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Analysis of the determining factors of good teaching practices of mobile learning at the Spanish University. An explanatory model

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ABSTRACT

The use of mobile devices in education is becoming standardized at the higher education stage. However, it is necessary to evaluate good teaching practices of mobile learning (m-learning) in order to set proper application of mobile devices and favourable learning outcomes for students. The purposes of this paper were, on the one hand, to determine the degree of implementation of m-learning and good teaching practices in Spanish universities; on the other hand, to know the causes that lead university professors not to integrate mobile devices and to determine the socio-demographic factors that influence the development of good teaching practices of m-learning. In relation to the researching method, it was used a quantitative approach focused on the implementation of an online survey. A total of 1544 university professors attached to the Faculties of Education throughout Spain, aged between 20 and 77, participated in the study (M = 45.29; SD = 10.45). The results obtained revealed that: 1) More than 70% of Spanish university professors use mobile devices in the classroom; 2) The main reasons whereby mobile devices are not used in the classroom are ignored, belief that they are a distraction, resistance to change and perceived uselessness; 3) Only 39.56% carried out good teaching practices; 4) The main and possible influential factors good teaching practices of m-learning were professional category, line of research in educational technology, other teaching innovations, believes in the adequacy of mobile devices and the expansion of m-learning in the coming years. Finally, the practical implications of this study are discussed, highlighting the wealth of collected data from this pioneering research on the evaluation of good teaching practices of m-learning.

1. Introduction

Nowadays, it is a well-known fact that, mobile computing has advanced at a relentless pace in recent years. The development of the functionalities of mobile devices has been exponentially, since start making a simple call and sending of Short Message Service (SMS) to the arrival of Internet to the devices and the commerce of mobile applications. This evolution in their functionality has increased the use of mobile devices by educational context as another tool available for teachers. Furthermore, the use of Information and Communication Technologies (ICT) is linked to educational paradigm of the 21st century, where the role of teachers was defined as a learning guide, the main figure to be followed by the students.

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This implementation of ICT in education is supported by different organizations. Firstly, European level, the Digital Agenda 2020 includes in its actions research and innovation with ICT and the promotion of literacy, skills and digital inclusion (European Commission, 2019); secondly, the Horizon Reports, a global benchmark in the analysis of trends and adoption of technology in higher education, have highlighted since 2012 the integration of mobile devices in the university classroom (Adams et al., 2017; Adams et al., 2018; Alexander et al., 2019; Johnson, Adams, & Cummins, 2012; Johnson, Adams, Estrada, & Freeman, 2014; 2015; Johnson et al., 2013; Johnson et al., 2016). However, this prediction is still remains to be seen as consolidated fact, since every year some trends related to mobile learning (m-learning) continues to stand out (Table 1).

As for the Spanish context, data from the Mobile Report in Spain and the World in 2019 showed that the most widely used Internet access device in Spain was the smartphone, with a penetration rate of 96% (Ditrendia, 2019). In addition to these data, in 2016 Spain became the country with the most smartphones per inhabitant and was the fifth country in the world with the most hours of Internet use through the smartphone (Atresmedia, 2019). Thus, as some theories state "technostress" is a present problem in the reality of university students, but the academic use of mobile devices does not cause this type of stress (Cong, 2019). Therefore, the academic integration of mobile devices in the university classroom allows the establishment of new scenarios and possibilities that can have a positive impact on improving the teaching-learning process. It should also be noted that the educational context where m-learning has been most developed is higher education (Crompton & Burke, 2018), being a useful resource to expand the capacities of university students (Fox, 2019; Pinto, Sales, Fernández-Pascual, & Caballero-Mariscal, 2020).

For all these reasons, this paper proposed an analysis of the application of m-learning in Spanish universities. At the same time, the causes of non-application and the factors that influence the development of good teaching practices with mobile devices were also examined.

2. Background

M-learning in Spain has experienced a growing interest from teachers since the beginning of 2009 (Brazuelo & Gallego, 2014). It is clear that, the emergence of implementation experiences at different educational levels and the configuration of a theoretical body of knowledge on m-learning (Hinojo-Lucena, Aznar-Díaz, & Romero-Rodríguez, 2018). Specifically, m-learning refers to the use of mobile devices (smartphone, tablet, laptop …) to encourage learning and extend the scope of teaching (Díez, Valencia, & Bermúdez, 2017). Furthermore, ubiquity is one of its main features, since it allows learning at any time and place, while facilitating the provision of immediate feedback (Mohsen & Khatony, 2019).

Moreover, m-learning provides distance learning, adapting itself to the particular characteristics of the student (Grant, 2019). In this sense, m-learning is linked to the principles of the socio-constructivist theory of learning (Vygotsky, 1979) and to a sociocultural vision (Bachmair & Pachler, 2015; Bannan, Cook, & Pachler, 2016), which explains, the student acquires an active role in a social collective learning environment favoured by mobile devices (Robles-Altamirano & Barreno-Salinas, 2016). However, the most important pedagogical approach to m-learning is the pedagogical model established by Kearney, Schuck, Burden, and Aubusson (2012). This model considers three essential elements: (i) authenticity (location and contextualization), which refers to the perception of the contents and their adaptation to the real world; (ii) collaboration (conversation and data exchange), related to the way the user interacts with the learning community and; (iii) personalization (participation and adaptation), linked to the user's perception of the adaptation of the technology to their needs.

It is clear that, the relevance of this points for m-learning, where empirical studies confirm the improvement of academic performance (Arain, Hussain, Rizvi, & Vighio, 2018; Aznar-Díaz, Cáceres-Reche, & Romero-Rodríguez, 2018a; Sung, Chang, & Liu, 2016), cooperative work (Chang, Liu, & Huang, 2017), self-regulation (Khan, Oiriddine, Kettunen, & Gregory, 2019, pp. 1–17; Zheng, Li, & Chen, 2016) and even increased creativity (Jahnke & Liebscher, 2020). Another factor to take into account is it has been found to be a useful method for language learning (Hoi, 2020).

These potentialities, highlighted in previous studies, promote rigour and credibility to m-learning to be implemented in the educational context. Although, the adoption of this methodology is influenced by aspects related to effort expectations, performance expectations, confidence expectations, learning self-management, system functionality and social influence (Al-Adwan, Al-Adwan, & Berger, 2018; Chao, 2019). However, perceived utility is the most effective factor for the acceptance of m-learning (Chavoshi & Hamidi, 2019; Gómez-Ramírez, Valencia-Arias, & Duque, 2019; Hamidi & Chavoshi, 2018). In fact, the key factors for the expansion of m-learning is found in the positive perceptions towards its use and the belief focused on improving student learning.

In spite of the fact that, there is still resistance to the adoption of mobile technology in the classroom (Hadad, Meishar-Tal, & Blau, 2020), there are many reasons why teachers do not apply mobile devices in their teaching, such as mainly the ignorance, derived from the lack of techno-pedagogical training (Boude & Sarmiento, 2017; Sánchez-Prieto, Hernández-García, García-Peñalvo,

Table 1
Predictions on the implementation of m-learning in the Horizon Reports (2012–2019).

Year	Resource	Prediction
2012	Mobile applications and tablets	A year or less
2013	Tablets	A year or less
2014 to 2016	Bring Your Own Device (BYOD)	A year or less
2017 to 2019	Mobile Learning	A year or less

Source: Prepared by the authors on the basis of analysis of the 2012–2019 Horizon Reports.

Chaparro-Peláez, & Olmos-Migueláñez, 2019). Furthermore, some previous studies point out that gender influences the adoption of m-learning, where being a woman increases this possibility (López & Silva, 2016).

It cannot be denied that, the introduction of mobile devices in the classroom must be accompanied by pedagogical and didactic principles (Crompton & Burke, 2020). It means linking m-learning with the implementation of good teaching practices, where

Table 2
Socio-demographic data in the application of m-learning.

Variables	Non-application		M-learning application	
	n	%	n	%
Gender				
Male	167	10.81	434	28.10
Female	252	16.32	691	44.75
Age				
20–29	23	1.48	79	5.11
30–39	88	5.69	293	18.97
40–49	118	7.64	374	24.22
50–59	138	8.93	281	18.19
60 or more	52	3.36	98	9.34
Category				
Professor	29	1.87	28	1.81
Professor of University School	2	.12	6	.38
Senior Lecturer	108	6.99	215	13.92
Senior Lecturer of University School	15	.97	10	.64
Lecturer	72	4.66	211	13.66
Assistant Professor PhD	48	3.10	149	9.65
Assistant Professor	3	.19	13	.84
Interim Substitute Professor	20	1.29	64	4.14
Associate Lecturer	85	5.50	306	19.81
Adjunct Professor	6	.38	21	1.36
Postdoctoral	5	.32	6	.38
Pre-doctoral	20	1.29	63	4.08
Visiting Professor	1	.06	5	.32
Collaborating Professor	4	.25	26	1.68
Emeritus Professor	1	.06	2	.12
Knowledge field				
Didactics of Body Expression	34	2.20	66	4.27
Didactics of Musical Expression	13	.84	42	2.72
Didactics of Plastic Expression	6	.38	41	2.65
Didactics of Language and Literature	32	2.07	110	7.12
Didactics of Experimental Sciences	25	1.61	86	5.56
Didactics of Social Sciences	24	1.55	72	4.66
Didactics of Mathematics	32	2.07	59	3.82
Didactics and School Organization	63	4.08	241	15.60
Physical and Sport Education	26	1.68	78	5.05
Research and Diagnostic Methods in Education	26	1.68	81	5.24
Evolutionary and Educational Psychology	81	5.24	153	9.90
Theory and History of Education	57	3.69	96	6.21
Teaching experience				
1–5	83	5.37	291	18.84
6–10	81	5.24	241	15.60
11–15	60	3.88	154	9.97
16–20	46	2.97	133	8.61
21–25	45	2.91	114	7.38
26 or more	104	6.73	192	12.43
Type of institution				
Public	379	24.54	917	59.39
Private	40	2.59	208	13.47
Educational technology research				
Yes	49	3.17	419	27.13
No	371	24.02	706	45.72
Other teaching innovations				
Yes	304	19.68	1063	68.84
No	115	7.44	62	4.01
Mobile devices are appropriate				
Yes	313	20.27	1052	68.13
No	106	6.86	73	4.72
M-learning expansion (belief)				
Yes	250	16.19	905	58.61
No	170	11.01	220	14.24

satisfactory results are obtained by the students (greater involvement, motivation and development of skills) and the experience becomes a practice that can be transferred to other contexts due to its excellence (Alonso-García, Aznar-Díaz, Cáceres-Reche, Trujillo-Torres, & Romero-Rodríguez, 2019). The fact is that, if we refer to good teaching practices of m-learning, these must be involved the training of knowledge, self-regulation, cooperative work and the development of digital competence (Aznar-Díaz, Cáceres-Reche, & Romero-Rodríguez, 2018b). So, these factors are indicators for good teaching practices of m-learning in the classroom, being at this study, with the aim of analysing and identifying these referenced practices.

As for the previous studies on good teaching practices of m-learning, the published manuscripts have been diverse: Application of the Unied Theory of Acceptance and Use Technology (UTAUT) model, where it was found that perceived quality of information, perceived compatibility, perceived trust, perceived awareness and availability of resources, self-efficacy and perceived security were the main factors in ensuring the success of m-learning practices (Almaiah, Alamri, & Al-Rahmi, 2019); review of the literature on the use of mobile devices, where different experiences based on good teaching practices of m-learning were identified that showed improvements in academic performances and student motivation (Caldeiro-Pedreira, Yot-Domínguez, & Castro-Zubizarreta, 2018); experiences of a good teaching practice of m-learning in the training of future teachers at the University of Cantabria (Spain), where it was highlighted that the practice got increased motivation, participation and self-regulation of learning (González-Fernández & Salcices-Talledo, 2017); identification, application and evaluation of the effectiveness of good practices on m-learning, as activities were implemented in a training course for health professionals in Ontario (Canada), finally the structure and delivery of m-learning was considered as the most relevant aspects during the instruction plan (Kellam, 2020); according to the use of Mobile Instant Messaging (MIM) in higher education, this study highlighted some advantages of developing good practices with MIM including interactivity, knowledge sharing, sense of presence, collaboration and ubiquity (Klein, Da Silva, Vieira, Barbosa, & Baldasso, 2018); application of heuristic evaluation for the detection of good teaching practices of m-learning, the results indicated that this type of evaluation provides a clear and easy guide for the detection of good practices (Kumar, Goundar, & Chand, 2020); exploration on the perceptions of good teaching practices of m-learning, the results showed that teachers identified the concept of good practices but were not able to recognize concrete cases of application (Navarro, Vega, Chiroque, & Rivero, 2018).

In short, in the study of m-learning, the research trend has been to analyse the factors for the adoption of m-learning (Moorthy, Yee, Ting, & Kumaran, 2019; Moreira, Santos, Durao, & Joao, 2018; Vidal, Blasco, & Sastre, 2019; Zhonggen & Xiaozhi, 2019). On the other hand, it can be seen that m-learning in higher education is still at an experimental stage (Kaliisa, Palmer, & Miller, 2019). Thus, empirical research on good teaching practices of m-learning is scarce. In connection with this information, this study is an attempt to answer it, with the aim of reversing the trend and initiating a line of research on m-learning that is more practical and related to real application in the classroom. Therefore, the objectives were established as (i) to determine the degree of implementation of the m-learning methodology and good teaching practices in Spanish universities, (ii) to know the causes that lead university professors not to integrate mobile devices in their teaching, (iii) to determine the socio-demographic factors that influence the development of good teaching practices of m-learning, and (iv) to generate an explanatory model of good teaching practices of m-learning. Next, the research questions raised were:

RQ1: What is the frequency of application of m-learning in Spanish universities?
RQ2: What are the main causes for not implementing mobile devices in the classroom by university professors?
RQ3: What socio-demographic factors influence the development of good teaching practices of m-learning?

3. Method

3.1. Participants and procedure

A cross-sectional study design was adopted using a self-administered survey of the population of university professors who teach in the Faculties of Education of Spanish public and private universities (N = 9655). Participant data was collected from the email distribution of an online survey, in Google Forms format. The research was conducted based on a convenience sampling design. In total, professors from 59 Spanish universities participated, of which 40 were public and 19 were private (n = 1544).

The participants answered questions related to their socio-demographic data and a scale to evaluate good teaching practices of m-learning in the university environment. Before answering the scale, participants agreed on their informed consent. Information was also provided to all respondents about the purpose of the study and the anonymous processing of their data. The data collection period was from May to September 2019.

Specifically, the sample was defined by 601 men and 943 women, aged between 20 and 77 (M = 45.29; SD = 10.45). The group's teaching experience was between 1 and 60 years (M = 15.34; SD = 11.20). In this regard, it should be pointed out that the application of mobile devices in the classroom, the percentage of university professors who use them was higher (72.86%; n = 1125) than those who do not use mobile devices in their teaching (27.14%; n = 419). Table 2 shows the socio-demographic data of the participants.

3.2. Measures

3.2.1. Socio-demographic measures

Different socio-demographic variables were evaluated, which were extracted from different studies that related some of these factors to the development of m-learning practices. So it was a relevant and interest fact which explains to include each one in this study, among them were (i) gender (Alasmari & Zhang, 2019; García, López, & Castillo, 2019; López & Silva, 2016); (ii) age, (iii)

teaching category (according to the Spanish university system) and (iv) teaching experience (Drozdikova-Zaripova, Kalatskaya, & Zhigalova, 2019; Fombona & Rodil, 2018; Valencia, Benjumea, Morales, Silva, & Betancur, 2018); (v) knowledge field (Aliaño, Hueros, Franco, & Aguaded, 2019), which were established based on the different educational fields of the Spanish university system; (vi) type of institution (public or private) (Espinosa, Betancur, & Henao, 2017).

Data were also collected on: (vii) the teacher's line of research is linked to educational technology and (viii) other types of teaching innovations implemented, being research and innovation in the development of m-learning fundamental aspects (Barrett & Liu, 2019; Lamia, Hafidi, Tricot, & Benmesbah, 2019; Xiao-Dong & Hong-Hui, 2020). Finally, the believes and personal attitudes about m-learning were also significant factors as noted in previous studies (Chao, 2019; Hu, Ng, Tsang, & Chu, 2019; Nikolopoulou, Gialamas, & Lavidas, 2020; Sultana, 2020), so the variables were applied: (ix) considers the use of mobile devices in the classroom to be appropriate; (x) believes that e-learning will become widespread in university education in the coming years.

3.2.2. Analysis of M-learning practices at the university (APMU)

The APMU scale was used to assess good teaching practices of m-learning of university professors, which has good psychometric properties (Aznar-Díaz, Romero-Rodríguez, Ramos, & Gómez-García, 2020). This instrument identifies whether teachers apply good teaching practices with mobile devices through the response to 16 items divided into five dimensions: mobile devices, digital competence, knowledge building, cooperative work and good use of technology. Responses are grouped around a four-level Likert scale based on frequency, where 1 is never and 4 is always. Scores on the scale range from 16 to 64 points, with the cut-off at $\geq$ being 48 points to estimate that teachers are applying good teaching practices of m-learning in their classroom. For this study a good internal consistency in the scale was obtained (Cronbach's a = 0.83).

3.3. Data analysis

As for the analysis of the data, different statistical tests were used as a result of the aims and questions of the study. Firstly, the reasons attributed by university professors for not using mobile devices in the classroom were analysed. To this end, the responses were categorized and a content analysis was developed as a method of data analysis (Elo & Kyngäs, 2008; Hsieh & Shannon, 2005).

Subsequently, the values relating to the frequency and percentage of cases of good teaching practices of m-learning were established on the basis of each of the socio-demographic factors. The possible existence of significant differences between these factors was also analysed with the T-test for independent samples and ANOVA test.

A linear regression analysis was used to examine the possible influence of socio-demographic factors on good teaching practices of m-learning. Finally, relations were calculated using a structural equation model (SEM), taking into account socio-demographic data that were significant for good teaching practices of m-learning (extracted from the linear regression model). In addition, before the establishment of the SEM, the Mardia coefficient was calculated to verify the hypothesis of multivariate normality of the data (Mardia, 1970).

Data analysis was performed using Microsoft Excel Professional Plus 2013 (Microsoft, Redmond, WA), IBM SPSS and IBM SPSS Amos, version 24 (IBM Corp., Armonk, NY).

4. Results

A content analysis was showed as on the reasons that Spanish university professors do not use mobile devices in the classroom. The responses were coded in four categories: distraction, change resistance, ignorance and uselessness (Fig. 1). Thus, it was gathered that the main causes were: I would not know how to apply them (ignorance) (45.59%; n = 191); I consider that they distract students

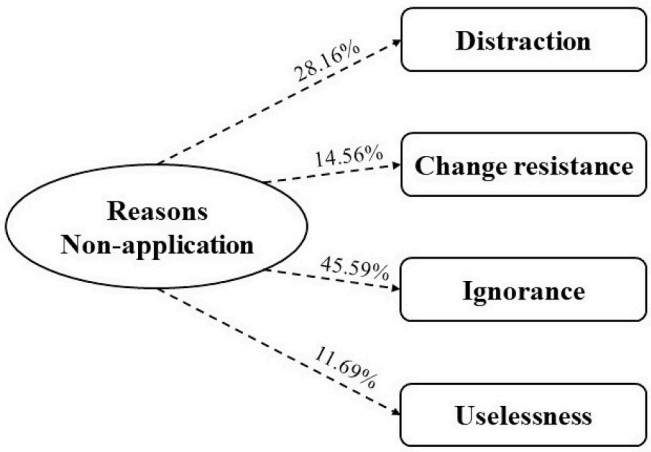

Fig. 1. Reasons for non-application (n = 419).

(distraction) (28.16%; n = 118); I prefer a traditional methodology (change resistance) (14.56%; n = 61) and; I believe that they are not a useful resource for learning (uselessness) (11.69%; n = 49).

According to the teachers who applied mobile devices in the classroom, Table 3 shows the division of each of the average scores got in every dimension together with the total. The cases of good teaching practices were defined following the specifications of the APMU scale, with the value 48 being the key score for their recognition and in the case of the other dimensions the same pattern was used, which establishes the obtaining of a value three times the minimum score to ensure the representativeness of all the items on a frequent basis. So, for mobile devices and cooperative work it was 9, digital competence was set at 6, while for knowledge building and good use of technology it was 12. However, the value taken as a reference for the consideration of good teaching practices in m-learning was that of the population as a whole. Therefore, the sample was divided into two groups based on the scores obtained on the APMU scale: Group 1 - the application of m-learning was not classified as a good teaching practice (Non-GTP) (<48 scores; 60.44%; n = 680) and Group 2 - the application of m-learning was classified as a good teaching practice (GTP) (≥48 scores; 39.56%; n = 445).

The frequency and percentage of cases of good teaching practice were grouped around socio-demographic factors. The percentages were calculated according to the proportion of the sample for each of these factors (Table 4). It was also found that the largest cases were found in the population of men (41.94%), in an age range of 20–29 years (44.3%), in the professional category of Visiting Professor (60%), in the teaching staff of the Department of Didactics of Plastic Expression (60.98%), in cases with teaching experience between 21 and 25 years (43.86%), in the professors who work in private universities (40.38%), whose line of research is educational technology (58.95%), those who implement other teaching innovations (41.4%), those who believe in the suitability of mobile devices for teaching (39.73%) and others who believe that m-learning will become widespread in the coming years (42.54%). Although, significant differences were found only between the knowledge field ($p = .000$), in the case that the teacher's line of research was educational technology ($p = .000$), the fact of implementing other teaching innovations ($p = .000$) and the belief that m-learning will become widespread in the coming years ($p = .000$).

On the other hand, the multiple linear regression model of the good teaching practices of m-learning indicated an adequate adjustment and was significant ($R^2 = 0.186$; *F*-statistic = 25.491; p = .000). The significant independent variables for this model were category ($p = .022$), educational technology research ($p = .000$), teaching innovations ($p = .000$), appropriate ($p = .000$) and belief ($p = .000$) (Table 5).

Before the establishment of the SEM (Fig. 2), the hypothesis of multivariate normality was tested and met in this case (Mardia = 25.789). The value was less than 288 because of [p × (p + 2)], "p" being the number of variables (Bollen & Long, 1993). Table 6 shows the estimates of the structural equation model and the associations between the significant variables that predict good teaching practices of m-learning. In this regard, it should point out that the professional category relationship with GTP was positive and significant ($R = 0.052$, p = .05); the educational technology research relationship with GTP was negative and significant ($R = -0.322$; $p = ***$); the teaching innovations relationship with GTP was negative and significant ($R = -.112$; $p = ***$); the appropriate relationship with GTP was negative and significant ($R = -.102$; $p = ***$) and the belief relationship with GTP was negative and significant ($R = -.171$; $p = ***$). Nevertheless, significant correlations occurred only between teaching innovations and appropriate, which was positive ($R = .095$; $p = .002$), educational technology research and teaching innovations which was positive ($R = 0.146$; $p = ***$) and, belief and appropriate which was positive ($R = .143$; $p = ***$). No significant correlations were established between the remaining correlations.

Finally, the goodness-of-fit indexes of SEM were normal and confirmed the adequacy of data: Chi-square ($\chi^2 = 0.450$); degrees of freedom (df = 0.834); ratio χ^2/df = 0.539; Root Mean Squared Error of Approximation (RMSEA = 0.003); Goodness-of-Fit Index (GFI = 0.992); Normalised Fit Index (NFI = 0.998); Comparative Fit Index (CFI = 1); Adjusted Goodness-of-Fit Index (AGFI = 0.997); Standardized Root Mean Square Residual (SRMR = 0.0045). The coefficient of determination for Good Teaching Practices was 18% ($R^2 = 0.18$).

5. Discussion

The data showed the wide adoption of m-learning in Spanish universities, confirming the exponential growth that has taken place since 2009 (Brazuelo & Gallego, 2014). Over 70% of the study sample applied mobile devices in the classroom. It reaffirmed that the educational context where m-learning, not only, has been most developed, but also, it has been the higher education stage (Crompton & Burke, 2018). Thus, these data show that the academic use of the mobile devices is much higher than expected in Spanish higher

Table 3
Scores in each dimension.

Dimension	Items	Max-score	Min- score	Mean score	SD	Good practice cases	
						n	%
Mobile devices	3	3	12	9.72	1.70	868	77.15
Digital competence	2	2	8	6.07	1.46	782	69.51
Knowledge building	4	4	16	11.56	2.41	603	53.6
Cooperative work	3	3	12	8.89	2.04	691	61.42
Good use of technology	4	4	16	8.98	3.54	301	26.75
Global (sum of dimensions)	16	16	64	45.22	7.57	445	39.56

Note: SD = Standard deviation; $n = 1125$.

Table 4
Distribution of good teaching practices cases by socio-demographic factor.

Variables	n(%)	Non-GTP		GTP		*p*
		n	%	n	%	
Gender						
Male	434(38.6)	252	58.06	182	41.94	.196
Female	691(61.4)	428	61.94	263	38.06	
Age						
20–29	79(7)	44	55.7	35	44.3	.851
30–39	293(26)	182	62.12	111	37.88	
40–49	374(33.2)	228	60.96	146	39.04	
50–59	281(25)	163	58	118	42	
60 or more	98(8.7)	63	64.28	35	35.72	
Category						
Professor	28(2.5)	15	53.57	13	46.43	.358
Professor of University School	6(.5)	5	83.33	1	16.17	
Senior Lecturer	215(19.1)	135	62.79	80	37.21	
Senior Lecturer of University School	10(.9)	7	70	3	30	
Lecturer	211(18.8)	130	61.61	81	38.39	
Assistant Professor PhD	149(13.2)	91	61.07	58	38.93	
Assistant Professor	13(1.2)	7	53.85	6	46.15	
Interim Substitute Professor	64(5.7)	40	62.5	24	37.5	
Associate Lecturer	306(27.2)	176	57.52	130	42.48	
Adjunct Professor	21(1.9)	15	71.43	6	28.57	
Postdoctoral	6(.5)	3	50	3	50	
Pre-doctoral	63(5.6)	36	57.14	27	42.86	
Visiting Professor	5(.4)	2	40	3	60	
Collaborating Professor	26(2.3)	17	65.38	9	34.62	
Emeritus Professor	2(.2)	1	50	1	50	
Knowledge field						
Didactics of Body Expression	66(5.9)	45	68.18	21	31.82	.000
Didactics of Musical Expression	42(3.7)	24	57.14	18	42.86	
Didactics of Plastic Expression	41(3.6)	16	39.02	25	60.98	
Didactics of Language and Literature	110(9.8)	60	54.55	50	45.45	
Didactics of Experimental Sciences	86(7.6)	53	61.63	33	38.37	
Didactics of Social Sciences	72(6.4)	48	66.66	24	33.34	
Didactics of Mathematics	59(5.2)	45	76.27	14	23.73	
Didactics and School Organization	241(21.4)	120	49.79	121	50.21	
Physical and Sport Education	78(6.9)	48	61.54	30	38.46	
Research and Diagnostic Methods in Education	81(7.2)	45	55.55	36	44.45	
Evolutionary and Educational Psychology	153(13.6)	110	71.9	43	28.1	
Theory and History of Education	96(8.5)	66	68.75	30	31.25	
Teaching experience						
1–5	291(25.9)	184	63.23	107	36.77	.442
6–10	241(21.4)	145	60.16	96	39.84	
11–15	154(13.7)	92	59.74	62	40.26	
16–20	133(11.8)	77	57.89	56	42.11	
21–25	114(10.1)	64	56.14	50	43.86	
26 or more	192(17.1)	118	61.46	74	38.54	
Type of institution						
Public	917(81.5)	556	60.63	361	39.37	.787
Private	208(18.5)	124	59.62	84	40.38	
Educational technology research						
Yes	419(37.2)	172	41.05	247	58.95	.000
No	706(62.8)	508	71.95	198	28.05	
Other teaching innovations						
Yes	1063(94.5)	623	58.60	440	41.4	.000
No	62(5.5)	57	91.94	5	8.06	
Mobile devices are appropriate						
Yes	1052(93.5)	634	60.27	418	39.73	.643
No	73(6.5)	46	63.01	27	36.99	
M-learning expansion (belief)						
Yes	905(80.4)	520	57.46	385	42.54	.000
No	220(19.6)	160	72.73	60	27.27	

Note: GTP = Good Teaching Practices, $n = 1125$.

education. In fact, the use of technology in education has been quite well received by university professors attached to the Faculties of Education.

On the contrary, there are still teachers who do not apply mobile devices, pointing out that the main reasons which explains they did not use them, so were ignorance, belief that they are a distraction, resistance to change and perceived uselessness. In relation to

Table 5
Multiple linear regression analysis.

Independent variable	B	SE	T	β	*p*
Gender	.276	.427	.647	.018	.518
Age	-.326	.282	−1.158	-.046	.247
Category	.184	.080	2.294	.074*	.022
Knowledge field	-.089	.065	−1.377	-.038	.169
Teaching experience	.328	.177	1.851	.079	.064
Type of institution	1.002	.532	1.885	.051	.060
Educational technology research	−5.027	.431	−11.652	-.321***	.000
Teaching innovations	−3.637	.916	−3.968	-.110***	.000
Appropriate	−3.155	.847	−3.726	-.103***	.000
Belief	−3.187	.525	−6.069	-.167***	.000

Note: B = coefficient; SE = Standard error; T = coefficient based on the T of Student; β = standardized coefficient; *p < .05; **p < .01; ***p < .001.

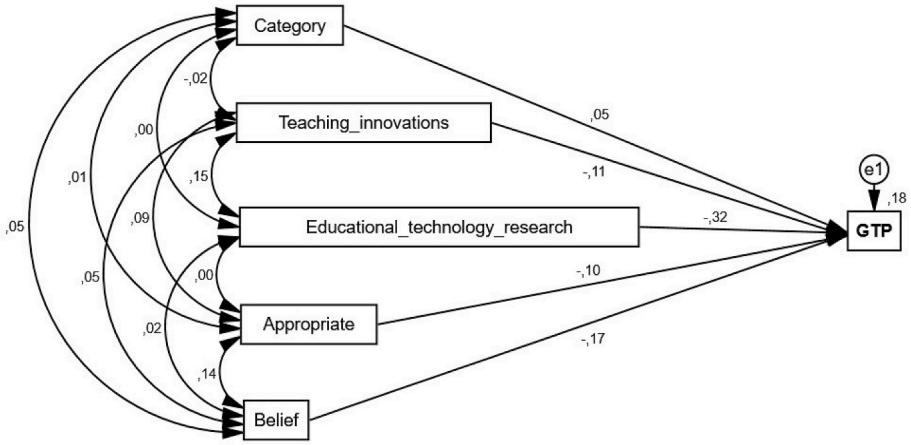

Fig. 2. Estimations of the structural equation model.

Table 6
Parameter estimates of final model.

Associations between Variables	Cov	SE	CR	*p*	*R*
GTP ← Category	.130	.068	1.96	.05	.052
GTP ← Educational technology research	−5.03	.428	−11.78	***	-.322
GTP ← Teaching innovations	−3.73	.910	−4.09	***	-.112
GTP ← Appropriate	−3.13	.842	−3.72	***	-.102
GTP ← Belief	−3.25	.522	−6.24	***	-.171
Teaching innovations ↔ Appropriate	.005	.002	3.15	.002	.095
Belief ↔ Teaching innovations	.004	.003	1.60	.109	.048
Educational technology research ↔ Teaching innovations	.016	.003	4.83	***	.146
Category ↔ Educational technology research	-.001	.044	-.030	.976	-.001
Category ↔ Appropriate	.006	.022	.276	.782	.008
Belief ↔ Appropriate	.014	.003	4.74	***	.143
Educational technology research ↔ Belief	.004	.006	.767	.443	.023
Category ↔ Belief	.065	.036	1.81	.070	.054
Category ↔ Teaching innovations	-.014	.021	-.671	.502	-.020
Educational technology research ↔ Appropriate	.000	.004	.047	.962	.001

Note: GTP = Good Teaching Practices; Cov = Covariance; SE = Standard error; CR = critical radio; ***$p < 0.001$; R = standardized coefficient.

ignorance, lack of training is the most important cause, where there is a deficit of training in technopedagogical issues among teachers (Boude & Sarmiento, 2017; Sánchez-Prieto et al., 2019). On the other hand, many teachers believe that mobile devices distract students from doing their homework in the classroom. So they don't think it's appropriate to implement them. Resistance to change is another reason, where the population over 40 years of age is the most likely not to want to change their teaching methodology. It is related to the reproduction of teaching models based on the master class, where the teacher is the main figure in the teaching-learning process. As Robles-Altamirano and Barreno-Salinas (2016) point out the need of a model that moves away from the educational premises of the twenty-first century about promoting active learning by students and the role of teachers as guides to learning. Finally,

the perceived uselessness is a consequence of the above causes, making m-learning an invalid method of learning in the opinion of these teachers. Thus, a positive perception of m-learning is key to its adoption (Al-Adwan et al., 2018; Chao, 2019).

More specifically, almost 40% of sample that carried out a good teaching practice, apply m-learning as a teaching methodology. This only goes to show that the m-learning experiences involved factors such as digital competence, the building of knowledge (González-Fernández & Salcices-Talledo, 2017; Khan et al., 2019, pp. 1–17; Zheng et al., 2016), cooperative work (Chang et al., 2017) and good use of technology (Aznar-Díaz et al., 2018b). The presence of these factors distinguished the normal application of mobile devices compared with good teaching practice. However, the lowest scores of the good use of technology were obtained in education, in relation to the other dimensions, in spite the fact that, they were widely represented in the average scores exceeding or approaching the appropriate values.

The presence of good teaching practices in the Spanish university system is a symptom of the appropriate application of mobile devices in the classroom (Alonso-García et al., 2019). From all this, it follows that it is good news to know that a large part of the population of university professors develops good teaching practice of m-learning, which can be as a reference for other teachers, who want to apply mobile devices in the classroom.

On the question of the sample, the best cases of good teaching practices were concentrated on men, obtaining data contrary to those that indicated, in previous studies, how being a woman increased the possibility of implementing mobile devices in the classroom (López & Silva, 2016). In addition, the preferred age for implementing was between 20 and 29 years, highlighting a young teaching profile. So, novice teachers opt to apply innovative methodologies in the classroom. The professional category of Visiting Professor was also an incentive for the development of good teaching practices. This category is defined by being an external professor of the institution who stays for a short period of time in which he or she is allowed to teach. However, other professional categories as a Professor, Predoctoral and Associate Professor show with a higher rate in the development of good teaching practices. Very different profiles indicate that professional experience influences in the development of good teaching practices (Professor profile); the fact of being a new teacher who has just started in the teaching field is also relevant (Predoctoral profile) and developing part of the teaching in Primary or Secondary school is too a very influential aspect (Associate Professor profile). By the same token, the teachers that belong to the Department of Didactics of Plastic Expression, and the teachers from the area of Didactics and School Organization, both had the highest rate of development of good teaching practices. This particular case of these two areas of knowledge could be interpreted as the type of profile of these teachers, joined to educational technology and often they require the application of technological resources in the classroom.

Teaching in private universities was shown as a higher rate than other teachers. Although, compared with the public university is only a difference of one percentage point. Therefore, it can be stated that belonging to a public or private university is not a decisive factor in the development of good teaching practice of m-learning. On the other hand, it determined to a greater extent that the teacher's line of research was educational technology. This shows how the view of teacher, who works in this line, is considered an expert in the field. A higher rate was also obtained in those who applied other teaching innovations, being a key factor, since they are teachers who experiment with active learning methodologies. The believes, firstly, in the suitability of mobile devices and, secondly, in the expansion of m-learning in the coming years, were also two important indicators in the development of good teaching practices. So, it was to highlight the relevance of show the positive perceptions towards m-learning.

On the other hand, although certain socio-demographic factors indicated the presence of good teaching practices, the more significant differences between the sample were in the area of knowledge, the line of research in educational technology, other teaching innovations and the belief in the expansion of m-learning in the coming years. Ultimately, then, belonging to a knowledge area determines the fact of developing good teaching practice of m-learning. This show that teachers in certain areas are more likely to make appropriate use of technological resources, which opens up an interesting line of research with regard to previous studies (Aliaño et al., 2019).

So, it would appear that the factors that could influence the good teaching practices of m-learning were the professional category, the line of research in educational technology, the fact of applying other teaching innovations, the believes in the suitability of mobile devices and the expansion of m-learning in the coming years. This showed the fact that perceived usefulness and the development of good teaching practices are one of the most effective factors for the acceptance of m-learning (Almaiah et al., 2019; Chao, 2019; Chavoshi & Hamidi, 2019; Gómez-Ramírez et al., 2019; Hamidi & Chavoshi, 2018; Hu et al., 2019; Nikolopoulou et al., 2020; Sultana, 2020). Added to this are research in educational technology and teaching innovation were considered essential aspects as stated in other studies (Barrett & Liu, 2019; Lamia et al., 2019; Xiao-Dong & Hong-Hui, 2020).

6. Conclusions

The analysed results showed important aspects of good teaching practice of m-learning at the higher education stage. It is being a context with full experimentation and expansion of m-learning (Alexander et al., 2019; Kaliisa et al., 2019).

The fact is that this paper is a pioneering study whose data advance the field of knowledge about m-learning. To give a graphic example, it can be seen the possible explanatory model generated on the good teaching practices of m-learning in the Spanish University by teachers of the Faculties of Education. This model shows the aspects that can influence the development of good teaching practices, establishing as a reference for detection of educational field. It should also be noted that a series of aims and interests to the scientific community have been established, where the degree of implementation of m-learning methodology and good teaching practices at the Spanish University has been determined. In this regard, the reasons for which, university professors do not integrate mobile devices into their teaching have become known. The variety of these data gives significant applicability in future studies on m-learning, both in the Spanish context and outside.

One of the issues of the study is the small size of the sample in some sectors of the population, where some of them are unbalanced in relation to others. However, it was decided to maintain these cases to ensure the representativeness of all sectors. A second disadvantaged was the limited socio-demographic factors. In future studies, it would be advisable to expand them in order to verify whether they influence the development of good teaching practices.

Finally, as future directions, it suggests that continue investigating good teaching practice of m-learning and to reverse the trend in research, which is based mostly on investigating teachers' and students' perceptions of m-learning and the factors for its adoption. So that it starts a more practical line of research related to the real application in the classroom, where for instance, models of experiences based on good teaching practices of m-learning are described and collected.

In the final analysis, this study tries to be the beginning so that, in future, further studies can be focused on good teaching practice of m-learning, mainly, because it is one of the first research to this issue, in an empirical and practical view, among a large population of university professors.

CRediT authorship contribution statement

Inmaculada Aznar-Díaz: Conceptualization, Methodology, Supervision. **Francisco-Javier Hinojo-Lucena:** Formal analysis, Investigation, Writing - original draft. **María-Pilar Cáceres-Reche:** Visualization, Investigation, Writing - review & editing. **José-María Romero-Rodríguez:** Software, Writing - review & editing, Funding acquisition.

Declaration of competing interest

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