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Development and validation of the E-learning Acceptance Measure (ElAM)

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ABSTRACT

This research involves the development and validation of a survey that measures users' acceptance of e-learning. A total sample of 386 university students from a teacher training institute in an Asian country participated in this study. Comprising two studies, the first study ($n = 197$) initiated a generic questionnaire, and examined factorial validity and reliability. The second study ($n = 189$) used confirmatory factor analysis to establish factorial validity and measurement invariance by gender using a different sample. A correlated three-factor model (Tutor Quality, Perceived Usefulness, and Facilitating Conditions) was fit using maximum likelihood estimation (MLE) and found to be adequate. For the two samples, the E-learning Acceptance Measure (ElAM) was found to be a precise and internally consistent measure. Applications of the ElAM were discussed.

1. Introduction

With the proliferated use of the Internet for learning, users' reactions towards e-learning are expected to vary, according to their Internet-related activities, behavior, and experience. As such, it is important to understand the factors that drive the users' intention to participate in e-learning. By doing so, we may take a closer step to understanding the full potential of the Internet for educational uses. However, Duggan, Hess, Morgan, Kim, and Wilson (1999) found that previous research on the Internet had tended to focus on the technical aspects of e-learning, while the reactions and acceptance of users towards e-learning were not studied. They also suggested that future research should incorporate greater coverage on the determinants that impact on e-learning. Furthermore, in spite of the crucial role that e-learning played in teaching and learning, there appeared to be a dearth of published studies that offered validated instruments to measure the effectiveness of e-learning. For example, Miltiadou and Yu (2000) reported that although few instruments have been designed to measure teaching and learning in the online environment, there was an apparent lack of a well-developed psychometric instrument for students' evaluation of the quality of Web-based instruction.

For example, Stewart, Hong, and Strudler (2004) developed an instrument that enabled instructors to evaluate the quality of Web-based courses. The results of their study suggest that instructors were able to determine the quality of their Web-based courses using fifty-nine items in seven dimensions. These were *appearance of Web pages*, *class procedures and expectations*, *technical issues*, *hyperlinks and navigation*, *online applications*, *content delivery*, and *instructor and peer interaction*. At the same time, Bernard, Brauer, Abrami, and Surkes (2003) reported on their development and validation of an instrument to assess achievement outcomes of distance education (DE)/online learning success. Using a factor analysis, Bernard et al. found a four-factor solution: *general beliefs about DE*, *confidence in prerequisite skills*, *self-direction and initiative*, and *desire for interaction*. Soon after, Zhang (2005) developed an Internet Attitude Scale (IAS) comprising four factors: *enjoyment*, *usefulness*, *anxiety*, and *self-efficacy*. By conducting two experiments, Zhang found construct and factorial validity for the IAS for measuring Internet attitudes. To evaluate an individual's confidence in using the Internet, Eachus and Cassidy (2002) developed the Web User Self-Efficacy Scale (WUSE) using participants from the student body of a large university in the North West of the United Kingdom. In their study, they found Internet self-efficacy to be a multidimensional construct comprising four domains: *Information Retrieval*, *Information Provision*, *Communication*, and *Internet Technology*. It was suggested that these four domains would cover aspects of Internet self-efficacy from the simplest retrieval of a web page up to the more complex issues associated with the design and construction of whole web sites.

More recently, Artino and McCoach (2008) examined the impact of students' academic self-regulation on online learning. The purpose of their study was to develop a quantitative self-report measure of perceived task value and self-efficacy for learning within the context of self-paced and online training. The result was an 11-item Online Learning Value and Self-Efficacy Scale (OLVSES) comprising two factors: *task value* and *self-efficacy*. At the same time, Kay and Knaack (2008) sought to examine the impact, effectiveness, and usefulness of learning objects by developing the Learning Object Evaluation Scale for Students (LOES-S). Their findings showed the LOES-S to be a valid instrument that measures three constructs: *learning*, *quality*, and *engagement* of a learning object. Akkoyunlu and Yılmaz-Soylu (2008) developed a scale to measure

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learners' views on blended learning. They found that learners' views were influenced by five domains: *ease of use for web environment*, *online environment*, *content*, *face-to-face session*, and *assessment concerning the content*. A more recent study by Rovai, Wighting, Baker, and Grooms (2009) resulted in an instrument to measure learning in the cognitive, affective, and psychomotor domains in the traditional and virtual settings. Using three phases, a total of 80 items were reduced to a final 9-item CAP Perceived Learning Scale that was developed and validated with online and face-to-face learners at a university. From the above studies, it is apparent that some of the domains overlap with each other and although they measure Internet-related factors, none was designed to assess the users' acceptance of e-learning.

The literature described above suggests that the factors affecting e-learning are many and their interactions are complex. While it is important to know that e-learning is an effective medium for teaching and learning in the present educational milieu, it is necessary to gain a deeper understanding of the drivers that motivate users to accept e-learning. The purpose of this study is to develop and validate an instrument that would provide data to foster a better understanding of the factors that influence e-learning. E-learning is defined in this study as the use of the Internet by users to learn specified contents. This is often situated in a course where students are given access to learning resources which are uploaded onto a learning management system (LMS) and a tutor whose responsibilities include interacting and guiding the student. It is believed that research on Internet behavior is still in the early stage hence validated instruments would allow researchers to gain insights on the benefits and encumbrances that are brought to bear in the world of e-learning. The instrument developed from this study has the potential to provide useful information into the degree to which users are willing to embrace e-learning as part of their repertoire of learning opportunities.

Various theories and models of technology acceptance were consulted in the construction of this measure. In particular, the constructs from two models were found to be appropriate: the technology acceptance model (Davis, 1989) and the unified theory of acceptance and use of technology (Venkatesh, Morris, Davis, & Davis, 2003). These models have been widely cited in the technology acceptance literature and were found to be effective in explaining and predicting users' technology acceptance.

The technology acceptance model (TAM) (Davis, 1989) assumes that behavioral intention to use a particular technology is a very important factor that determines actual system use. Behavioral intention is affected by attitude towards usage, as well as the direct and indirect effects of perceived usefulness and perceived ease of use. Both perceived usefulness and perceived ease of use jointly affect attitude towards usage, while perceived ease of use has a direct impact on perceived usefulness (Davis, 1989). The unified theory of acceptance and use of technology (UTAUT) aims to explain users' intentions to use technology and subsequent usage behavior. The theory holds that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of users' acceptance of technology and this may be translated into adoption intention and behavior (Venkatesh et al., 2003). The theory was developed through a review and consolidation of the constructs of eight models that earlier research had employed to explain information systems usage behavior (e.g., theory of reasoned action, technology acceptance model, and theory of planned behavior).

2. Method

2.1. Item generation

The process of item generation was performed through consulting the literature and studies that have employed the TAM and UTAUT (Teo, 2009a,b; Teo, 2008; Teo, Wong, & Chai, 2008) and research on course satisfaction (Lee et al., 2007; Teo, Lee, Chai, & Choy, 2009). In addition, the search for appropriate items was made from empirical studies that fit the following criteria: (a) they contained items to measure some or all of the above constructs, and (b) they included pre-service teachers or teachers as participants. A list of 40 items was sent to experts in educational technology who are professors and have used the Internet for teaching. Based on the experts' recommendations, items that were identified as ambiguous were reworded or removed, resulting in the total number of items being reduced from 40 to 31 at this stage. An important consideration at the item generation stage was to ensure that the items would be understood by the potential respondents. For this reason, the 31 items were presented to two groups of 10 students at two separate focus-group discussions. These students were drawn from the same institution where the main data collection will be conducted. They were asked to explain what they thought each item meant in order to allow for subsequent revisions, with an aim to improve the clarity and conciseness for each item. Based on the comments from the students, a further removal of ten items was made, leaving 21 items for the pilot study. Based on the feedback from the experts and students and literature in the preceding sections, the items were distributed into four factors: Tutor Quality (eight items), Perceived Usefulness (four items), Perceived Ease of Use (five items), and Facilitating Conditions (four items).

2.2. Study one: development

2.2.1. Aim and participants

This study aimed to test and refine the 21 items. These items were presented using a 7-point Likert response scale with 1 = strongly disagree and 7 = strongly agree. A total of 197 student teachers enrolled in the Bachelor of Arts (with Education) program at a teacher training institute in an Asian country participated in this study. The mean age of the participants was 20.9 (SD = 2.63) and there were 109 (55.3%) females in the sample. All participants were volunteers and they were briefed on the purpose of this study and informed of their rights not to participate and withdraw from completing the questionnaire at anytime during or after the data have been collected. Participants took about 20 min to complete the questionnaire.

2.2.2. Results

Apart from descriptive statistics, an exploratory factor analysis using principal components and varimax rotation was carried out on the 21 items. The mean values of all items ranged from 5.96 (PEU14) to 6.44 (TA7). The standard deviations ranged from 1.22 to 1.64 and the skew and kurtosis indices from −.79 to −.06 and −.90 to .97 respectively. Following Kline's (2005) recommendations, the data in this study were considered to be univariate normal.

A principal components analysis (PCA) with varimax rotation was conducted on the 21 items to explore the underlying structure of the E-learning Acceptance Measure (ElAM). The criteria for determining the number of components to retain were Kaiser's (1960) eigenvalue greater than 1 (K1) and Cattell's (1966) scree test. The initial solution yielded three components with eigenvalues exceeding 1, accounting for a total of 87.90% of the variance. Inspection of the scree plot supported the retention of three components as well. Following the recommendations by Hair, Black, Babin, Anderson, and Tatham (2006), only items with loadings of more than .70 should be retained. On this basis, all 21 items were retained for further analysis. However, based on the pattern of the factor loadings, the initial four factors were reduced to three. An inspection of the five items for 'Perceived Ease of Use' showed that they had loaded onto the 'Perceived Usefulness' factor (four items). Given that the meaning of the items was in the direction of perceived usefulness than perceived ease of use, they were combined into one factor for further analysis. At this stage, the final three factors were Tutor Quality (8 items), Perceived Usefulness (9 items), and Facilitating Conditions (4 items). To provide further checks on the factor structure, two rotations: orthogonal (varimax) and oblique (oblimin: delta = 0) were conducted on the three-factor solution and these yielded consistent results. Table 1