Full length article

MLearning and pre-service teachers: An assessment of the behavioral intention using an expanded TAM model

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A R T I C L E   I N F O

A B S T R A C T

This paper presents the results of a study conducted in the University of Salamanca, on the behavioral intention of using mobile devices within the future teaching practice of pre-service primary education teachers. To this end we elaborated a technology adoption model based on the Technology Acceptance Model (TAM), to which we incorporated the constructs of self-efficacy and mobile anxiety. The study consisted of 678 participants from the Primary Education Teacher Bachelor's Degree at said university.

The model was examined with the PLS-SEM technique. The analysis supported all the relational hypotheses proposed, and suggested that the stronger relationships were those established between perceived usefulness and behavioral intention, perceived ease of use and perceived usefulness, and self-efficacy and perceived ease of use.

The multi-group analysis barely yielded any significant differences at a structural level controlling for gender and course year. However, we did find some significant differences between mean scores at an indicator level. The PLS-POS analysis of unobserved heterogeneity identified two groups with significant differences in their path coefficients.

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1. Introduction

The research on the incorporation of technology to the teaching methods in formal education has experienced an evolution process that has increased the number of research topics and disciplines interested in this matter. At first, research had a technological point of view, and it was focused on studying the advantages of using ICTs in the classroom (Petrova & Li, 2009).

Without abandoning this line of research, the gradual recognition on part of the society of the integration of new technologies as one of the key factors for the improvement of the teaching-learning process (Pelgrum, 2001) has caused a rise in the number of studies centered on characteristics other than the functional features of the information system (IS).

One of the topics of study that is attracting the most attention is the analysis of the factors that influence the success or failure of initiatives dealing with the integration of a new information system (Murray & Olcese, 2011; Orr, 2010; Wang, Wiesemes, & Gibbons, 2012). Within these factors, teacher acceptance has proven to be an essential element in the educational innovation process (Chen, Looi, & Chen, 2009).

However, engaging teachers in this process is a complex task (Dündar & Akçayır, 2014). Among the factors that condition their attitude we find elements such as the extra work that preparing new materials or activities for new ISs entails for teachers, the need to invest time to undertake the necessary training, or the anxiety produced by not feeling able to handle new devices.

One of the most recurrent tools for the study of these factors is the elaboration and application of technology adoption models. The pioneer of these models is the IDT (Innovation Diffusion Theory) (Rogers, 1962), a theory that explains the stages of the technology innovation process. After this theory, the development of other acceptance models has constituted a research field with a growing number of investigations, due to the increasing importance of ICTs in all human activities.

Among all these models, the most extended one is the TAM (Technology Acceptance Model) (Davis, 1989). The proposal, based on the assumptions of the TRA (Theory of Reasoned Action) (Fishbein & Ajzen, 1975), characterizes a system's acceptance process through 5 constructs:

- **Perceived usefulness (PU):** PU is *"defined as the prospective user's subjective probability that using a specific application*

system will increase his or her job performance within an organizational context" (Davis, Bagozzi & Barsaw, 1989, p.985)

- **Perceived ease of use (PEU):** It "*refers to the degree to which the prospective user expects the target system to be free of effort*" (Davis et al.,1989, p.985).
- **Attitude towards use (A):** Based on the definition proposed on the TRA, it designates "*an individual's positive or negative feelings (evaluative affect) about performing the target behavior*" (Davis et al.,1989, p.984).
- **Behavioral intention (BI):** Another concept built from the TRA, it is conceived as "*a measure of the strength of one's intention to perform a specified behavior*", in this case the use of an IS (Davis et al.,1989, p.984).
- **Actual use (AU):** The level of actual use of the IS.

From these constructs, Davis proposes a series of relational hypotheses, shown in Fig. 1.

Since its inception, TAM has been established as the most frequently used model for the study of technology adoption (Teo, Lee, & Chai, 2008). Authors highlight parsimony as the model's main advantage, with which we can explain a significant percentage of the variance (King & He, 2006).

This model has been subject to modifications by researchers, both to adapt it to different contexts and to increase the percentage of variance it can explain by adding new constructs from other theories (Hernández García, 2012). Aiming to integrate the findings of these extended models, two new versions of the TAM were created: TAM 2 (Venkatesh & Davis, 2000), which introduces constructs such as subjective norm and image, and TAM 3 (Venkatesh & Bala, 2008), which extends the TAM 2 with factors such as perceived enjoyment and perception of external control.

In the field of education, the number of studies that use TAM to investigate technology adoption processes is on the rise. We can find significant examples of its use in research both with teachers and students at all educational levels, especially in the field of elearning and higher education (Sánchez-Prieto, Olmos-Miguelánez, & García-Peñalvo, 2016a).

Our research focuses on the study of the acceptance of mobile technologies among primary education pre-service teachers. The inclusion of mobile devices in the formal field of education has been one of the most prominent technological innovation processes in the past few years (Fulantelli, Taibi, & Arrigo, 2015), with a growing number of studies focused on the educational applications of these devices (Sánchez Prieto, Olmos Miguelánez & García-Peñalvo, 2014). Given this rising importance, the number of

studies on their acceptance among teachers and students, both within the educational context (Joo, Lee, & Ham, 2014; Kim, Chun, & Lee, 2014; Yamakawa, Delgado, Díaz, Garayar, & Laguna, 2013), and outside of it (Kuo, Liu, & Ma, 2013; Riad Jaradat, 2013) has also grown.

However, despite this interest, most of the research on the acceptance of mobile technologies is focused on the students (Kim, Kim, & Han, 2013; Park, Nam, & Cha, 2012; Yamakawa et al., 2013), paying little attention to teachers.

Our initiative goes along the lines of other studies on the employment of technology acceptance models with pre-service teachers (Acarli & Sağlam, 2015; Camilleri & Montebello, 2011; Teo, 2010; Valtonen et al., 2015), aiming to analyze the future teachers' intention to use these devices when they take up their job, and to gain a better understanding of the factors that contribute to the acceptance of mobile learning within this collective.

To this end we have developed a TAM-based model expanded with two constructs: mobile anxiety and self-efficacy. With this purpose we have conducted a study on the intention to use mobile technologies in the future teaching practice of students from the Primary Education Teacher Bachelor's Degree at the University of Salamanca.

The structure of the reminder of this paper is divided in three sections. The first one will include a literature review and describe the methodology employed in the study. After that, we will present the results obtained from the analysis of the measurement and structural models, including the descriptive statistics, the hypothesis testing related to demographic factors and the study of unobserved heterogeneity. Lastly, we will finish the paper providing the discussion drawn from the results.

2. Literature review and methodology

Our research is focused on a topic related to the level of acceptance of mobile technologies among pre-service primary education teachers, in order to try to assess their future intention to these devices technologies and to gain a better understanding of the factors that affect such disposition.

Below we will explain the methodology employed in our research. We will begin by presenting the theoretical model we designed, focusing on the definition of the constructs and the basis for the formulation of relational hypotheses. After this, we will describe the characteristics of the population and sample and, lastly, the operationalization of the variables.
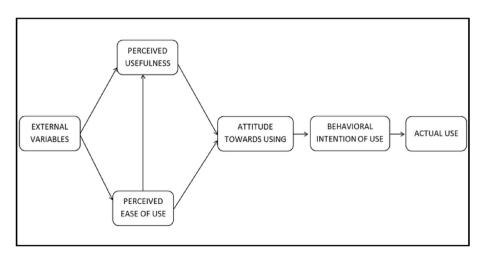

Fig. 1. TAM (Davis et al.,1989).