ANEXO F: A CROSS-CULTURAL STUDY ON THE INFLUENCE OF CULTURAL VARIABLES AND TEACHING BELIEFS ON UNIVERSITY TEACHERS' INFORMATION AND COMMUNICATION TECHNOLOGIES ACCEPTANCE

Sánchez-Prieto, J. C., Huang, F., Teo, T., Olmos-Migueláñez, S., y García-Peñalvo, F. J. (Pre-print) A cross-cultural study on the Influence of cultural variables and teaching beliefs on university teachers' information and communication technologies acceptance.

A Cross-Cultural Study on the Influence of Cultural Values and Teacher Beliefs on University Teachers' Information and Communications Technology Acceptance

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Abstract

The main objective of this study was to examine how cultural values and teacher beliefs influence Chinese and Spanish university teachers' acceptance of information and communications technologies (ICTs). We developed an extended technology adoption model using the constructs of behavioural intention, constructivist teacher beliefs, subjective norms and perceived behavioural control. We combined this model with Hofstede's cultural values theory to test the moderating effects of power distance, uncertainty avoidance and individualism/collectivism.

Four hundred and twenty-five university teachers from China and 385 teachers from Spain participated in the study. After confirming the partial structural invariance of the constructs, we tested the technology acceptance model using the samples from both countries and the effects of the cultural variables using PLS-SEM with multigroup analysis. The results confirmed the validity of the model in both samples and the effects of cultural values on the adoption of ICTs, and significant differences were observed

between the two samples. The theoretical and practical implications of these results are discussed.

Keywords.

Cultural values, Higher education, Technology Acceptance, In-service teachers.

1. Introduction

The use of ICTs in higher education is already a consolidated reality in many countries, and teachers now have a growing number of technologies at their disposal. However, the rapid technological development and incorporation of new devices into the classroom have not ensured teachers' technology acceptance (Gil-Flores, Rodríguez-Santero, & Torres-Gordillo, 2017).

Teachers are key players in the integration of ICTs in educational contexts (Teo, 2015). Therefore, to design successful initiatives to promote technological innovation it is essential to know the factors that condition teachers' acceptance of these technologies (Sánchez, Marcos, González, & GuanLin, 2012). Technology adoption models are among the most commonly used tools for studying these factors.

In the educational field, numerous studies have used using technology adoption models to analyse the internal and external barriers (Ertmer, 1999) that condition ICT acceptance among both pre-service and in-service teachers (Kiraz & Ozdemir, 2006; Stols & Kriek, 2011; Teo, Milutinović, & Zhou, 2016). However, the research on the influence of cultural values on the technology acceptance process is still in the initial stage of development (Tarhini, Hone, & Liu, 2014).

In the past few years, a growing body of research has examined how national and organisational cultures contribute to the differences in the behaviour of individuals. In particular, a number of cross-cultural studies have focused on the effects of culture on the technology adoption process in the educational field (Arenas-Gaitán, Ramírez-Correa, & Javier Rondán-Cataluña, 2011; Ritchie, Drew, Srite, Andrews, & Carter, 2011). These studies have indicated that cultural values condition the views and opinions of individuals. These values also have a strong influence on the technology acceptance of users, and thus affect the strength of the relationships between the

constructs in the technology adoption models. The influence of these specific cultural variables may have contributed to the inconsistencies in the research on the adoption processes in different cultures (Tarhini, Hone, Liu, & Tarhini, 2017).

Accordingly, if we ignore the elements related to these cultural values we risk introducing significant research biases that may compromise the applicability of the adoption models to different cultural contexts (McCoy, Galletta, & King, 2007). However, few studies have focused on the technology acceptance of higher education teachers. Moreover, few or no studies have compared the technology acceptance of teachers in countries in the Latin-European cluster and those in countries in the Confucian-Asian cluster (Gupta, Hanges, & Dorfman, 2002).

Spain, as a representative country of the Latin-European cluster, is characterised by a paternalistic state, and as having some collectivistic features within an individualistic value system. Accordingly, the Spanish tend to deal well with uncertainty, but still feel the need to be part of a more structured organisation. However, this desire contrasts with the rejection of the values of power distance, and Spanish citizens prefer a society in which power is distributed equally (Jesuino, 2002).

In contrast, Chinese society is characterised by its strong institutional collectivism and family orientation. The organisations in Chinese society have highly structured hierarchies in which the members accept the power distance between themselves and their leaders, and expect their leaders to absorb the uncertainty in new situations (Gupta, MacMillan, & Surie, 2004; Pillai, Kohles, Bligh, Carsten, & Brodowsky, 2011).

In recent years, Spain and China have been making continuous efforts to integrate ICTs into their universities (Gil-Flores et al., 2017; Teo, Huang, & Hoi, 2017). Thus, these countries are ideal settings for analysing how cultural differences influence higher education teachers' adoption of ICTs.

Therefore, the aims of this study are to develop a technology adoption model that can explain the factors that predict the intention to use ICTs in teaching practices in higher education institutions and to analyse how certain cultural factors influence the ICT acceptance of Spanish and Chinese university teachers. We examine the following three research questions:

RQ1. Which factors predict the technology acceptance of university teachers in China and Spain?

RQ2. In what way do cultural values affect the relationships between the factors that predict the acceptance of ICTs among university teachers?

RQ3. Are there any differences between China and Spain in the relationships between the factors that predict the acceptance of ICTs among university teachers?

To address these questions, we develop a model based on two of the most well-known theories used in the analysis of technology adoption and cultural values, namely, the technology acceptance model (TAM) (Davis, 1989) and Hofstede's cultural values (Hofstede, 2011).

2. Literature Review

Technology Acceptance Models

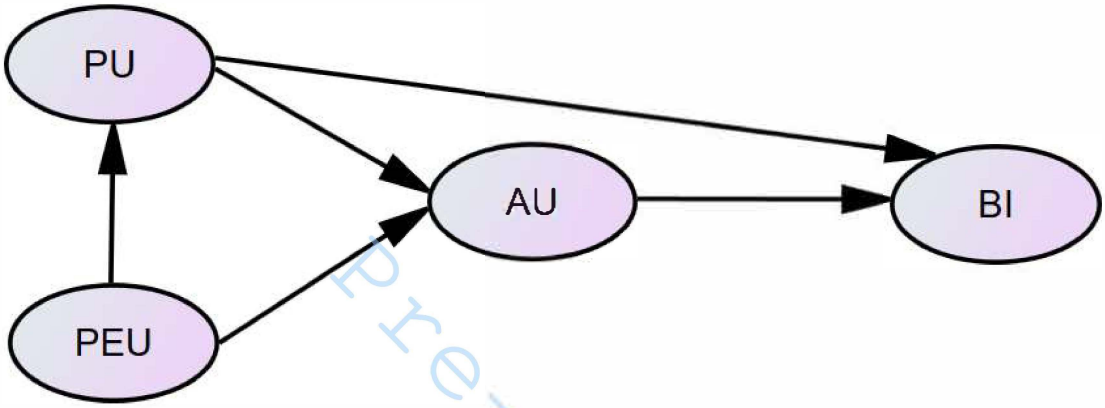
The TAM is arguably one of the most comprehensive tools for studying the factors that condition the use of a given technology by an individual (King & He, 2006). The model explains the adoption process based on four main dimensions: perceived usefulness (PU), perceived ease of use (PEU), attitude towards use (AU) and behavioural intention (BI) (figure 1).

PU measures the user's perception of the utilitarian properties of a technology and is defined by Davis as '*the prospective users' subjective perception of the probability that using a specific application system will increase his or her job performance within an organizational context*' (Davis, Bagozzi, & Barsaw, 1989, p. 985).

PEU refers to the effort required to incorporate a new tool within the working practice of the potential user. In the TAM, PEU is defined as '*the degree to which the prospective user expects the target system to be free of effort*' (Davis, Bagozzi, & Barsaw, 1989, p. 985).

The two remaining constructs were developed by Davis based on the theory of planned behaviour (TPB) (Ajzen, 1991). First, AU assesses whether an individual has a favourable or unfavourable attitude towards using a new ICT. Second, the direct antecedent of using a technology, BI measures the strength of the user's intention to incorporate the technology into their working practice.

Figure 1. TAM (Davis, 1989).



The TAM has evolved over the years, and has frequently been adapted to new fields of knowledge or extended with new constructs to increase the percentage of variance explained. In addition, two new versions of the model, TAM 2 (Venkatesh & Davis, 2000) and TAM 3 (Venkatesh & Bala, 2008), integrate some of the new constructs used by researchers.

Within the educational field, numerous studies have used different versions of the TAM to measure the acceptance of ICTs, such as computers and learning management systems (Agudo-Peregrina, Hernández-García, & Pascual-Miguel, 2014; Teo, 2010). The TAM has also been used as the basis for developing new theories and studies on the factors that condition the acceptance of ICTs among both in-service and pre-service teachers (Sánchez-Prieto, Olmos-Migueláñez, & García-Peñalvo, 2017; Teo, 2015).

However, the TAM has some limitations, mainly due to its excessive simplicity, which impedes the analysis of external and contextual variables that may affect the acceptance process. This simplicity can also cause problems in the level of variance explained when applying the TAM in exploratory studies (Legris, Ingham, & Collerette, 2003). In

addition, the TAM has been criticised for being culturally biased, especially when applied to non-Western cultures (Tarhini et al., 2017).

For these reasons, we decided to design and develop a modified TAM that is applicable to the context and objectives of this study. Our modified model is based on the original TAM proposal by Davis (1989), and retains the constructs of PU, PEU and BI.

Although attitude was included in the first version of the TAM, in the following years Davis and Venkatesh (2000) and Venkatesh and Bala (2008) removed this dimension in TAM 2 and TAM 3 because the construct only partially moderates the effects of PU and PEU on BI. Thus, its removal allows for a better understanding of the effects of the constructs on the fundamental dependent variable of interest, BI (Venkatesh, 2000). In the educational field, attitude is also frequently removed to achieve more compelling models that are adapted to the educational context (e.g., Hu et al., 2009; Park, 2009; Tan, Ooi, Leong, & Lin, 2014).

We propose the following hypotheses for the abovementioned constructs adapted from TAM 2 and TAM 3:

> **H1**: *PU positively predicts higher education teachers' BI to use ICTs in their teaching practice.*
>
> **H2**: *PEU positively predicts higher education teachers' BI to use ICTs in their teaching practice.*
>
> **H3**: *PEU positively predicts higher education teachers' perception of the usefulness of ICTs.*

In the educational context, the perception of the potential uses of ICTs is conditioned by the teaching beliefs of the teacher (Kiraz & Ozdemir, 2006). This way, if a university teacher espouses a traditional teaching approach, he or she will mainly use ICTs to support static content with little to no interaction with the student. However, if university teachers use a constructivist framework to develop their teaching strategies, they will use ICTs as tools to promote interactive learning, active and collaborative content creation, and communication among the students. In addition, if the use of ICTs

in education conflicts with the teaching beliefs of the university teacher, this may have a demotivating effect on the teacher's intention to use it.

In consequence, we propose the following hypotheses based on the works of Teo, Chai, Hung and Lee (2008) and Karahanna, Agarwal and Angst (2006).

> **H4:** *Constructivist teaching beliefs positively predict higher education teachers' BI to use ICTs in their teaching practice.*
>
> **H5:** *Constructivist teaching beliefs positively predict higher education teachers' perception of the usefulness of ICTs.*

As previously mentioned, the TAM is partially based on the TPB, which proposes that the behaviour of an individual is conditioned by three factors: the individual's beliefs, environmental pressure and the individual's ability to control his or her behaviour.

To measure the environmental pressure placed on an individual to perform a given task, Ajzen (1991) proposed the subjective norms (SN) variable. This construct is frequently used in TAM-based studies within the educational field (Kreijns, Vermeulen, Kirschner, Buuren, & Acker, 2013; Ma, Andersson, & Streith, 2005; Park, 2009) to measure the factors related to the effects of social pressure on teachers and students' intentions to use ICTs. The SN variable is also included in TAM 2 and TAM 3.

In this context, following Venkatesh and Davis (2000) and Venkatesh and Bala (2008), we hypothesise that SN affects both PU and the BI to use ICTs:

> **H6:** *SN positively predicts higher education teachers' BI to use ICTs in their teaching practice.*
>
> **H7:** *SN positively predicts higher education teachers' perception of the usefulness of ICTs.*

SN, as formulated in TAM 2 and TAM 3, measures the sources of subjective norms in a generic manner, as the relevance of the opinions of the people important to the user. However, Taylor and Todd (1995) proposed analysing the effects of each of these sources and how they condition SN.

A possible source of SN in the educational context is the influence of the teacher's perceived expectations of the students. Student influence (STI) is a relatively new construct that examines how the perceived pressure of students influences the behaviour of the teachers. Although the exploration of this construct is still in its initial stages, it
has been used in studies on teachers (Mejia & Phelan, 2013).

We posit that STI has a direct effect on SN following the principles proposed by Taylor and Todd (1995).

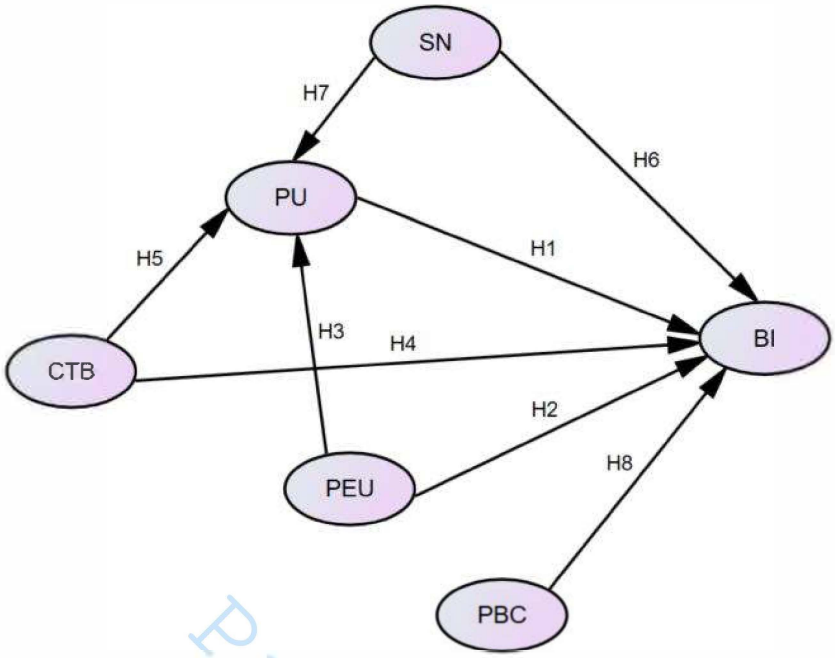
> **H8:** *STI positively predicts higher education teachers' perception of the social pressure to use ICTs.*

As previously mentioned, the TPB also proposes that an individual's control over his or her behaviour is a direct antecedent of BI (Ajzen, 1991). From this perspective, higher education teachers' perception of their control over the use of ICTs in educational contexts is likely to condition their intention to use the technology (Taylor, 1995). The elements that constrain higher education teachers' use of ICTs may be related to the availability of the resources, knowledge or skills needed to use the technology.

PBC has been successfully used to study technology acceptance in educational settings (Liu, 2010; Teo, 2012). For this study, we formulate the following hypothesis based on the work of Taylor and Todd (1995), thus completing the research model (Figure 2):

> **H9:** *PBC positively predicts primary teachers' BI to use mobile devices.*

Figure 2. Research Model



2.2. Moderating Effects of Cultural Variables

Culture can be defined as the shared system of meanings that members of the same community follow, and is acquired through a learning process that may differ across groups and individuals (Arenas-Gaitán et al., 2011; Hoecklin, 1995). The effects that these shared systems of values have on the behaviour of individuals is a growing topic of interest among researchers (Tarhini et al., 2017).

Hofstede's (1980) cultural values framework is one of the most cited theories in the applied study of culture. The framework stems from a series of studies on national cultures based on a sample of nearly 120.000 workers from IBM in 40 different countries. Initially, Hofstede (1980) distinguished four universal dimensions of culture: power distance, individualism/collectivism, uncertainty avoidance and masculinity/femininity. Over the years, Hofstede's framework has been extended to include new dimensions, such as short-term/long-term focus and indulgence (Hofstede, Hofstede, & Minkov, 2010). This theoretical framework is widely used by researchers in cross-cultural studies to measure the cultural values of the participants in samples from different countries.

In recent years, Hofstede's cultural dimensions have also been incorporated in technology acceptance research in e-commerce (Smith et al., 2013) and education (Sánchez-Franco, Martínez-López, & Martín-Velicia, 2009). The research in these fields suggests that Hofstede's cultural differences may affect the strength of some of the relationships within the TAMs (Tarhini et al., 2017).

Based on the analysis of Chinese and Spanish samples by Hofstede et al. (2010), we selected three dimensions that were found to differentiate two countries more than the other dimensions, namely, power distance (PD), individualism/collectivism (IC) and uncertainty avoidance (UA).

PD is defined as the extent to which the members of institutions and organisations within particular societies expect and accept inequalities in the distribution of power (Hofstede, 2001). Some authors (e.g., Dinev, Goo, Hu, & Nam, 2009; Tarhini et al., 2017) have suggested that PD moderates the relationship between SN and BI, such that a higher PD leads to SN having a greater effect on BI, and thus increases the effect of the opinions of others on an individual's BI to use ICTs. In addition, we have established how SN affects PU; therefore, we posit that this influence will also be stronger in societies with higher levels of PD.

Within the educational field, there is also a power relationship between teachers and students. Consequently, in societies with higher PD, teachers are placed in the centre of the teaching-learning process, and thus have complete control over the communication process (Hofstede, 2001). As a result, we expect that the opinions of the students will have less influence on the teachers' perceptions of the social pressure to use ICTs. Furthermore, research suggests that users from low PD countries may feel more empowered to decide whether to use a technology based on their own judgement of its usefulness (Tarhini et al., 2017). Hence, we expect to find a stronger relationship between PU and BI among higher education teachers from countries with lower PD than those from countries with high PD.

Following this line of reasoning, we also expect that the teachers' personal beliefs about the teaching methodology will have less influence on their intention to use ICTs in

countries with higher PD. Therefore, we propose the following research hypotheses for this variable:

H10A: *PD positively moderates the predictive relationship between SN and BI.*

H10B: *PD positively moderates the predictive relationship between SN and PU.*

H10C: *PD negatively moderates the predictive relationship between STI and SN.*

H12D: *PD negatively moderates the predictive relationship between constructivist teaching beliefs and BI.*

The second dimension included in this study is IC, which focuses on the relationship between the individual and the collective (Hofstede, 2001). In Hofstede's work, individualism signifies loose social ties and is predominant is societies where individuals are expected to look after themselves and their immediate family only. In contrast, collectivism is predominant in societies in which individuals are integrated into cohesive groups from birth. The strong loyalty bonds within these groups protect the members throughout their lifetime.

The moderating effects of IC have also been explored in the technology acceptance research. Researchers have hypothesised that IC conditions both the effect of PU on BI and the influence of SN on BI such that in collectivist societies the effect of SN on BI is stronger given that the group preferences are more important than the individual ones. In consequence, the relationship between PU and BI in these groups is weaker, given that PU refers to individual preferences (Sánchez-Franco et al., 2009).

In collectivist societies, the organisational relationships are closer to those established among family members, and are predicated on mutual obligations to protect in exchange for loyalty (Hofstede, 2001). This characteristic may affect how students' opinions influence the behaviour of their teachers. In collectivistic societies, the relationship between STI and SN should be stronger, and the students' opinions should have a greater influence on the general social pressure perceived by the higher education teachers, whereas in individualistic societies teachers are likely to be less concerned about the opinions of the students.

Finally, IC may also affect the influence of the control over BI. In collectivistic societies, individuals place more trust in collective decisions and thus have less control over their work and working conditions. This situation may weaken the influence of PBC on BI. To summarise, we propose the following hypotheses for the moderating effect of IC:

H11A *Collectivism positively moderates the predictive relationship between SN and BI.*

H11B *Collectivism positively moderates the predictive relationship between SN and PU.*

H11C: *Collectivism positively moderates the predictive relationship between STI and SN.*

H11D: *Collectivism negatively moderates the predictive relationship between PU and BI.*

H11E: *Collectivism negatively moderates the predictive relationship between constructivist teaching beliefs and BI.*

Finally, the third cultural dimension examined in this study is uncertainty avoidance (UA). This construct measures how individuals in a particular society cope with uncertainty. In cultures with a low tolerance for uncertainty, individuals tend to rely more on specific rules and regulations to guide their behaviour.

In the context of technology acceptance, UA can affect some of the relationships between the constructs proposed in the research model. First, in societies with high levels of UA, individuals rely more on their superiors, both in educational institutions and in the workplace, thus increasing their loyalty. In these situations, individuals place more trust in the good judgment of their leaders or the group than on their own decisions (Hofstede, 2001). In consequence, we expect that there will be stronger relationships between SN and both BI and PU and also weaker relationships between STI and SN and PU and BI among higher education teachers with high levels of UA.

The dependence on rules and regulations among individuals with high levels of UA also limits their freedom to control their behaviour and make decisions on their own. Thus,

we expect that PBC will have less influence on the decision to use ICTs among teachers with high UA.

However, the effect of UA on the relationships between the variable in the TAM remains unclear because the results of the existing studies are contradictory (Tarhini et al., 2017). We aim to contribute to the exploration of this construct by examining the following hypotheses:

H12A *UA positively moderates the predictive relationship between SN and BI.*
H12B *UA positively moderates the predictive relationship between SN and PU.*
H12C: *UA positively moderates the predictive relationship between STI and SN.*
H12D: *UA moderates the predictive relationship between PU and BI.*
H12E: *UA negatively moderates the predictive relationship between PBC and BI.*

Method

2.3.2 Population and Sample

The sample for this study comprised 806 university teachers from Spain (385) and China (425). The participants were selected using convenience sampling and participated in the study voluntarily through an online questionnaire.

In the overall sample, 52.6% of the respondents were men and 47.4% were women, although the percentages varied in the subsamples of the two countries. In the Spanish sample, 62.9% of the participants were men and 37.1% women, while in the Chinese sample the majority of the participants were female (56.8%).

The average age of the participants was 43.6 years (S.D. 9.5), and the average teaching experience was 12.31 years (S.D. 7.8). The Chinese sample had an average age of 38.51 years (S.D. 8.455) and average teaching experience of 8.97 years. In the Spanish sample, the average age was higher, at 46.99 years (S.D 8.7), and the participants also had higher average teaching experience of 16.03 years (S.D. 7.9).

To explore the cultural values of the participants, we performed a descriptive analysis of the items for Hofstede's' dimensions (Table 1). The results show higher levels of

collectivism, UA and PD in the Chinese sample, with the average values being above 5 for the majority of the items. In contrast, the values for all of the cultural dimensions are lower in the Spanish sample, with the values being under 5 for almost all of the items. We conducted a Student's t-test to test the statistical differences between the samples of the two countries. The results confirmed that the differences observed between the two samples were significant in all of the indicators except UA_04.

Table 1. Averages of the cultural dimension items and t-test results.

	Complete Sample	Chinese Sample	Spanish Sample	95% CI for Mean Difference		t	df
				Lower	Upper		
IC_01	4.82	4.98	4.67	-0.53	-0.07	-2.58***	817
IC_02	4.93	5.22	4.62	-0.80	-0.38	-5.53*	818
IC_03	5.09	5.37	4.81	-0.77	-0.34	-5.21*	818
IC_04	5.11	5.22	4.99	-0.43	-0.01	-2.04***	819
IC_05	4.35	5.20	3.45	-1.97	-1.53	-15.58*	816
PD_01	4.08	4.74	3.35	-1.61	-1.16	-12.11*	820
PD_02	5.08	5.33	4.81	-0.73	-0.32	-5.07*	819
PD_03	3.40	3.81	2.99	-1.07	-0.57	-6.54*	818
PD_04	3.65	4.17	3.08	-1.31	-0.86	-9.40*	816
UA_01	5.02	5.21	4.82	-0.58	-0.19	-3.91*	823
UA_02	5.17	5.30	5.03	-0.46	-0.09	-2.94**	818
UA_03	5.27	5.44	5.07	-0.55	-0.19	-4.05*	821
UA_04	5.36	5.37	5.36	-0.19	0.17	-0.08	821
UA_05	4.66	5.21	4.07	1.33	-1.33	-10.97*	817

Note. IC = individualism-collectivism, PD = power distance, UA = uncertainty avoidance. *p <.001, **p<.01, ***p<.05

2.3.1. Instrument

The survey instrument used in this study was divided into two sections. The first section gathered the demographic data of the participants, including country, gender, age, and

teaching experience. The second section comprised 38 Likert-type items ranging from 1 to 7 (1=completely disagree, 7=completely agree), which were used to measure the dimensions of the model. The items for these dimensions were developed based on the literature and adapted to the context and technologies under study (Appendix 1).

The items used to measure PU (4 items), PEU (4 items) and BI (4 items) were adapted from Davis (1989), and those for SN (4 items) and PBC (4 items) were adapted from Fishbein and Ajzen (1991) and Taylor and Todd (1995). The items used to measure STI (4 items) were adapted from Mejia and Phelam (2013), and those for CTB (7 items) were based on Teo and Chai (2008).

Lastly, to assess the cultural values of the participants, we adapted the items proposed by Hofstede (Hofstede, 2011): IC (5 items), PD (4 items) and UA (5 items).

The final version of the survey instrument was translated into Chinese and Spanish separately in a collaborative manner by teams of researchers at the University of Macau and the University of Salamanca. To ensure the sematic equivalence of the items, the translations were back-translated from Chinese and Spanish, respectively, into English (Renda & Okazaki, 2016).

Data analysis

The model analysis and hypothesis testing was performed using a partial least squares structural equation modelling (PLS-SEM) approach. This approach to multivariate data analysis goes beyond the ordinary least squares (OLS) approach and allows the inclusion of more flexible assumptions and more precise examination of the relationships between the variables, thus reducing random measurement errors and misspecification (Garson, 2015; Garson, 2016).

Due to the predictive nature of the study and the exploratory nature of the research on the effects of cultural values on the technology acceptance process, we decided to use PLS-SEM instead of the more traditional CB-SEM methodology (Hair, Hult, Ringle, & Starsted, 2017; Nitzl, 2016). Consequently, we decided to follow the example of previous cross-cultural studies on technology acceptance by integrating the TAM and

Hofstede's cultural values (e.g., Arenas-Gaitán et al., 2011; Sánchez-Franco et al., 2009) for the data analysis.

The model analysis in PLS-SEM is a two-stage approach in which the first step involves examining the quality of the measurement model to confirm the validity and reliability of the dimensions. Once the validity and reliability are stablished, the second step focuses on evaluating the relationships in the structural model by testing the significance of the relationships and the variance of the endogenous variables predicted by the model (Hair et al., 2017).

The analysis was conducted using the software SmartPLS 3.2.7 (Ringle, Wende, & Becker, 2015). We applied the consistent PLS algorithm, which is more appropriate in PLS models where all of the variables are modelled as reflective.

Results

Model Assessment

We assessed the model using the guidelines suggested by Hair, Hult, Ringle and Starsted (2017). In the first stage of this procedure, we assessed the goodness of fit of the global model using the standardised root mean square residual (SRMR) index. According to this index, both the saturated and estimated model should have scores lower than 0.08. As we can see in Table 2, this condition is fulfilled in the complete sample and the subsamples of the two countries participating in the study have scores well under the threshold value. The Chinese sample has a slightly better goodness of fit than the Spanish sample in the saturated model, while the fit of the estimated model is better in the Spanish sample.

Table 2. Global model assessment

	Complete Sample	Chinese Sample	Spanish Sample
Saturated Model	0.024	0.025	0.039
Estimated Model	0.059	0.064	0.059

In the second stage of the model assessment, we analysed the construct reliability and validity of the measurement model for the three data groups. We tested the reliability of

the indicators by checking that the loadings of all of the indicators were around 0.7 or higher (Hair et al., 2017). This process indicated the need to eliminate some items, namely, PEU_01, CTB_01, CTB_03, CTB_05 and CTB_06. In addition, the values for the composite reliability index (CRI) and average variance extracted (AVE) of the constructs were above .6 and .5, respectively, thus confirming the convergent validity and reliability of the dimensions included in the model (Hair et al., 2017) (Table 3).

Table 3. Convergent validity and reliability

	Complete sample		Chinese Sample		Spanish Sample	
	CRI	AVE	CRI	AVE	CRI	AVE
BI	.952	.832	.955	.842	.939	.795
CTB	.797	.568	.821	.607	.761	.515
PBC	.959	.854	.966	.875	.949	.823
PEU	.903	.757	.927	.809	.865	.682
PU	.876	.702	.866	.683	.903	.757
SN	.897	.684	.906	.706	.882	.653
STI	.942	.803	.938	.791	.948	.820

Note. BI = behavioural intention, CTB = constructivist teaching beliefs, PEU = perceived ease of use, PU = perceived usefulness, SN = subjective norm, STI = student influence.

The analysis of the measurement model concluded with the estimation of the discriminant validity. In PLS, the discriminant validity is usually verified using two methods, namely the Fornell-Larker criterion (Fornell & Larcker, 1981) and the heterotrait-monotrait ratio (HTMT) (Henseler, Ringle, & Sarstedt, 2015). All of the variables in the model satisfied the conditions of both methods, with the square root of the AVE being higher than the inter-construct correlations and HTMT scores under 0.085 for all of the constructs, respectively.

In the third and final stage of the model analysis, we examined the structural model by analysing the amount of variance predicted by the model and testing the predictive hypotheses.

As we can see in Table 4, the proposed model explains a large percentage of the BI in the three data groups, although the percentages of variance predicted for the three endogenous variables in the Chinese sample are higher than in the Spanish sample.

Table 4 also shows the results of the Stone-Geisser test, which yielded a Q^2 above 0 for all of the constructs, thus confirming the predictive capability of the model.

Table 4. Variance explained and the Stone-Geisser test.

	R2			Q2		
	Complete Sample	Chinese Sample	Spanish Sample	Complete Sample	Chinese Sample	Spanish Sample
BI	.643	.724	.542	.456	.549	.375
PU	.506	.551	.442	.280	.343	.251
SN	.464	.608	.325	.283	.436	.238

For the predictive hypotheses, the path analysis results in Table 5 provide support for all of the hypotheses proposed in the model except for H2 and H8. These results are consistent across the three groups of teachers. We can also observe in the table that the Chinese sample has higher path coefficients than the Spanish sample in all of the relationships except PU->BI and SN->PU.

Table 5. Path analysis

Path	Path coeff.			T values		
	Comp.	China	Spain	Comp.	China	Spain
CTB→BI	.039+	.068+	.016+	1.948	1.798	0.301
CTB→PU	.234*	.171**	.242*	5.193	3.117	4.869
PBC→BI	.362*	.273*	.259**	5.570	3.569	3.242
PEU->BI	-.059+	.008+	.012+	0.207	0.127	0.205
PEU->PU	.345*	.352*	.245*	7.528	5.064	4.986
PU->BI	.429*	.331*	.424*	8.365	5.198	7.559
SN->BI	.182*	.306*	.160**	4.923	4.498	3.299
SN->PU	.336*	.327*	.376*	7.604	4.013	7.670

STI->SN	.682*	.743*	.543*	20.085	18.129	10.905

Note. *p<.001, **p<.01, + Not Supported

3.2. Moderating Effects

We used a two-stage methodology (Hair et al., 2017) to test the hypotheses regarding the moderating effects of cultural values (Table 6). We first tested the validity and reliability of the moderator variables, and then created the interaction term measuring the moderating effect. We then conducted a bootstrapping analysis to test the significance of the moderation.

Table 6. Moderating effects

Path	Path coeff.			T values		
	Comp.	China	Spain	Comp.	China	Spain
ICxCTB->BI	.028+	-.007+	.081***	0.998	0.167	1.863
ICxPBC->BI	-.082**	-.037+	-.149**	2.464	0.798	2.574
ICxPU->BI	-.101***	-.138***	.007+	2.338	2.320	0.107
ICxSN->BI	.079***	.116+	-.020+	1.845	1.455	0.391
ICxSTI->SN	.009+	.018+	-.023+	0.272	0.444	0.447
PDxCTB->BI	-.020+	-.057+	.005+	0.690	1.186	0.107
PDxPU->BI	-.184*	-.197*	-.122***	4.879	3.973	1.961
PDxSN->BI	.127*	.148**	.014+	3.617	2.843	0.301
PDxSTI->SN	-.024+	-.026+	-.050+	0.757	0.593	1.149
UAxPBC->BI	.013+	.056+	-.135***	0.249	0.685	1.864
UAxPEU->BI	-.041+	-.055+	.041+	0.954	0.894	0.700
UAxPU->BI	-.135**	-.191**	-.076+	2.869	2.680	1.020
UAxSN->BI	.051+	.117+	-.003+	1.081	1.366	0.050
UAxSTI->SN	.028+	.023+	.027+	0.974	0.580	0.568

*Note. *p<.001, **p<.01, p<.05, + Not Supported*

The results in Table 6 show that there are differences in the moderating effects among the three samples. First, in the complete sample, IC negatively moderates the PBC->BI and PU->BI relationships, and positively moderates the SN->BI relationship. However,

this cultural dimension only moderates two relationships (CTB->BI and PBC->BI) in the Spanish sample, while in the Chinese sample it only negatively moderates the PU->BI relationship. Second, PD moderates the PU->BI and SN->BI relationships in the complete sample and the Chinese sample. However, in the Spanish sample, this variable only moderates the PU->BI relationship. Finally, UA also negatively moderates PU->BI in the Chinese sample and the complete sample. This dimension has a different effect in the Spanish sample, in that it negatively moderates PBC->BI instead of PU->BI.

Multigroup Analysis

Although there were some differences in the path coefficients and the R^2 of the Chinese and Spanish samples, we needed to conduct a PLS multigroup analysis (PLS-MGA) to determine whether these differences found at the structural level between the samples were statistically significant.

To test the measurement invariance between the two groups necessary for the PLS-MGA, we conducted a measurement of invariance of composite models (MICOM) test (Henseler, Ringle, & Sarstedt, 2016), which is a three-step process. The first step tests the configural invariance to ensure that the two groups have identical indicators and are analysed using the same procedure. This step is necessary for the second step, which tests the compositional invariance to assess whether the dimensions are equally formed across the groups. To do so, the MICOM procedure examines the weights of the indicators in the different groups and applies a statistical test to ensure that the weights do not significantly differ across the groups.

Finally, if the results of step 2 confirm the compositional invariance of the indicators, then the third and final step can be completed. This step tests the scalar invariance by analysing the equality of the mean values and variances of the dimensions. If the results of this step show the existence of scalar invariance, then there is full measurement invariance. Alternatively, if there is no scalar invariance, then there is partial measurement invariance across the data groups. PLS-MGA requires the existence of at least partial measurement invariance (Henseler et al., 2016).

Our results showed that the model had both configural and compositional invariance, although there was no scalar invariance. Therefore, the model had partial measurement invariance, which was sufficient to conduct the MGA to compare the path coefficients of the country samples.

The results of the MGA analysis shown in Table 7 reveal significant differences in two of the paths of the model, namely, SN->BI and STI->SN**.** In both cases, the path indexes for the Chinese university teachers are higher than those for the Spanish higher education teachers.

Table 7. MGA of the path coefficients

Path	Path coeff dif.	P value
CTB→BI	.053	.800
CTB→PU	.070	.172
PBC→BI	.200	.575
PEU->BI	.021	.480
PEU->PU	.004	.894
PU->BI	.106	.128
SN->BI	.097	.049
SN->PU	.141	.302
STI->SN	.049	.001

We also tested whether the differences found between the R^2 coefficients were also significant at a statistical level using the same PLS-MGA procedure. As we can see in Table 8, there are significant differences in the constructs BI and SN.

Table 8. MGA of the variance explained

	Spanish Sample	Chinese Sample	P value
BI	.542	.724	.002
PU	.442	.551	.196
SN	.325	.608	.002

4. Discussion

The results obtained in this study allow us to clarify some of the factors relating to university teachers' acceptance of ICTs. Below, we discuss the implications of our findings in the same order as the research questions.

The first research question related to the factors that predict university teachers' intentions to use ICTs. To answer this question, we developed an extended TAM, as described in section 2. Our results confirm the reliability and predictive validity of the model in two countries as different as China and Spain. In both contexts, the model predicts more than 50% of the variance of BI. When examined separately, the model predicts 72.4% of the variance of the BI in the Chinese sample.

Although the results for the hypotheses are consistent between the two samples, the variables display different behaviours. First, PU, SN and PBC play key roles in the university teachers' technology acceptance in both countries, in line with previous studies on technological adoption (Chen & Tseng, 2012; Lay, Chen, & Chi, 2013; Teo, 2015). As expected, SN is especially important in the case of China. We further elaborate this finding later in this section.

In turn, PEU does not play a relevant role as a direct predictor of BI. This can be explained by the teaching experience of university teachers. As we have observed, the teachers who participated in this study had on average around 10 years' professional experience in both samples. Therefore, the teachers were already used to having ICTs in their classrooms.

Taking this into account, our results concur with the findings of Davis, Bagozzi and Warsaw (1989), who affirm that experience moderates the relationship between PEU and BI by weakening its effect. Moreover, hypothesis H3, which suggests that there is a predictive relationship between PEU and PU, is supported in both samples. These results support TAM 3, which hypothesises that experience has a moderating effect in strengthening this relationship (Venkatesh & Bala, 2008).

The results of the data analysis also support the relationship between STI and SN, which indicates that the students' opinions have a strong effect on the teachers' perceived

social pressure to use ICTs. This finding also suggests that university teachers have a high consideration of their students and close relationships with them. As with the case of H4, this relationship is also stronger in the Chinese sample.

Finally, constructivist teaching beliefs do not directly predict the participants' BI to use ICTs. However, this variable does have a predictive direct effect on PU, thus confirming that the usefulness of ICTs is influenced by the methodology used by the teacher.

We predicted that the effect of constructivist teaching beliefs on technology acceptance would be similar to the effect of the compatibility with the preferred work style proposed by Agarwal and Karahanna (2006). However, the results indicate that constructivist teaching beliefs only condition the teachers' perception of the possible application of ICTs in their teaching, which explains why this construct works in a similar way to the job relevance construct included in the TAM 3. Given that the constructivist teaching beliefs variable has only recently been included in the TAMs, our results suggest that further research is needed on this construct.

To answer the second research question, we analysed the moderating effects of the cultural dimensions. Although the results show that the cultural variables have a moderating effect on some of the hypotheses, our analysis highlighted some differences between the two countries. These differences suggest that the moderating effects of the cultural variables on the adoption process also depend on the contextual and organisational factors. Therefore, further research on this topic is needed to explore these possible interaction effects.

Some of the results relating to the moderating effects are of interest. First, the cultural dimensions have more moderating effects in the complete sample than in the Chinese and Spanish samples, which can be explained by the greater heterogeneity of the scores in the overall sample. Second, none of the cultural variables have any effect on the relationship between STI and BI, which reflects the complex relationship between teachers and students in both countries. Third, all of the cultural dimensions negatively moderate the relationship between PU and BI, which indicates that the effect of this dimension on BI would be lower in China if PU was not also a moderator of the effect

of SN on BI. This further indicates the important role that SN plays in the technology acceptance of Chinese higher education teachers.

Finally, the MGA conducted to answer the third research question revealed significant differences at the structural level between the samples in two of the relationships that explain why R^2 is higher in the Chinese sample. First, there is a significant difference in the relationship between SN and BI, which can be explained by the effect of PD in strengthening this relationship in the Chinese sample. Second, there is also a significant difference in the relationship between STI and SN. The explanation for this difference lies in the complex relationship between teachers and students. First, because PD has no moderating effect, we can conclude that there is no perceived PD that may weaken the relationship. However, because IC also has no moderating effect, this suggests that teachers do not perceive themselves as belonging to the same group as their students. The explanation for this difference may lie in the desire for harmony and conflict avoidance that characterises leadership in China (Hofstede, 2001), which may generate teachers that value the opinions of their students more. Leadership in Latin-European countries is more focused on charismatic leadership than humane leadership (Jesuino, 2002), which may explain why the Spanish university teachers are less concerned about their students' expectations.

Limitations of the Study

This study has some limitations. First, we used a convenience sampling process, which may affect the generalisability of the sample. Thus, future studies should address this issue by using a more systematic sampling procedure. The second limitation is related to the construct selection. Specifically, we focused on three constructs from Hofstede's theory, and did not consider other constructs from different theories that might have enriched the analysis. We leave this issue for future investigations.

Conclusion

In this study, we presented an extended TAM, which we validated in two different national contexts. Our findings confirm that the proposed model constitutes an effective tool for predicting Spanish and Chinese higher education teachers' intentions to use ICTs. Our results also show that cultural values influence the technology adoption of higher education teachers. Accordingly, our findings suggest that there are differences in the acceptance processes of higher education teachers in the Latin-European and Confucian-Asian clusters.

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Apendix A. Questionnaire Items

Construct	Number of Items	Items
PU	4	1: Using technologies enables me to efficiently use the limited class time. 2: Using technologies enhances my teaching effectiveness. 3: Using technologies improves my teaching performance. 4: Using technologies is useful in my job.
PEU	4	1: My interaction with technologies is clear and understandable. 2: I find it easy to get technologies to do what I want to do. 3: I find computers easy to use. 4: I find technologies easy to learn.
BI	3	1: I will use technologies in teaching in the future. 2: I plan to use technologies in teaching often. 3: I expect that I will use technologies in teaching in the future.
SN	3	1: People whose opinion I value think that I should use technologies in teaching. 2: People who are important to me think that I should use technologies in teaching. 3: People who influence my behaviour think that I should use technologies in teaching.
PBC	4	1: I have the ability to use technologies in teaching. 2: I have sufficient knowledge to use technologies in teaching. 3: I have the resources needed to make use of technologies in teaching.

		4: Using technologies in teaching is entirely under my control.
STI	3	1: My students think I should use technologies in teaching. 2: My students expect me to use technologies in teaching. 3: My students think it is important for a teacher to apply technologies in teaching.
IC	5	1. Individuals should sacrifice their self-interest for the interests of the groups they belong to. 2. Individuals should stick with the group even when faced with difficulties. 3. Group interest/welfare is more important than individual interest. 4. Group success is more important than individual success. 5. Being accepted as a member of a group is more important than having autonomy and independence.
PD	5	1: Teachers should make most of their decisions by consulting/discussing with administrators/superiors. 2: Teachers should have social interactions with administrators/superiors. 3: Administrators/superiors should use authority and power when dealing with teachers. 4: Teachers should agree with administrators/superiors' decisions.
UA	5	1: Specific rules or regulations are important to me. 2: Detailed requirements are important to me. 3: Detailed instructions are important to me. 4. Standardised operating procedures help me to follow suit. 5: The best approach is to closely follow requirements, instructions and procedures.
CTB	7	1: Good teachers always encourage their students to think for answers themselves.

		2: The focus of teaching is to help students construct knowledge from their learning experience instead of knowledge delivery. 3: Different objectives and expectations in learning should be applied to different students. 4: Good teachers always make their students feel important. 5: Instruction should be flexible enough to accommodate students' individual differences. 6: It is important that a teacher understands the feelings of the students. 7: Learning means students have ample opportunities to explore, discuss and express their ideas.