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THE ACCEPTANCE OF MICROBLOGGING IN THE LEARNING PROCESS: THE µBAM MODEL

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Abstract

Microblogging social networks (µBSNs) provide the opportunity to communicate worldwide while using a small number of characters; this is an apparent limitation that forces users to share only essential information when linking to the world with which they interact. These platforms can serve to motivate students by narrowing the physical and psychological distances separating teachers and students, thus increasing their confidence and engagement in the learning process. The main thrust of this paper is the notion that µBSNs open a window to informal knowledge, self-directed learning and the creation of knowledge-based networks for use in a classroom setting.

To examine this issue in greater depth, an experiment was carried out using a µBSN before, during and after face-to-face class sessions. In this study we used the Technology Acceptance Model (TAM), incorporating some of the constructs commonly found in the scientific literature. These constructs refer to the effect of subjective norms and social images on the use of web-based social networks.

The analysis gave rise to a robust and parsimonious model of social network usage behavior that confirmed the proposed research hypotheses. The findings demonstrated that the extended TAM model is suitable for explaining the acceptance of web-based teaching tools as well as the validity of microblogging networks in combination with traditional classes.

Keywords – Microblogging, self e-learning, social networks, TAM, µBAM.

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1 INTRODUCTION

Introduction: One of the future challenges and priorities of the European Higher Education Area (EHEA) is the implementation of a new methodological approach to transform the current educational system from being "teaching-centered" to "learning-centered". This new approach aimed at improving education must be interactive and based on three basic principles (University Coordination Council, Spanish Ministry of Education, 2005):

- Increased student engagement and autonomy.
- The use of more active methodologies, including practical cases, teamwork, tutorials, seminars, multimedia technologies, and others.
- The teacher as a facilitator and motivator of the learning process.

Information and Communication Technologies (ICTs) play an important role in achieving these goals at the higher education level. Interactive communications technologies based on the Internet have given rise to what is now known as e-learning, the aim of which is to facilitate the acquisition of knowledge. In this context, more attention is given to the matter of the learner's own attitude, as well as the opinions of others (Ebner,

Lienhardt, Rohs & Meyer, 2010). According to Trombley and Lee (2002), e-learning has several definitions, but can be referred to as "the method of learning based on electronic media". While e-learning allows students to continue their learning outside conventional educational settings, it is still facilitated and guided by the classroom teacher. This constructivist view of learning fosters the acquisition of knowledge in non-conventional settings, such as virtual environments (Arteaga & Duarte, 2010).

A similar concept is that of blending learning or b-learning, which integrates face-to-face classroom time with on-line learning. This model of learning is a specific type of e-learning or distance learning. Both learning methods involve some self-study outside the classroom setting and constitute a new medium for the exchange of information between teachers and students. They combine the benefits of on-line teaching (virtual classrooms, discussion forums and links) with the advantage of having a tutor/instructor to monitor all the activities and tasks. These learning methods do not attempt to adapt a given teaching model to the ICTs, but rather use them as a teaching tool to achieve a valid teaching-learning model. The users of these b-learning and e-learning platforms can access content from different courses in a variety of ways and through various multimedia formats (text, images, sound, video, etc.), and can interact with their peers and teachers individually or simultaneously through forums, chat rooms, video conferencing, message boards and so on (Uzunboylu, Bicen & Cavus, 2011). In this way, students can learn anywhere, at their own pace and according to their own needs (Trombley & Lee, 2002; Zhang & Zhou, 2003).

The main objective of this research study is to gain a better understanding of how the acceptance of ICTs in social networks can improve learning by permitting students to keep abreast of course content, fostering positive attitudes towards teachers, and providing a setting for informal learning. More specifically, we use a microblogging social network for various reasons. Firstly, to provide a space in which students can keep informed about and discuss topics seen in class, as well as other related topics. Secondly, to serve as a platform to index content in real time so that students can conduct searches on the topics seen in class, and ultimately, to use this space as a documented script that enables students to review course content and lectures, focus on the most important ideas and share, create and display the course content in its entirety.

The following section examines the main findings of studies on the use of networks in e-learning. Following a review of the literature, section two is dedicated to the various applications and extensions of Technology Acceptance Models and research hypotheses. Sections three and four describe the data collection method that permitted the application of a structural equation model (SEM) to model acceptance of microblogging networks. In section four, the main results of the study are examined, while conclusions are drawn in section six. The limitations of the study, as well as future lines of research, are discussed in section seven.

2 APPROACH: THE ROLE OF ICTS IN THE LEARNING PROCESS

Human learning, or the intellect of individuals, is constructed by generating new knowledge based on previous teachings. The overall aim is for learning to be an active process, that is, it must incorporate activities that allow students to become involved in their learning in an autonomous manner. According to Piaget's (1985) Constructivist Learning Theory, students build self-knowledge and construct meaning as they learn. Based on this idea, it is assumed that individuals learn when they have control over their learning and when they are aware of the control they have over their development. Hence, the importance of self-directed learning is that individuals construct and generate meaning by interacting with the world that surrounds them. According to this theory, students should engage in fulfilling activities in the classroom; these should be original and innovative activities that are interesting and meaningful to them, and useful in the real world in order to obtain added benefits beyond a simple final mark.

In order for class activities to be fulfilling, specific guidelines must be followed to ensure student satisfaction with learning-based technologies. On the one hand, students must perceive that distance education is a useful and flexible way of learning, and on the other, that it provides a context for innovative, student-centered instruction (Sahin & Shelley, 2008). According to Lee and Tsai (2011), students perceive higher levels of collaboration in Internet-based contexts than in traditional learning environments. They reported that students who spent a moderate amount of time in online learning environments perceived higher levels of capabilities and experiences relating to collaboration, self-management and the learning process.

2.1 Social Networks

Social networking is a gathering of people brought together for different reasons, such as family, work, or simply common interests and hobbies. The members of a network form a social structure comprised of nodes (generally individuals or organizations) that are linked together by more than one type of relationship, such as values, visions, ideas, financial exchange, friendship, kinship, dislikes or websites, among others (Ugarte, 2007).

New technologies have radically changed the ways in which people influence others, without having to establish direct social contact. People can now share their ideas with their peers and teachers and acquire new knowledge both inside and outside the classroom. Moreover, these technologies allow students not only to present their own insights, but also to consolidate and refine each other's contributions (Schroeder, Minocha & Scheidert, 2010). This social contact is not associated with a time or place, as the users of these social networks have the opportunity to post and share their thoughts when and with whom they wish, thus creating a bond of friendship that is not constrained by a physical space.

Social networks as constructivist tools function as a continuation of the classroom by creating a virtual learning environment in which the space for interaction between students and teachers is expanded to allow ongoing contact and provide new avenues for communication between them. This technology is interactive, provides high quality images and sound, immediacy, interconnection and diversity. Indeed, both academics and industry advocates have recognized social networks as one of the key elements of the next generation Web (Parameswaran & Whinston, 2007).

The need for research on social networks in educational contexts is now recognized (Lockyer & Patterson, 2008). Hence, explaining the reasons for the rapid diffusion, adoption and acceptance by individuals of social networks and the purposes of users is fundamentally important to determine the factors influencing the adoption of social networks by users in educational contexts (Mazman & Usluel, 2010).

2.2 Microblogging (or Nanoblogging) Social Networks (µBSN)

The interaction of students with new technologies is related to cognitive development and constructivism. According to Roschelle, Pea, Hoadley, Gordin and Means (2000), "cognitive research has shown that learning is most effective when four fundamental characteristics are present: active engagement, participation in groups, frequent interaction and feedback, and connections to real world contexts".

In this paper, we analyze the use of microblogging tools for teaching purposes and the management of self-directed learning. Microblogging social networks (µBSNs) (also known as nanoblogging networks), are a tool that allows users to send and post brief messages. The options for sending messages range from websites, SMS and instant messaging to ad hoc applications. Updates are displayed on the user profile page and are also immediately sent to other users who have chosen the option to receive them. Users can send messages only to members of their circle of friends, or permit access to all users by means of the default option.

Specifically, we center on the use of Twitter as it is the most widely used µBSN worldwide. Twitter is a real-time informational network, a microblogging site that allows its users (called "followers") to communicate with each other by sending and reading microtext entries (known as "tweets") with a maximum length of 140 characters. This apparent limitation in the number of characters forces users to share only the most essential information when linking to the world in which they interact. Twitter has 175 million registered users worldwide, and about 95 million tweets are written every day around the world (Twitter, 2010).

As a social network, Twitter revolves around the "follower" principle. When someone chooses to follow another user, that user's tweets are displayed in reverse chronological order on the user's profile page. Short messages can be labeled by including one or more hashtags: words or phrases prefixed with a hash (#) symbol followed by multiple concatenated words. These tagged words will then appear in the search results. These hashtags are also displayed in a number of websites on trending topics, including the Twitter homepage. The Twitter hashtags serve to generate conversation as they permit users to engage in several conversations with different groups by labeling messages which can be retrieved at a later time.

The most common uses of Twitter include the monitoring of live events, broadcasts of lectures and presentations to which people have difficult access, the exchange of opinions during an event and even comments about films or debates shown on television. This is especially important for people with the same interests (Ebner et al., 2010). From an educational standpoint, these platforms are able to motivate students by narrowing the physical and psychological distance between them and the teacher, while increasing their confidence and engaging them in their own learning process (Junco, Heibergert & Loken, 2011). These social

networks can be used before, during and after theoretical or practical classes. Course content can be posted on the network for use by all those interested. The use of tags to classify, index and retrieve course content transforms conventional, unidirectional classes into a more interactive discussion among all those involved, thus permitting ideas to be proposed, course content to be reviewed and, most importantly, information to be retrieved at any time (EduTwitter, 2011).

Social networks, such as Twitter, can be used to support teaching and learning in the higher education context in a number of ways:

- Creating a class diary in which students and/or the teacher post class-related experiences and topics.
- Raising questions in real time during the class.
- Indexing video, photo and audio content from other platforms.
- Providing students class-related information.
- Permitting students to share their opinions about the topics seen in class.
- Creating categories or hash tags to identify messages about specific topics or ideas or from specific groups of people.
- Posting public notebooks.

Most of these are integrated into so-called informal learning (Ebner et al., 2010). But most ways are mixtures of both informal and formal learning.

The use of social networks, and more specifically µBSNs, has enormous potential, as it is a novel application that increases participation by students and encourages them to engage in conversations, while overcoming barriers and creating a context for informal and self-directed learning. Given that these tools were developed in ICT environments, and due to the lack of spatial and temporal limitations, they can be integrated, aggregated and monitored by teachers with great ease and flexibility, giving more and more truth tothe famous A3 expression (anytime, anywhere, anybody) (Ebner et al., 2010). They are ideal tools for summarizing course content, giving examples, discussing, sharing, consulting and, above all, engaging students in the dynamics of learning and promoting the creation of their own content (Lee & McLoughlin, 2008).

Furthermore, the fact that it is easy to make queries or integrate other services, such as mobile telephony and (b)-learning environments, permits transforming these social networks into dynamic classroom conversations.

3 LITERATURE REVIEW: BEHAVIORAL MODELS AND RESEARCH HYPOTHESES

Online learning platforms and tools are a very useful resource for educational purposes across space and time. Their success, however, largely depends on how users accept and employ them in the learning process. For this reason, it is crucial to determine and evaluate the acceptance of these information technologies (IT).

The acceptance and use of new technologies has been widely studied over the past two decades, especially the Technology Acceptance Model (TAM) of Davis, Bagozzi and Warshaw (1989), the subsequent TAM2 model (Venkatesh & Davis, 2000) and the TAM3 model (Venkatesh & Bala, 2008), which seek to list and group factors that explain and mediate acceptance (see also the WAM of Castañeda, Muñoz-Leiva & Luque, 2007). These models provide a robust and reliable way to predict how a new technology will be accepted and ultimately used.

Although many educational institutions currently use the Web in their teaching systems, few studies have focused on identifying the factors that explain the acceptance of ICT tools in social networks. This paper employs some of the extensions proposed in the TAM3 (Venkatesh & Bala, 2008) to model the variables influencing the acceptance of a µBSN and to analyze the positive effects of these networks on informal learning. Specifically, we develop a model of behavioral intention to use a microblogging platform in higher education, based on perceived usefulness and ease of use, two factors which have been shown to be key in the intention to use ICTs, as well as other factors included in the previous extensions, always from a student perspective. A similar attempt was made by Kennedy-Clark (2011) from a teacher perspective.

3.1 Technology Acceptance Models (TAM)

The TAM, which was originally developed by Davis (1989), is one of the most widely employed models for explaining the use and acceptance of ITs and information systems (IS) (Featherman & Pavlov, 2003; Mathieson, 1991; Taylor & Todd, 1995; Venkatesh & Davis, 2000). The original TAM model attempts to explain at least 40%

of the variance in intention to use ITs. Since their development, TAM models have received considerable attention and strong empirical support (Venkatesh & Bala, 2008).

TAM models are rooted in the Theory of Reasoned Action (TRA) of Ajzen and Fishbein (1980), according to which beliefs are influenced by attitudes, which lead to intentions and result in certain types of behavior. The TRA is a general theory that attempts to explain and predict virtually any type of human behavior, based on the importance of individual beliefs. In the context of technology acceptance, this theory has been used to determine the factors that condition users in terms of innovation, behavioral intention (BI) and intensity of system use (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975).

A large body of research has demonstrated the validity of this model across a wide range of ITs (e.g., Gefen & Straub, 1997; Karahanna & Limayen, 2000; Moon & Kim, 2001). The TAM model has an acceptable predictive validity for measuring the use of new communication technologies, such as electronic mail (Gefen & Straub, 1997; Huang, Lu & Wong, 2003; Karahanna & Straub, 1999; Karahanna & Limayem, 2000), the Web (Agarwal & Prasad, 1998; Agarwal & Karahanna, 2000; Sánchez-Franco & Roldán, 2005), search engines (Morris & Dillon, 1997), websites (Lin & Lu, 2002; Van der Heijden, 2003), on-line sales (O'Cass & Fenech, 2003; Chen, Gillenson & Sherrell, 2002), online purchase intentions (Van der Heijden, Verhagen & Creemer, 2003), and in the field of education, the adoption of WebCT (Ngai, Poon & Chan, 2007), specifically e-learning environments and the acceptance of Moodle platforms (Sánchez & Duarte, 2010).

The two key variables that determine the intention to use and predict the acceptance of an innovation are present in all the studies that develop the TAM, namely perceived usefulness (PU) and perceived ease of use (PEOU) (Castañeda et al., 2007; Davis et al., 1989; Davis & Wiedenbeck, 2001; Gefen, Karahanna & Straub, 2003b; Muñoz-Leiva, 2008; Sánchez-Franco & Roldán, 2005; Verhoeven, Heerwegh & De Wit, 2010), which was called design dimensions by Sun, Tsai, Finger and Chen (2008). Indeed, TAM models suggest that the acceptance and use of technology are determined by these two beliefs.

PEOU refers to “the degree to which the prospective user expects the target system to be free of effort” (Davis, 1989). If individuals perceive that a technology is easy to use, they will be more likely to use said technology (Ramayah, Jantan & Ismail, 2003; Saad & Bahli, 2005). In this sense, PEOU is related to website structure, that is, users find the site simple to use, easily understand its contents and functions and can find the information they want fairly quickly (Muñoz-Leiva, 2008).

PU was first defined by Davis (1989) in the work setting as “the prospective user’s subjective probability that using a specific application system will increase his or her job performance within an organizational context”. This is a concept related to the issues of working speed, work efficiency and effectiveness, making work easier, and other practical considerations. A system with a high perceived usefulness is, in turn, one which the user believes to offer a positive “use – execution” relationship. In particular, a system presenting high levels of PU would be one in which the worker expects a positive return when using the system.

Most of the research conducted on TAM models has focused on the extrinsic perspective of the model (Igbaria, Parasuraman & Baroudi, 1996). More recent studies, however, have examined non-cognitive aspects, such as emotions, symbolism and desires in understanding attitudes towards the use of IS and different facets of human behavior. As a result, researchers have called for the incorporation of intrinsic factors and other theories to improve the predictability of TAM models (Hu, Chau, Sheng & Tam, 1999; Legris, Ingham & Collerette, 2003; Moon & Kim, 2001; Sánchez & Duarte, 2010; Venkatesh & Davis, 2000; Venkatesh & Bala, 2008; Verhoeven et al., 2010).

Early studies on the TAM have focused mainly on three areas or interests:

- First: Replication of the TAM model, focusing on psychometric aspects of the constructs.
- Second: Studies that emphasize the relative importance of the constructs of the original TAM (PEOU, PU).
- Third: Studies aimed at adding new constructs as determinants or moderators of the original variables (Castañeda et al., 2007; Venkatesh & Davis, 2000; Verhoeven et al., 2010). These new variables can be classified as follows:
  - *Individual differences,* such as personal or demographic attributes or experience, among others.
  - The most prominent *features of the system* that can contribute positively or negatively to perceived usefulness or ease of use.
  - *Social influence*, i.e. social processes and mechanisms that influence perceptions about various aspects of ITs.
  - *Enabling conditions,* such as organizational support to facilitate the use of information technology.

Along similar lines, Venkatesh and Davis (2000) proposed an extension of the original TAM model, in which they identified and theorized about the determinants of PEOU (subjective norms, image, relevance to work, quality of output, demonstrated results). We have proposed to explain the PU of an ITC-based tool in the context of a visible social network.

Subjective norms (SN) refer to "the degree to which an individual perceives that most people who are important to him think he should or should not use the system" (Fishbein & Ajzen, 1975; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000; Verhoeven et al., 2010). According to Moore and Benbasat (1991), social image (IMAGE) is "the degree to which an individual perceives that the use of an innovation will enhance his or her status in his or her social system". In the context that is of interest to us here, social image can be defined as the degree to which the potential user of the µBSN perceives that its use will improve his or her status within an environment of greater or lesser visibility to which he or she belongs. These variables moderate perceived usefulness (Venkatesh & Bala, 2008; Venkatesh & Davis, 2000).

3.2 Research Model And Hypotheses

For the purposes of our study, we consider PEOU to be the degree to which the student believes that using µBSNs is free of effort. Selim (2003) investigated the use and acceptance of course websites, employing variables on the perceived usefulness of the courses, perceived ease of use and usage. The results show that PEOU has a direct effect on PU and a positive effect on intention to use technology, with both being directly and indirectly moderated by PU (Davis, 1989).

The relationship between perceived ease of use and perceived usefulness and their effects on user behavior have been examined extensively, and support can be found in the literature related to ITs and IS (e.g. Castañeda et al., 2007; Gefen & Straub, 1997; Karahanna & Limayen, 2000; Ngai et al., 2007; Venkatesh & Bala, 2008).

The results of Selim's study show a significant relationship between use and ease of use for determining the usage of a given website. In this way, PEOU has a double impact on acceptance: self-efficacy and instrumentality. On the one hand, efficacy is one of the main factors behind intrinsic motivation (Bandura, 1982). It affects acceptance in that it captures this intrinsically motivating aspect of ease of use. On the other hand, improvements in PEOU can also be instrumental, contributing to increased efficacy. The effort saved thanks to increased PEOU can be re-directed elsewhere, thus permitting more work to be done with the same amount of effort (Davis, Bagozzi & Warshaw, 1992). This belief is significantly linked to intention, mainly via its indirect effect through perceived usefulness.

Therefore:

H1: PEOU has a direct and positive influence on PU.

H2: PEOU has a direct and positive influence on BI.

In the context of our analysis, PU can be defined in an analogous manner as the extent to which the student or user of the µBSN believes that the information obtained by participating in the network provides a number of benefits that would be difficult to obtain without participating in it. It is believed that PU is one of the most important factors influencing the acceptance of a Web (Bhattacherjee & Premkumar, 2004; Castañeda et al., 2007; Chen et al., 2002; Featherman & Pavlou, 2003; Moon & Kim, 2001; Sánchez-Franco & Roldán, 2005; Shen & Eder, 2009; Venkatesh & Bala, 2008). Indeed, the TAM proposes a direct relationship between usefulness and behavioral intention (Davis et al., 1989). PU is the only factor that has repeatedly proven to be valid in technological environments for determining positive feelings and intention of future use (Davis et al., 1989; Karahanna & Straub, 1999; Verhoeven et al., 2010).

This usefulness-intention relationship is based on the idea that students form intentions towards behaviors they believe will increase their task performance, over and above whatever positive or negative feelings may be evoked towards the behavior per se. This is because enhanced performance is instrumental to achieving various rewards that are extrinsic to the content of the task itself. Intentions towards such means-end behaviors are theorized to be based largely on cognitive decision rules to improve performance-contingent rewards.

Based on the above, we propose the following research hypotheses:

H3: PU has a direct and positive influence on BI.

However, some studies have shown that the importance of PU is greater than that of ease of use. They find that although usefulness has a positive and significant effect, ease of use has a direct, yet inconsistent impact on the acceptance phase, which can become insignificant in subsequent usage decisions (Davis et al., 1989; Karahanna

& Straub, 1999). This result confirms the importance of expected usefulness in shaping behavioral intentions, thus prompting us to complete the motivations and factors influencing the PU. To do so, we will focus on the variables of subjective norms and social image.

According to Venkatesh and Bala (2008), SNs directly influence PU. In this paper, we also argue that SNs directly affect PU, since teachers play an important role in prescribing and ensuring that students perceive the usefulness of µBSNS in learning environments. Van Raaij and Schepers (2008) studied the acceptance of a virtual learning environment in China, using the extended TAM2 model (Venkatesh & Davis, 2000). Their results indicated that the PU has a direct effect on the use of virtual learning environments (VLE), while PEOU and SNs had an indirect effect through PU. This leads us to propose that:

H4: SN has a direct and positive influence on PU

IMAGE is a variable which is also a moderator of perceived usefulness (Herbert & Benbasat, 1994; Morre & Benbasat, 1991; Venkatesh & Davis, 2000). In our context, social image refers to the degree to which the user of the network perceives that the use of the system will improve his or her status within a highly visible environment, such as a social network. We therefore propose that:

H5: IMAGE has a direct and positive influence on PU

The TAM2 model presents two theoretical processes, social influence and cognitive instrumental processes, to explain the effects of the various determinants on perceived usefulness and behavioral intention. In this model, subjective norm and image are the two determinants of perceived usefulness that represent the social influence processes. TAM2 also theorizes that three social influence mechanisms — compliance, internalization and identification — will play a role in understanding the social influence processes. Compliance represents a situation in which an individual performs a behavior in order to attain certain rewards or to avoid punishment (Miniard & Cohen, 1979). Identification refers to an individual's belief that performing a behavior will elevate his or her social status within a referent group, because important referents believe the behavior should be performed (Venkatesh & Davis, 2000). Internalization is defined as the incorporation of a referent's belief into one's own belief structure (Warshaw, 1980). TAM2 posits that subjective norm and image will positively influence perceived usefulness through processes of internalization and identification, respectively. It further theorizes that the effect of subjective norm on both perceived usefulness and behavioral intention will attenuate over time, as users gain more experience with a system. In turn, Venkatesh and Bala (2008) suggest that subjective norms have a positive influence on social image, a relationship that we adopt in the following hypothesis:

H6: SN has a direct and positive influence on IMAGE

We therefore propose the following conceptual µBSN acceptance model (µBAM).

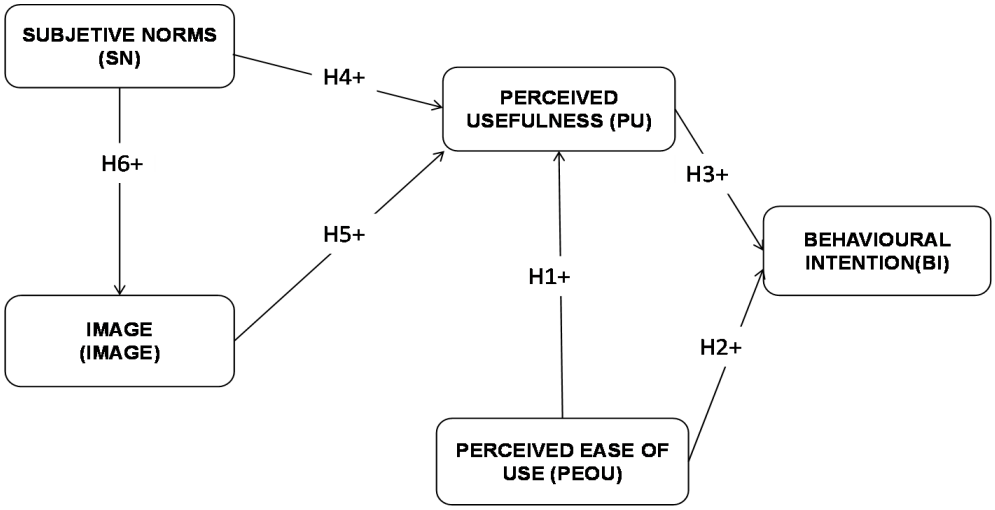

Figure 1. Proposed microblogging acceptance model (µBAM)

As a dependent variable, most of the literature on the cognitive-behavioral approach focuses on behavioral intention. Accordingly, we have also focused on this dependent variable for two main reasons. Firstly, previous empirical studies overwhelmingly support a strong positive association between intention and IT acceptance (e.g., Davis et al., 1989, 1992; Mathieson, 1991; Taylor & Tood, 1995), and retesting this association would not serve any purpose beyond validating the obvious (Bhattacherjee, 2000). Secondly, individuals are aware of their decisions to accept a technology; therefore, acceptance can be explained by the underlying behavioral intention (Hu, Clark & Ma, 2002).

Finally, to determine the effect of using Twitter on student performance, we propose two additional research questions:

RQ1: What is the connection between behavioral intention to use micro-blogging and increased self-directed learning?

RQ2: Can the effect of micro-blogging be demonstrated by a difference in grades (in terms of student "marks") between a class of micro-blog users and a (traditional) class of non-users?

4 DESIGN AND METHODOLOGY (STUDY METHOD)

The research was conducted using a survey structured into two sections. The first section of the questionnaire was devoted to knowledge and use of social networks, while the second section included 18 items (see Table 1 and 2) related to the five constructs of the proposed model: PEOU, PU, SN, IMAGE and BI. These items were drawn from previous studies and incorporated in the TAM3 model (Venkatesh & Bala, 2008). The five variables were measured using a seven-point Likert scale with 1 being "strongly disagree" and 7 "strongly agree". The fieldwork was begun on January 15 and concluded on January 30, 2011. The sample comprised 135 students enrolled in various undergraduate degree programs in the School of Economics and Business at the University of Granada (Spain). The questionnaire was completed after tests were submitted to the teachers in the different programs.

Sample population	***Higher Education Students***
Sample frame	*Students in the School of Economics and Business at the University of Granada*
Sample size	*135*
Confidence level	*95%*
Maximum allowed error of estimate	*±8.4%*
Fieldwork	*January 15 - 30, 2011*
Method of interview	*Personal, by means of questionnaire*
Sampling type	*Convenience sampling (students registered in the course)*

Table 1. Technical specifications of the study

SPSS software (version 18) was used for the statistical analysis, and LISREL 8.71 for estimating the structural equations model, using the robust maximum likelihood method. This method is especially useful in situations where the sample is small and the variables are not distributed according to a multivariate normal distribution (Hu & Bentler, 1995). The results were obtained by means of the following types of analysis: 1) Exploratory analysis to examine the validity of the variables and test the initial reliability of the scales, 2) confirmatory factor analysis (CFA) to test the dimensionality obtained in the exploratory analysis and to refine the established scales, and 3) structural equation modeling (SEM) to test the proposed causal relationships.

Constructs	Items	Description	Mean	SD
BI (Behavioral Intention)	INT1	If I have access to a microblogging tool, I will use it for/in class.	4.70	1.37
	INT2	If I have access to a microblogging network (i.e., Twitter), I predict that I will use it.	4.44	1.41
	INT3*	I plan to use this tool in the following months.	4.13	1.56
PU (Perceived Usefulness)	USE1	Using the microblogging tool improves my performance in class.	3.91	1.36
	USE2	Using the tool for studying increases my productivity.	3.96	1.34
	USE3	Using the tool makes me more effective in class.	4.07	1.39
PEOU (Perceived Ease of Use)	PEOU1*	I think the tool is useful in class.	2.78	1.32
	PEOU2	Interaction with the microblogging tool is clear and easy to understand.	4.64	1.29
	PEOU3	Interaction with the microblogging tool does not require much mental effort.	4.95	1.37
	PEOU4	I think the tool is easy to use.	5.36	1.26
	PEOU5	In my opinion, it is easy to make the tool do what I want it to do.	4.80	1.20
IMAGE	IMA1	Classmates who use microblogging networks have greater prestige and visibility than those who don't.	2.78	1.33
	IMA2	Classmates who use microblogging networks earn better marks.	3.09	1.33
	IMA3*	Using Twitter in class is a sign of distinction for my class.	3.15	1.47
SN (Subjective Norm)	SN1	People who have an influence on my behavior think I should use microblogging networks.	3.31	1.44
	SN2	People who are important to me think I should use microblogging networks.	3.16	1.47
	SN3*	Some teachers employ microblogging networks in a useful way.	1.53	0.49
	SN4*	In general, the university setting is compatible with the use of this system.	1.25	0.43

*: The CFA recommended the elimination of this item

Table 2. Constructs and description

5 ANALYSIS AND RESULTS

5.1 Exploratory And Confirmatory Analysis (CFE & CFA)

To verify that the measurement scales used in the questionnaire corresponded to what was initially proposed in the theoretical model, we applied a principal components factor analysis using Varimax Rotation with a Kaiser test, as recommended in the literature (Arteaga & Duarte, 2010; Hair, Anderson, Tatham & Black, 1999; Kaiser, 1970, 1974). This initial analysis recommended extracting five factors corresponding to the originally proposed variables. The KMO (Kaiser-Meyer-Olkin) index was 0.830, thus suggesting that the data were sufficiently interrelated, and that the factor analysis was reliable. The five factors that were extracted explained 74.13% of the variance. Finally, we performed a preliminary analysis of the reliability of the scales employed in the model, using Cronbach's *alpha* coefficient (Table 3).

Cronbach's alphas values were above 0.8, thus indicating acceptable reliability (Nunnally, 1978). The measurement instruments are therefore reliable and internally consistent. A subsequent CFA recommended eliminating item PEOU1, belonging to the variable PEOU; item INT3, belonging to the variable BI; items SN3 and SN4, belonging to the SN construct; and item IMA3, belonging to the IMAGE construct (see Table 3).

Variables	Cronbach´s α
BI (behavioral intention)	0.838
PU (perceived usefulness)	0.897
PEOU (perceived ease of use)	0.853
IMAGE (image)	0.823
SN (subjective norms)	0.949

Table 3. Reliability of the scales, according to Cronbach's alpha coefficient

5.2 Adequacy Of The Proposed Model

For the SEM analysis, we used different indices that indicated the goodness of fit of the data to the proposed model, as well as any recommendations for correction. As seen in Table 3, the goodness-of-fit indices showed acceptable values, as described in the literature (Hair et al., 1999).

The values of the structural model are shown in Table 4 and 5 below.

Goodness-of-fit indices for the structural model *(*Not significant for a significance level of 5%)*			
χ^2	*61.59*	*Df = 58*	*p-value = 0.348*
RMSEA	*0.021*	*C. I. = (0.00;0.059)*	*p -value =0.880**
GFI	*0.89*		
AGFI	*0.81*		
CFI	*0.99*		
NFI	*0.97*		

Table 4. Goodness-of-fit indices for the structural model

Constructs	***No. Original items***	***Standard Weights***	***Composite Reliability***	***Extracted Variance***
PU (perceived usefulness)	*3*	*USE1(0.85)*	*0.9*	*0.76*
		USE2 (0.89)		
		USE3 (0.87)		
PEOU (perceived ease of use	*5*	*PEOU2 (0.78)*	*0.86*	*0.61*
		PEOU3 (0.71)		
		PEOU4 (0.79)		
		PEOU5 (0.84)		
BI (behavioral intention)	*3*	*INT1 (0.81)*	*0.82*	*0.71*
		INT2 (0.86)		
IMAGE (image)	*3*	*IMA1 (0.77)*	*0.83*	*0.71*
		IMA2 (0.91)		
NS (subjective norms)	*4*	*NORMA1 (0.86)*	*0.95*	*0.91*
		NORMA2 (0.88)		

Table 5. Values for the proposed structural model

Finally, we present the proposed structural model which incorporates the values of the standardized coefficients between constructs and the R^2 or coefficients of determination for each endogenous variable. In the final model, the R^2 values of PU, PEOU and BI are 45%, 45% and 69%, respectively. More specifically, it is possible to explain approximately 69% of intention to use μBSNs according to PEOU and PU, and the moderating effect of SN and IMAGE on the PU.

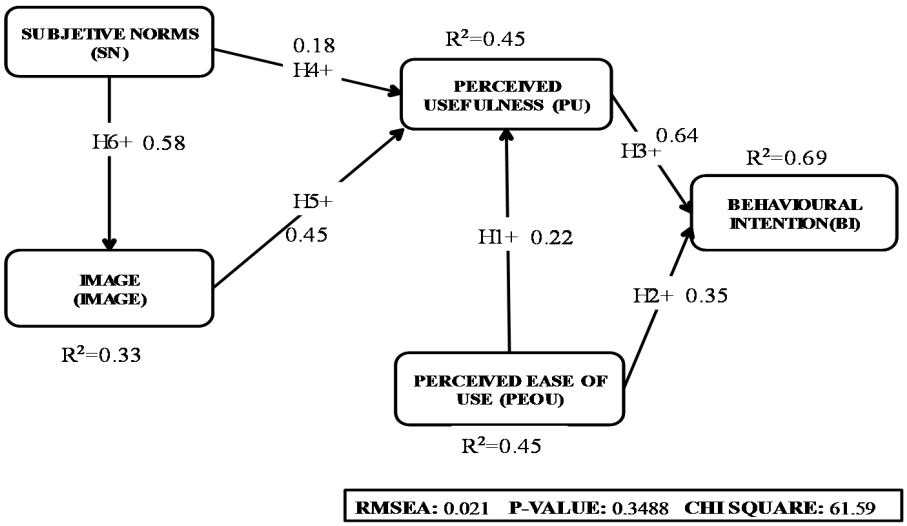

Figure 2. The µBSN acceptance model (µBAM)

The results provide empirical evidence to support the proposed hypotheses ($p < .005$ or $t > 1.96$). As can be seen, the model confirms hypothesis H1, specifically that PEOU of the µBSN has a positive influence on perceived PU (β = 0.22). The model also confirms the hypotheses H2 and H3, which hold that there is a direct and positive relationship between PEOU and PU with BI (β = 0.35 and β = 0.64, respectively). Hypotheses H4 and H5, which state that the variables IMAGE and SN have a direct influence on the PU, are also supported empirically (β = 0.45 and β = 0.18). Hypothesis H6 regarding the positive effect of the variable SN on IMAGE (β = 0.58) is also confirmed.

6 CONCLUSIONS AND RECOMMENDATIONS

Communication via µBSNs has increased greatly in recent years. The use of new technologies in e-learning or b-learning environments is a growing trend that has given rise to highly successful teaching methods. Within the context of this distance education model, this paper examines the factors that determine the acceptance of µBSNs among students with a view to incorporating such networks in their learning processes and methods. To test the relationships of the model proposed, an experiment was conducted using a µBSN before, during and after face-to-face classes. The network was used to make queries and observe students' responses and the conversations regarding them. Students were specifically asked to use the network to communicate with each other and the teacher. During the experiment, ideas were proposed and the users were informed about the content of subsequent sessions in order to receive feedback that could be viewed within the network itself. Course-related hashtags and the course profile were tracked to monitor the activity of the students on the network.

We proposed an extension of the TAM model that included relationships among five constructs. Three of the constructs (PU, PEOU and BI) are widely used in Technology Acceptance Models, while two additional interrelated constructs (NS and IMAGE) were proposed to explain the PU of an ICT-based tool in the context of a visible social network. These last two constructs constituted the most important contribution to the field of research and teaching examined in this paper, resulting in a robust and parsimonious model.

Empirical evidence was found for all of the relationships, thus confirming the validity of using a TAM model to measure the acceptance of µBSNs in e-learning environments (Arteaga & Duarte, 2010; Ngai et al., 2007).

This indicates that the proposed model, depending on the goodness of fit of the data set, can explain about 70% of intention to use µBSNs, according to their perceived ease of use, perceived usefulness and the moderating effect of subjective norms and social image on the perception of this type of technology. In this study, we show that a number of key features present in µBSNs contribute to effective learning as measured through observation and surveys, given that these networks: 1) provide a creative environment with multiple tools and contents that actively engage students in processes of self-directed learning, 2) enable students to engage in conversations, establish contacts and share ideas either individually or in groups, 3) provide added benefits for students by overcoming traditional barriers of time and space, as it is no longer necessary to be

physically present in the classroom to ask or answer questions, interact with peers or obtain continuous feedback where Internet access is available, and 4) permit indexing content, which allows students to better understand and make use of what they have learned.

µBSNs are also advantageous for teachers as they permit them to 1) track students more effectively, 2) provide academic guidance with greater ease, 3) better assess informal learning, participation and performance of students, 4) give examples and explanations, 5) provide a script of topics seen in class in real time, and lastly, 6) monitor and correct misinterpretations and misunderstandings.

To determine the effect of using Twitter on student performance, we proposed two additional research questions: Regarding research question 1 (RQ1), Table 6 shows the significant relationships of a Chi-square carried out to see the dependency relationships between different behaviors using microblogging social networks in learning and the perceptions regarding the use of these networks by students. These included a dependent relationship between the use of microblogging social networks and reduced shyness in class an improvement in the student's attitude towards the teacher and an enhanced opinion of informal learning by the student. As in Chen, Lambert and Guidry (2010), the results of this study suggest a positive relationship between the use of the Web-based learning technologies and student participation and learning, generating desirable outcomes, such as: level of academic challenge, active and collaborative learning , student-faculty interaction, and a supportive campus environment (Yang & Chang, 2011).

Students who have used in-class microblogging	***Chi²***	***f.g.***	***p-value***
It helps me overcome shyness with examples in class	*12.904*	*4*	*0.012*
Improvement in the attitude toward the teacher	*9.233*	*4*	*0.056*
Students who have signed up for Twitter			
Improvement in the attitude toward the teacher	*10.443*	*4*	*0.034*
Probable use for learning	*15.745*	*4*	*0.008*
Students who use microblogging networks			
It is a good tool for informal learning	*12.294*	*4*	*0.015*
Intention to use this tool in their academic studies	*17.130*	*4*	*0.004*
Previous use of social networking/microblogging			
Interaction with the tool is clear	*15.282*	*6*	*0.018*
It is easy to use	*14.989*	*6*	*0.020*
We used sources that enhanced my informal learning	*15.361*	*6*	*0.004*
Intention to use it	*22.909*	*6*	*0.001*
My attitude toward the teacher has improved	*10.387*	*6*	*0.034*

Table 6. Chi square analysis: Questions to understand behavioral intention in relation to future perceptions of learners

To provide answers to RQ2, Table 7 shows a further analysis based on the difference of means, using a Student's t-test, which compares differences between the final marks obtained in the course by those students belonging to groups that have used the microblogging social network (groups A and B) and those groups of students who have not used them (groups C and D). Groups A and B obtained higher mean scores in the subject (A = 4.60 and B = 4.93) as opposed to those groups who did not use microblogging social networking (C = 3.04 and D = 2.52). These results are very valuable for teachers and students who wish to improve academic achievement through the use of microblogging networks, as they indicate a significant increase in an objective aspect, namely the final marks in the course.

Final Marks					***t-test: means - independent samples - p values***					
Groups	***Mean***	***N***	***SD***	***Error***	***Twitter***		***A***	***B***	***C***	***D***
A	*4.60*	*72*	*2.31*	*0.272*	*Yes*	*A*	*–*	*p = 0.400*	*p = 0.000**	*p = 0,000**
B	*4.93*	*70*	*2.32*	*0.277*	*Yes*	*B*	*p = 0.400*	*–*	*p = 0.000**	*p = 0.000**
C	*3.04*	*60*	*2.04*	*0.264*	*No*	*C*	*p = 0.000**	*p = 0.000**	*–*	*p = 0.129*
D	*2.52*	*65*	*1.81*	*0.225*	*No*	*D*	*p = 0.000**	*p = 0.000**	*0.129*	*–*
Total	*3.83*	*267*	*2.36*							

Table 7. Comparison of means t-test - independent samples

7 LIMITATIONS OF THE STUDY AND FUTURE LINES OF RESEARCH

The limitations of the study are: 1) the users' experience in social networks and time spent using the microblogging tool could not be quantified, 2) the elimination of certain items following the exploratory analysis that should be reformulated in subsequent studies, and 3) the use of a smaller number of variables than those proposed in recent extensions of the TAM. While µBSNs are ideal for professional and peer discussions, their use in the educational setting presents some drawbacks:

- The minimum age required to register on this type of network impedes their use by younger students.
- These networks are completely open systems, meaning that when they are used by students from several courses, a large amount of noise can be generated, as they do not discriminate among groups of users. However, this problem can be overcome by using hashtags to separate conversations, as we did.

Future lines of research should be directed at: 1) incorporating new behavioral variables that attempt to explain the intention to use microblogging tools in greater depth, 2) enlarging the sample size by including students of different ages and at different educational levels, and 3) using a longitudinal approach to analyze motivational differences regarding the use of these social networks in an e-learning or b-learning context. Additionally, an answer should be found to these questions: What is the relationship between intention to use micro-blogging and its actual use? and What is the relationship between the use of micro-blogging and self-directed learning?

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