</td>
<td>Educational sector - Online nursing courses</td>
<td>Proposition of a research framework in the basis of IDT and TAM along with perceived financial cost and computer self-efficacy.</td>
<td>SEM with LISREL</td>
<td>All hypotheses of the proposed model were confirmed, with compatibility to have a substantial role in relation to behavioral intention to use online nursing courses.</td>
</tr>
</tbody>
</table>


*Relationships depicted at the Findings column appeared to be significant at various levels*
A common finding of the presented studies is that students are quite motivated to learning online. The number of learners willing to take an online course is constantly increasing, due to the rich interaction and communication opportunities combined with novel multimedia capabilities and the ability to study anywhere, anytime in a self-paced manner. However, acceptance varies due to several factors. Sun et al. (2008) proposed a model with a series of specific dimensions under investigation. In particular, Sun et al. (2008) identified the “learner, instructor, course, technology, design and environmental dimensions” towards the identification of critical success factors in e-learning initiatives, with special focus at learners satisfaction (Sun et al., 2008, p. 1185). Ong and Lai (2006) surveyed 67 female and 89 male employees in Taiwan to examine influence of gender differences towards e-learning acceptance. They found that men’s perception of perceived usefulness was more significant and more salient than women’s’ in determining behavioral intention to use e-learning. In addition, they observed that men’s’ rating of perceptions with respect to computer self-efficacy, perceived usefulness, perceived ease of use, and behavioral intention to use e-learning are higher than women’s’.

A key finding of the presented studies is that the systems’ technological prowess should not be considered in isolation from other factors. As Johnson et al., 2008, (p.365): eloquently state “e-learning success is not simply a matter of providing a rich set of technological opportunities, but instead technology must be seen as contributing to the learning success”. Special emphasis should be given to provide balanced and well thought solutions with respect to technological, pedagogical and organizational issues. Thus, “a balance is needed in promoting e-learning as a means to deliver real improvements in quality education, not as a means to automate education” (Holspapple and Lee-Post, 2006, p.82). As a result, “the overall success of an e-learning initiative depends on the attainment of success at each of the three stages of e-learning systems development: system design, system delivery, and system outcome.” (Holspapple and Lee-Post, 2006, p. 67).

The surveyed technology acceptance research mainly focus on initial e-learning adoption. However, more studies should be conducted to further identify factors influencing systems’ discontinuance. Initial findings from Nitza and Orit (2008) suggest that increased levels of social and institutional influence and support may enhance continuous use. In addition, studies including more aspects such as credibility, privacy and computer anxiety (Sun et al., 2008) should be conducted to obtain a deeper understanding of the factors influencing attitudes towards blended learning adoption. For instance, students’ privacy concerns and perceived risks in interacting with LCMS have received little attention. Students’ and educators’ privacy concerns during use, might constrain the expected benefits (Corritore et al., 2005; Joinson et al., 2007). In addition, as derived from this study as well as from related works examining acceptance of e-learning, deep understanding of all learners’ personal cognitive strategies or information processing behaviors is required in order to provide a suitable information architecture that promotes the learning process (Tselios and Avouris, 2003; Tselios, Katsanos, Kahrimanis and Avouris, 2008).

5. Conclusions
In this paper, a survey of e-learning acceptance studies is provided. Throughout the process of e-learning evaluation, a series of important questions emerge, mainly related to the study of the appropriate teaching methods, the effective design of technological infrastructures and the design
of the interaction of students and teachers with the online distance learning (ODL) platform. All these diverse planes of investigation are oriented toward a common ground which is the ability of e-learning initiatives to become effective both in terms of the technology medium under use but also in terms of assessing the critical factors that contribute to the successful implementation and use of those platforms.

From the analysis of the research works presented previously it became evident that students’ personal beliefs and attitudes towards web-based education constitute a critical factor to the successful incorporation and adoption of such systems in the learning practices of an institution. Despite the importance of usefulness and usability towards e-learning adoption, several other factors emerged as important such as self-efficacy, computer anxiety, perceived enjoyment, satisfaction and cognitive absorption. Nevertheless, such studies provide substantial insight and highlight successful practices. The gap between system’s design and implementation and actual system’s usage and adoption could be bridged by focusing upon the identified factors. As a result, the surveyed body of research could contribute to more efficient e-learning design and implementation practices, thus further encouraging its proliferation and maturity.

References


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