Mobile Acceptance and Learning Beliefs. A Cross-Cultural Assessment Between China and Spain

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ABSTRACT

This paper presents the results of a study focused on the factors that condition the acceptance of mobile technologies among university students from China and Spain, paying special attention to the learning beliefs of the students. A total of 808 students from different universities from Spain and China participated in this study filling a questionnaire design and developed through the collaboration of researchers from both countries. The results of the descriptive analysis show a good level of acceptance of mobile technologies among both groups of students although the hypothesis contrast evidences important differences according to the variable country.

CCS CONCEPTS

• Applied computing → Education → Computer-assisted Instruction. • Social and professional topics → User characteristics.

KEYWORDS

TAM; learning beliefs; university students; mobile learning.

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1 INTRODUCTION

Nowadays, the proliferation of mobile devices in all the layers of the global society have attracted the attention of a growing number of fields interested in the benefits derived from the integration of this devices. The educational field is not an exception, the research on this topic, under the name of mobile learning (mLearning) is becoming a recurrent object of study [15].

One of the areas that is under the focus of researchers is the use of mobile devices in higher education contexts [18]. In this educational level students are more autonomous to make their own decisions and able to use mobile devices more efficiently than the those in lower levels, which makes possible both for teachers and students to take full advantage of all the didactic possibilities offered by mobile devices to improve the teaching-learning process [2].

In this field of education, the use of mobile devices can contribute to increase the flexibility of learning, making it possible anytime anywhere [6]. Related with this, mobile devices can also contribute to improve the interaction between the educational agents which can be especially useful in the development of

collaborative learning activities. Finally, it is also worth noticing the motivational aspect and the immersion potential derived from the multimedia capacities of these devices.

However, the aforementioned advantages and the high penetration of mobile technologies among university students does not ensure the success of the mLearning initiatives in higher education settings [2].

One of the key factors that influences the success or failure of the technology integration is the disposition of the students [19]. This element is especially important at a university level due to the higher decision power of the students to study the way is more suitable with their interests and conceptions of the learning process.

Therefore, the knowledge of the factors that condition their decision to use mobile devices as learning tools is essential in order to design successful initiatives that integrate these resources.

One of the main tools for the research of the factors that condition the use of a given technology are the technology adoption models, theories composed by a series of constructs and hypotheses that stipulate the relationships among them.

The most popular of this theories is the technology acceptance model (TAM) [7], a proposal based on the principles of the TRA (Theory of Reasoned Action) [9] and the TPB (Theory of Planned Behaviour) [1].

TAM intends to explain the acceptance process based on two concepts: perceived ease of use (PEU) defined as "t*he degree to which the prospective user expects the target system to be free of effort*" [8, p.985] and perceived usefulness (PU) that measures the perception that "*using a specific application system will increase his or her job performance within an organizational context*" [8, p.985].

These two constructs condition the attitude towards the use of a tool, composed by the beliefs and values of the individual. Finally, both the attitude and usefulness condition the intention to use the technology which constitutes the direct antecedent of the actual use of the technology (Figure 1).

Figure 1: TAM model

The main advantage of this model is its parsimony, that makes it able to explain a high percentage of the variance with a low number of constructs [12].

In the educational field, the popularity of TAM has grown over the past decade and nowadays we can find a growing number of studies conducted both we students [4, 14, 26] and teachers [3, 5, 25].

In some cases, the researches expend the model with constructs from other theories [13, 21], aiming to measure the influence of a given factor in the acceptance process, or to improve the model's explanatory capacity.

The proposal described in this paper goes in the line of these researches, developing a technology adoption model based on TAM and designed to measure the effect of university students learning beliefs in their adoption of mobile devices as learning tools.

This paper presents the results of a study developed in collaboration by the University of Macau and the University of Salamanca on the disposition of the Chinese and Spanish university students towards the use of mobile devices as learning tools.

Section two presents the methodology employed in the study, including the model development, the instrument and the sample of the study. Section two, includes the results of the descriptive analysis and so the hypothesis test conducted to verify whether there are significant differences according to the country of the students. Lastly, section four contains a brief series of conclusions drawn from the study.

2 METHODOLOGY

As we have mentioned, in order to carry out this study we developed a technology adoption model based on TAM that was expanded with two constructs designed to measure the learning beliefs of the university students. This section includes a description in detail of this model, the composition of the instrument to conduct the data gathering process and the sample of students that took part in the study.

2.1 Model development

The model designed for this research is based on the original TAM model proposed by Davis [7]. From this model we kept the five main constructs proposed by the author, namely: perceived usefulness, perceived ease of use, attitude towards the use and behavioural intention of using. Accordingly, the model also maintains the relational hypotheses initially stablished in TAM for these factors:

H1: Perceived usefulness is positively related with the intention of using mobile devices as learning tools of the university students.

H2: Perceived usefulness is positively related with the attitude towards the use of mobile devices as learning tools of the

university students.

H3: Perceived ease of use is positively related with the attitude towards the use of mobile devices as learning tools of the university students.

H4: Perceived ease of use is positively related with the usefulness perceived by the university students of the use mobile devices as learning tools.

H5: Attitude towards use is positively related with the intention of using mobile devices as learning tools of the university students.

As we have said, the model developed for this study is also focused on the influence of the learning beliefs of the students in the adoption process, which can condition their perceptions of the potential benefits and limitations in the use of mobile devices to learn.

The pedagogical beliefs of the students can be classified in two groups [23]:

- **Traditional learning beliefs (TLB):** This group of beliefs consider teaching as process of knowledge transmission and see the student as a passive agent.
- **Constructivist teaching beliefs (CLB):** This set of beliefs are define teaching as a process of knowledge construction in which students are active agents participating in their own learning. Under this paradigm, learning is built through the interaction and collaboration between the educational agents.

This way, in the traditional paradigm, mobile devices would be mainly used as tools to consult passive content while in a constructivist paradigm, teachers and students can also take advantage of their possibilities to enhance the communication and flexibility.

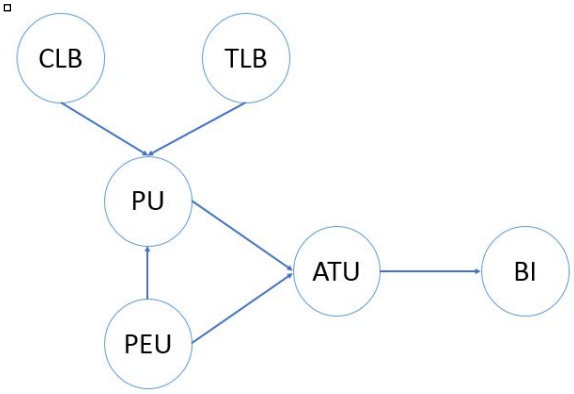

Figure 2: Research model

In consequence, we propose the following two hypotheses for these constructs:

H6: Traditional learning beliefs are negatively related with the usefulness perceived by the university students of the use mobile devices as learning tools.

H7: Constructivist learning beliefs are positively related with the usefulness perceived by the university students of the use mobile devices as learning tools.

Therefore, BI would be the endogenous variable of the model, PU would be endogenous and exogenous and PEU, CLB and TLB would be the exogenous variables. Additional we propose the country as explanatory variable (Figure 2).

2.2 Instrument

The instrument designed for this research is divided in two sections. Section one is dedicated to gather the identification data of the participants, including age, gender and country. Section two is composed by 32 Likert-type items (1: Completely disagree – 7: Completely agree) adapted to the context of this research from previous proposals.

The items to measure the variables from TAM where adapted from the proposal by Davis [8]:

- **Perceived usefulness:** Using mobile technologies enable me to learn efficiently (PU1); using mobile technologies improve my learning productivity (PU2); using mobile technologies enhance my learning performance (PU3); using mobile technologies increase my learning opportunities (PU4); using mobile technologies expand my learning materials (PU5); using mobile technologies are useful in my learning (PU6).
- **Perceived ease of use:** My interaction with mobile technologies is clear and understandable (PEU1); I find it easy to get mobile technologies to do what I want to do (PEU2); I find mobile technologies easy to use (PEU3); I find mobile technologies easy to learn (PEU4).
- **Attitude towards the use:** Using mobile technologies in learning is a good idea (ATU1); using mobile technologies in learning is a wise choice (ATU2); I like the idea of using mobile technologies in learning (ATU3); I feel positive to use mobile technologies in learning (ATU4).
- **Behavioural intention:** I will use mobile technologies in learning in the future (BI1); I plan to use mobile technologies in learning often (BI2), I expect that I would use mobile technologies in learning in the future (BI3); I will continue using mobile technologies in learning (BI4).

The items to measure the constructivist and traditional learning beliefs of the students were adapted from the proposal by Teo and Chai [23]:

- **Traditional learning beliefs:** Learning means teachers provide students with accurate and complete knowledge rather than letting students discover themselves (TLB1); learning occurs primarily through drill and practice (TLB2); learning means remembering what the teacher or textbook has taught (TLB3); good students keep quiet and follow teacher's instruction in class (TLB4); it is best if teachers exercise as much authority as possible in the classroom (TLB5); teachers should have control over what students do

all the time (TLB6); a teacher's task is to correct learning misconception/mistakes of students right away instead of letting students verify themselves (TLB7).

- **Constructivist learning beliefs:** Good teachers always encourage their students to think for answers themselves (CLB1); the focus of teaching is to help students construct knowledge from their learning experience instead of knowledge delivery (CLB2); different objectives and expectations in learning should be applied to different students (CLB3); good teachers always make their students feel important (CLB4); instruction should be flexible enough to accommodate students' individual differences (CLB5); it is important that a teacher understands the feelings of the students (CLB6); learning means students have ample opportunities to explore, discuss and express their ideas (CLB7).

In order to ensure the semantic equivalence of the items, they were subjected to a translation and back-translation process [16].

The internal consistency of the instrument was calculated with Cronbach's α coefficient, which yielded a value of 0.922 in the complete sample, 0.942 in the Chinese sample and 0.880 in the Spanish sample, which indicates a very high reliability in the three cases.

2.3 Population and sample

The population of this study is composed by the university students from China and Spain. Once the instrument was ready the data collection process was conducted during the first trimester of 2018 using convenience sampling.

The data from the Chinese sample was gathered using an electronic version of the instrument distributed through WeChat a mobile app with a high penetration rate in Chine. In the case of the Spanish sample, the data was gathered using both an electronic and a paper version of the instrument.

808 university students from universities in China and Spain participated in the study. The Chinese sample is composed by 438 students with an average age of 20.36 (S.D. 1.56). 48.2% of the students of this sample are males and 51.8% females.

The Spanish sample is composed by 370 students, the 64.9% of them are female and the 35.2% are male. The average age of this sample is 21.69 years (S.D. 3.97).

3 RESULTS

We began the analysis calculating the descriptive statistics of the two samples of students. Firstly, as we can see in Table 1, the Chinese students have a good disposition towards the use of mobile devices as learning tools with scores above 5 in most of the items of ATU and BI. As for the learning beliefs, the scores of the items of CLB are higher than those of TLB indicating a more constructivist view of the teaching-learning process.

For their part the Spanish students have scores on the same line, but they generally present higher mean values than the Chinese students in the items of BI, ATU, PU and PEU. In the constructs related with the learning beliefs, Spanish students also present high mean scores in the construct CLB and low mean scores on TLB, but in this case the values of the items of TLB are lower than those present in the Chinese sample in majority of the cases.

Table 1. Descriptive analysis of the items of the acceptance model in the two samples

	Chinese Sample				Spanish Sample			
	Mean	Median	Std. Dev.	N	Mean	Median	Std. Dev.	N
ATU1	5.18	5	1.34	438	5.65	6	1.21	368
ATU2	5.02	5	1.39	438	5.39	6	1.28	367
ATU3	4.84	5	1.41	438	5.48	6	1.39	368
ATU4	4.90	5	1.39	438	5.38	6	1.38	367
BI1	5.05	5	1.35	438	5.68	6	1.28	367
BI2	4.88	5	1.41	438	5.39	6	1.41	365
BI3	5.10	5	1.35	438	5.58	6	1.34	367
BI4	5.04	5	1.32	438	5.70	6	1.28	362
CLB1	5.62	6	1.26	438	6.31	7	0.87	368
CLB2	4.84	5	1.42	438	4.95	5	1.32	365
CLB3	5.68	6	1.26	438	5.81	6	1.13	369
CLB4	5.39	5	1.29	438	4.68	5	1.49	369
CLB5	5.75	6	1.26	438	5.75	6	1.35	365
CLB6	5.81	6	1.22	438	6.41	7	0.94	366
CLB7	4.74	5	1.61	438	5.76	6	1.44	367
PU1	4.67	5	1.46	438	4.16	5	1.38	366
PU2	4.86	5	1.42	438	5.04	5	1.47	368
PU3	4.69	5	1.43	438	4.60	5	1.56	369
PU4	5.20	5	1.32	438	5.58	6	1.27	369
PU5	5.47	5	1.28	438	5.91	6	1.19	369
PU6	5.23	5	1.31	438	5.66	6	1.19	369
PEU1	5.31	5	1.28	438	5.62	6	1.23	366
PEU2	5.31	5	1.28	438	5.47	6	1.25	368
PEU3	5.44	5	1.24	438	5.77	6	1.20	367
PEU4	5.28	5	1.32	438	5.87	6	1.22	366
TLB1	4.07	4	1.64	438	4.05	4	1.67	368
TLB2	4.98	5	1.56	438	5.60	6	1.34	368
TLB3	3.39	3	1.74	438	2.48	2	1.49	368
TLB4	4.71	5	1.53	438	3.60	4	1.79	369
TLB5	4.01	4	1.54	438	3.10	3	1.70	370
TLB6	3.38	3	1.70	438	3.17	3	1.61	368
TLB7	3.57	3.5	1.59	438	3.68	4	1.56	366

[a]Dimensions are presented alphabetically.

As we have stated there are important differences between the mean scores of the two samples observable at plain sight, in consequence we continued with the hypothesis test in order to know if these differences are significant at a statistical level.

Firstly, we begun conducting the tests of Kolmogorov-Smirnov and Shapiro-Wilk (Table 2) to detect if the distribution of the scores of the sample adjusts to the principles of normality.

Table 2. Kolmogorov-Smirnov and Shapiro-Wilk normalcy tests.

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistics	*df*	*Sig.*	*Statistics*	*df*	*Sig.*
ATU1	.177	766	.000	.902	766	.000
ATU2	.156	766	.000	.919	766	.000
ATU3	.148	766	.000	.917	766	.000
ATU4	.154	766	.000	.919	766	.000
BI1	.169	766	.000	.905	766	.000
BI2	.160	766	.000	.920	766	.000
BI3	.167	766	.000	.905	766	.000
BI4	.159	766	.000	.901	766	.000
CLB1	.227	766	.000	.821	766	.000
CLB2	.157	766	.000	.934	766	.000
CLB3	.202	766	.000	.858	766	.000
CLB4	.153	766	.000	.920	766	.000
CLB5	.215	766	.000	.841	766	.000
CLB6	.283	766	.000	.776	766	.000
CLB7	.166	766	.000	.892	766	.000
PU1	.159	766	.000	.926	766	.000
PU2	.169	766	.000	.924	766	.000
PU3	.150	766	.000	.936	766	.000
PU4	.174	766	.000	.897	766	.000
PU5	.187	766	.000	.856	766	.000
PU6	.163	766	.000	.895	766	.000
PEU1	.179	766	.000	.898	766	.000
PEU2	.179	766	.000	.905	766	.000
PEU3	.203	766	.000	.878	766	.000
PEU4	.203	766	.000	.873	766	.000
TLB1	.141	766	.000	.943	766	.000
TLB2	.179	766	.000	.895	766	.000
TLB3	.161	766	.000	.900	766	.000
TLB4	.147	766	.000	.937	766	.000
TLB5	.143	766	.000	.938	766	.000
TLB6	.146	766	.000	.931	766	.000
TLB7	.137	766	.000	.950	766	.000

[a]Liliefors significance correction.

As we can see in Table 2, the results of both tests lead us to conclude the rejection of the normality hypothesis. Taken this into account we selected non-parametric statistics for the hypothesis test. Given that the variable country in this research is a dichotomous variable, we chose Mann-Whitney's U test.

As we can see on the table 3, the test confirms that there are significant differences between the two samples in 25 of the 32 items.

Table 3. Mann-Whitney's U results for the variable gender.

	Mann-Whitney's U	Wilcoxon's W	Z	Asym. Sig. (bilateral)
ATU1	63804.500	159945.500	-5.245	.000
ATU2	67510.500	163651.500	-4.014	.000
ATU3	59143.500	155284.500	-6.666	.000
ATU4	63435.000	159576.000	-5.279	.000
BI1	57916.000	154057.000	-7.014	.000
BI2	62633.000	158774.000	-5.405	.000
BI3	63056.000	159197.000	-5.408	.000
BI4	55510.500	151651.500	-7.510	.000
CLB1	54557.000	150698.000	-8.331	.000
CLB2	76439.500	172580.500	-1.094	.274
CLB3	77263.000	173404.000	-1.118	.264
CLB4	58663.000	126928.000	-6.862	.000
CLB5	78548.500	174689.500	-.442	.659
CLB6	56669.000	152810.000	-7.728	.000
CLB7	50633.500	146774.500	-9.266	.000
PU1	63631.000	159772.000	-5.163	.000
PU2	73996.000	170137.000	-2.053	.040
PU3	78514.000	146779.000	-.713	.476
PU4	67848.500	163989.500	-4.050	.000
PU5	63470.500	159611.500	-5.453	.000
PU6	65297.500	161438.500	-4.846	.000
PEU1	68375.500	164516.500	-3.698	.000
PEU2	73972.500	170113.500	-2.070	.038
PEU3	66981.500	163122.500	-4.217	.000
PEU4	57695.500	153836.500	-7.074	.000
TLB1	80223.000	176364.000	-.114	.909
TLB2	61110.000	157251.000	-6.059	.000
TLB3	55988.500	123884.500	-7.623	.000
TLB4	51988.500	120253.500	-8.865	.000
TLB5	56674.000	125309.000	-7.491	.000
TLB6	75159.500	143055.500	-1.676	.094
TLB7	77051.000	173192.000	-.965	.335

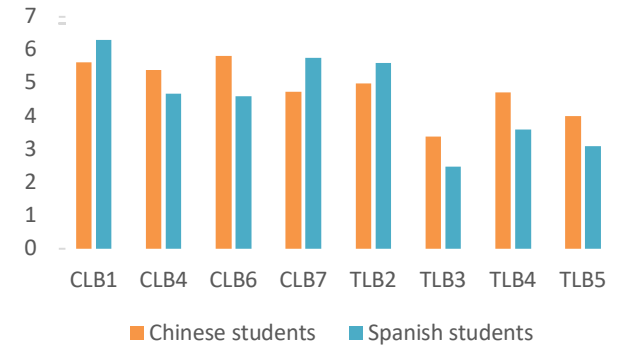

Figure 3: Mean scores of the items with significant differences

There are significance differences in all of the items of the dimensions included in the original TAM except in the item PU3 which confirms that the Spanish students have a better disposition towards the use of mobile technologies as a learning tool than the Chinese sample.

Finally, there are more similarities in the constructs of the learning beliefs. In both constructs there are significant differences in 4 of the 7 items included in the questionnaire. In the case of the CLB the Spanish sample has higher scores in three of the four items and in the case of TLB the Chinese sample has higher scores in three of the four items (Figure 3).

4 CONCLUSIONS

The results obtained from the descriptive analysis of the data gathered in this study indicate that the university students both from China and Spain have a good disposition towards the use of mobile devices as learning tools, with high scores both in BI and ATU.

However, it is noteworthy that the items of PU have lower scores than the rest of the TAM constructs, which indicates that although the university students from the two countries perceive mobile devices easy to use for learning and are willing to use them for didactic porpoises they do not have a clear idea of their usefulness. This may be due to factors as the motivational effect of the mobile devices or other factors such the attachment between the students and the technology that can also influence the adoption process [24], further studies are needed in order to confirm these hypotheses.

As for the descriptive analysis of the dimensions regarding the learning beliefs of the students, the results indicate that both samples have a more constructivist conception of the teaching-learning process, which corroborates the change of paradigm in the educational field.

Finally, the hypotheses contrast has evidenced important differences between the university students of the two countries. Firstly, the Spanish university students shows a higher level of acceptance of mobile devices than the students from China with scores consistent with those obtained in previous researches with Spanish university students [6, 20]. Secondly, although both samples have a more constructivist conception of the education, Chinese students are more traditionalist than their Spanish counterparts, which may explain their lower levels of technology acceptance.

Another explanation for these variations may lay in the influence of the cultural values in the technology acceptance process [17, 22], given that Spain is a country from the Latin European cluster and China is a country from the Confucian Asian cluster with important cultural differences [10, 11]. The results obtained in this research open the gate to further studies in this line in order to gain a deeper understanding on the effect of culture.

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