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Developing a General Extended Technology Acceptance Model for E-Learning (GETAMEL) by analysing commonly used external factors

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ABSTRACT

To identify the most commonly used external factors of Technology Acceptance Model (TAM) in the context of e-learning adoption, a quantitative meta-analysis of 107 papers covering the last ten years was performed. The results show that Self-Efficacy, Subjective Norm, Enjoyment, Computer Anxiety and Experience are the most commonly used external factors of TAM. The effects of these commonly used external factors on TAM's two main constructs, Perceived Ease of Use (PEOU) and Perceived Usefulness (PU), have been studied across a range of e-learning technology types and e-learning user types. The results show that the best predictor of student's PEOU of e-learning systems is Self-Efficacy ($\beta = 0.352$), followed by Enjoyment ($\beta = 0.341$), Experience ($\beta = 0.221$), Computer Anxiety ($\beta = -0.199$) and Subjective Norm ($\beta = 0.195$). The best predictor of student's PU of e-learning systems is Enjoyment ($\beta = 0.452$), followed by Subjective Norm ($\beta = 0.301$), Self-Efficacy ($\beta = 0.174$) and Experience ($\beta = 0.169$). Using these external factors and their effect sizes on PEOU and PU, this study proposes a General Extended Technology Acceptance Model for E-Learning (GETAMEL).

1. Introduction

E-learning is electronic learning, defined as a tool that uses computer network technology such as internet, intranets and extranets to deliver learning instructions to users (Cheng, 2011; Engelbrecht, 2005; Welsh, Wanberg, Brown, & Simmering, 2003). Similarly, an e-learning system is defined by Lee, Hsieh, and Ma (2011, p.355) as "an information system that can integrate a wide variety of instructional material (via audio, video, and text mediums) conveyed through e-mail, live chat sessions, online discussions, forums, quizzes and assignments". E-learning systems have become an important part of delivering the modern university curriculum (Paechter, Maier, & Macher, 2010, p.222), supporting teaching and learning in higher education through delivering information and instructions to learners via the Internet (Lee, Hsieh, & Chen, 2013, p.173). They also provide new ways of learning, enabling teachers to deliver learning instructions via audio, video, animations, images and text, as well as providing online learning spaces and timely feedback methods (accessible to students anytime and anywhere).

However, the benefits of an e-learning system cannot be maximised if learners do not use it (Alenezi, 2012, p.1; Lai, Wang, & Lei, 2012, p.569; Pituch & Lee, 2006, p.222; Tarhini, Hone, & Liu, 2014, p.153). Therefore, it is important to identify the factors that influence students to use e-learning to make it an effective teaching and learning tool in education (Sharma & Chandel, 2013, p.44). To do this, researchers have used a number of different technology adoption theories, including Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Task Technology Fit (TTF), Unified Theory of Acceptance and Use of Technology (UTAUT) and Technology Acceptance Model (TAM). Among these theories, "TAM is the most common ground theory in e-learning acceptance literature" (Šumak, Heričko, & Pušnik, 2011, p.2068).

E-learning researchers have been extending TAM with different external factors for more than a decade. This has resulted in a large number of different external factors and a high number of extended technology acceptance models in e-learning adoption studies (Lefievre, 2012; Martin, 2012; Williams & Williams, 2009). Given this, there is a need for a General Extended Technology Acceptance Model for E-Learning (GETAMEL). This model should be generally useful and broadly applicable to various e-learning technologies or systems and be based on a set of the most commonly used external factors. In order to develop such a model, the objectives of this study were therefore to: (1) systematically review recent e-learning

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adoption studies that have extended TAM, (2) identify the most commonly used external factors among these studies, (3) identify the strengths of the relationship between the most commonly used external factors and students' Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) of e-learning systems and (4) propose a General Extended Technology Acceptance Model for E-Learning (GETAMEL).

This study incorporates 107 studies (87 published journal papers and 20 conference papers) to identify the commonly used external factors of TAM. Once these factors were identified, the studies were categorised into different e-learning technology types (e.g. 'e-learning systems' and 'e-learning technology/tools') and e-learning user types ('employees', 'students' and 'teachers'). Checking for publication bias, via the file drawer problem, was not possible for this meta-analysis as the vast majority of the studies reported only significance levels, with no standard error values. However categories could still be analysed to determine the strength of the relationships between the commonly used external factors and students' PEOU and PU of e-learning systems and through this a General Extended Technology Acceptance Model for E-Learning (GETAMEL) was developed.

2. Background research – technology acceptance model (TAM)

Previous research studies have identified many factors that can affect users' behaviour towards using technologies. In the context of knowledge sharing in the e-learning, Hosseini, Bathaei, and Mohammadzadeh (2014) reported Self-Efficacy to be an important factor in influencing knowledge sharing in e-learning systems. Zhang, de Pablos and Xu (2014) have found that personal culture values (such as Power Distance, Confucian Dynamism and Uncertainty Avoidance) have moderating effects on users' knowledge sharing attitude within a multi-national virtual class.

In regards to adoption of new media in the general environment, Zhou, Fang, Vogel, Jin, and Zhang (2012) found that affective commitment (being attracted to) and calculative commitment (being locked in) affect users' continuance intention to adopt social virtual world services. According to Banerjee and Dey (2013) three factors that influence users to use Facebook – rich in usefulness, web site design to enhance users' convenience and trust worthiness.

E-learning researchers have also reported that, when learners are presented with a new learning system their decision to use the system is affected by different factors, including Computer Self-Efficacy (Chow, Herold, Choo, & Chan, 2012), Social Influence (Farahat, 2012, p.100), Perceived Enjoyment (Wu & Gao, 2011, p.47), Computer Anxiety (Alenezi, Abdul Karim & Veloo, 2010, p.29) and Experience (Martin, 2012, p.501). To identify and analyse these factors, researchers have predominantly used the Technology Acceptance Model (Šumak et al., 2011, p.2068).

TAM, shown in Fig. 1, was adapted from the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) by Davis in 1986, its purpose is to explain technology adoption behaviour. In TAM, external variables are proposed to trace the impact of outside factors on users' two main perceptions, perceived ease of use (PEOU) and perceived usefulness (PU). PEOU directly influences PU. These perceptions affect users' positive or negative attitudes towards using the technology. Attitude towards using the technology influences behavioural intention to use the technology. PU also directly influences behavioural intention to use. Behavioural intention to use technology then determines actual use.

2.1. Why the technology acceptance model?

TAM has been widely used to underpin e-learning acceptance or use (Al-Gahtani, 2014; Hidayanto, Febriawan, Sucahyo, & Purwandari, 2014; Hsia, Chang, & Tseng, 2014; Lee, Hsiao, & Purnomo, 2014; Motaghian, Hassanzadeh, & Moghadam, 2013; Padilla-Melendez, Aguila-Obra, & Garrido-Moreno, 2013; Tarhini et al., 2014; Wu & Zhang, 2014). A meta-analysis study carried out by King and He (2006) presents some good results when using TAM. King and He's study incorporated 88 research papers and reported high credibility of TAM. The result of their analysis showed "TAM to be a valid and robust model" (p.740). A systematic review of 42 e-learning acceptance studies by Šumak et al. (2011) showed that TAM is the most common theory in existing e-learning acceptance research, with 86% of the studies using TAM as a ground theory (p.2069). Also the results of previous e-learning studies (including Ifinedo, 2006, p.12; Lee et al., 2014, p.572; Lee et al., 2013, p.182; Liu, Li, & Carlsson, 2010, p.1217; Shen & Chuang, 2010, p.205) show that extended TAM models provided good explanatory power, with total variance, explained in their extended TAM models, ranging from 52% to 70%. The convenience of implementing TAM in e-learning acceptance research also has been confirmed by many other researchers (including Emmett, 2011; Escobar-Rodriguez & Monge-Lozano, 2012; Lin, Persada, & Nadlifatin, 2014). TAM is therefore adopted for this study as a ground theory to develop a General Extended Technology Acceptance Model for E-Learning (GETAMEL) which incorporates the most commonly used external factors of TAM.

2.2. Extended technology acceptance model

Perceived Ease of Use and Perceived Usefulness are the most important factors in the technology acceptance model (Chen, Lin, Yeh, & Lou, 2013, p.112). Perceived Ease of Use refers to "the degree to which a person believes that using a particular system would be free of effort". Perceived Usefulness is explained as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). In the TAM model, both these factors are influenced by external factors

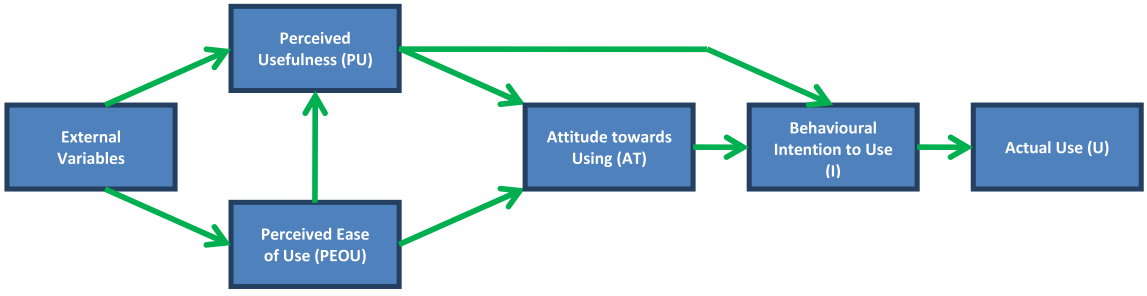

Fig. 1. Technology Acceptance model (Davis, 1986).