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EVALUATION OF M-LEARNING AMONG STUDENTS ACCORDING TO THEIR BEHAVIOUR WITH APPS

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ABSTRACT

The present paper has the goal to provide some insights regarding the current use of mobile technologies for learning. This research was conducted at University of Salamanca and University of Aveiro and took into account the collaboration of 518 students from both universities.

The main results indicate that the students are very willing to use m-learning and there is a relationship between the use of mobile devices (frequency of use of Tablet) and the use of Apps with the global evaluation of m-learning by students. However, most part of students still reported an unawareness and a lack of necessity of these instruments, which brings into light that it is necessary to support and promote the use of these technologies with a curricular and educational purpose by institutions and universities.

Keywords: higher education, m-learning, mobile devices, m-health, students

INTRODUCTION

Mobile technologies using for learning have become an upward trend in our society. The rapid spread of accessing mobile devices among students has caused they have been used for many purposes. Overall, thanks to the emergence of Apps, which are software programms that could run on mobile devices as Smartphones or Tablets to provide them with additional

functionalities. One of the potential uses of these new technologies is using them as educational tools. There are some researches about this issue, but there is still a gap regarding the real impact and benefits that could improve in the students' learning. Also, there are some challenges and barriers that it is necessary to overcome, as for example technical problems (Alrasheedi et al., 2015; Green et al., 2015; Toktarova et al., 2015; Handal et al., 2013; Székely et al., 2013), the support of the Institution of University (Alrasheedi et al., 2015; Alden, 2013; Ashour et al., 2012; Park et al., 2012; Lea & Callaghan, 2011), the lack of skills to use them (Haffey et al., 2014; Ferreira et al., 2013; Ozdalga et al., 2012; Fadeyi et al., 2010), the need of a pedagogical goal of the Apps (Ferreira et al., 2013; Handal et al., 2013; Székely et al., 2013; Ashour et al., 2012; Davies et al., 2012) or even the need of regulation of Apps that may cause a lack of trust on the efectiveness of them as instructional instruments for learning (Martínez-Pérez et al., 2015; Haffey et al., 2014; Khatoon et al., 2013; Visvanathan et al., 2012).

On the other hand, the different benefits are been also reported by different authors (Toktarova et al., 2015; Archibald et al., 2014; Ling et al., 2014; Ventola, 2014; Al-fahad, 2009; Hussain & Adeeb, 2009) standing out among these advantages the ubicuity or possibility to use the mobile devices anywhere, the flexibility and the possibility to access information easily.

Therefore, the potentional uses of mobile devices and Apps are still under study. This paper tries to cover this gap in order to analyse more deeply the current different students' uses for learning and the role that these tools could have over them.

METHODS

Method

The method used for this research was a non-experimental descriptive-correlational transaccional investigation, using a mixed methodology (quantitative and qualitative) with a deductive reasoning. We will collect the information from different variables and then, they will be correlated taking into account the independent variables (predictors) and the dependent variables (criteria).

Variables

The variables used for this research are detailed in this section. The table 1 describes them differentiating between dependent and independent variables. The results section will provide information regarding the relation between both types of variables. In our case, we only have one dependent variable, called VGLOB and measures the level of acceptance of m-learning between students.

The predictor variables considered for this study will be the frequency of use of participants with Smartphone and Tablet, the type of device that participants use the most to download Apps, the Characteristics that participants consider more important to download Apps and finally the type of Apps that participants use more frequently.

Table 1. Summary of Variables used in the reseach

Type	ID	Description	Values
Independent Variable	$FREQ_{SMP}$	Indicates how many daily hours use the participants the Smartphone	<1 h/day
			From 1 to 2 h/day
			From 3 to 4 h/day
			>4 h/day
			No use
	$FREQ_{TAB}$	Indicates how many daily hours use the participants the Tablet	<1 h/day
			From 1 to 2 h/day
			From 3 to 4 h/day
			>4 h/day
			No use
	DEV	Indicates what is the device most used to download Apps	Smartphone
			Tablet
			Smartphone and Tablet
			None
	$N^{o}Apps_{SMP}$	Describes the number of Apps downloaded with Smartphone	From 1 to 10
			From 11 to 20
			From 21 to 30
			>30
			None
			N/A
	$N^{o}Apps_{TAB}$	Describes the number of Apps downloaded with Tablet	From 1 to 10
			From 11 to 20
			From 21 to 30
			>30
			None
			N/A
	$CHAR_{APPS}$	Reports the characteristics more important to download Apps. It could be	Security/Privacy
			Content
			Usability
			Accesibility
			Data Connexion
			Recommendation
			Developer Information
			None
	$TYPE_{Apps}$	Reports the type of Apps that the participants used more frequently. It could have the values	Entertainment
			News
			Social Networks
			Mail
			Games
			Medical Apps
			Educational Medical Apps
			Other
			None
Dependent Variable	VGLOB	Indicates the total evaluation of using m-learning among participants	Numerical

Participants

The number of participants of this study was 518. As it is shown on Table 2, 96,9% of participants owned a mobile device (Smartphone or Tablet). Besides, most part of participants were women, were studying medicine and were within the range from 18 to 25 years old. The most popular operating system was Android for both Smartphone and Tablet.

Table 2. Descriptive Statistics of Students' Profile

Variable	Basic Profile Characteristics		
	Description	Frequency	%
Grade	Medicine	222	26,9
	Nursing	105	18,2
	Biomedical Sciences	136	29,8
	Physioterapy	37	8,1
	Doctorate	5	1,1
	Psychology	13	2,8
Sex	Male	113	21,8
	Female	405	78,2
Age	From 18 to 25 years	487	94,0
	From 26 to 35 years	19	3,7
	From 36 to 45 years	9	1,7
	+ 55 years	3	0,6
Mobile Device	Only Smartphone	206	39,8
	Only Tablet	24	4,6
	Smartphone and Tablet	272	52,5
	None	16	3,1
Operating System Smartphone	iOS (iPhone)	93	18,0
	Android	365	70,5
	Windows8	15	2,9
	N/A	38	7,2
	Do not know	7	1,4
Operating System Tablet	iOS (iPad)	83	16,0
	Android	164	31,7
	Windows 8	37	7,1
	Otros	7	1,4
	N/A	223	43,1
	Do no t know	4	0,7

Instruments

The instrument used for this resarch was a survey of 53 questions distributed in two parts. The first one was formed by 19 items to collect information from participants' profile. The second one was formed by 34 items designed according to the model proposed by Venkatesh et al. (2003) to unify the different theories of behaviour use and the acceptance of technology.

In our survey we added as well two more constructs related with the reliability and the Recommendation of new technologies for m-learning.

The survey was distributed from May to June 2014 at University of Spain and October and December 2015 at University of Aveiro and University of Coimbra in Portugal.

All the data was computerized using SPSS program (V.21) in order to obtain the descriptive statistics and the main results of the study.

RESULTS

This research presents the results of the students' use of mobile devices and Apps and how their profile could influence in the final evaluation of m-learning.

Use of Mobile Devices

The data collected from participants gave us information regarding how students were using mobile devices and the frequency of daily use. We differentiated between the use with Smartphones and the use with Tablets. According to the results, there is around 48,3% of participants that use the Smartphone from 1 to 2 hours per day and the tablet is used by 32,6% of students.

The Figure 1 represents the box plot chart considering the frequency of use with Smartphone and the median of global evaluation of m-learning. As it is shown in it, it seems that the median of evaluation of m-learning is very similar among participants.

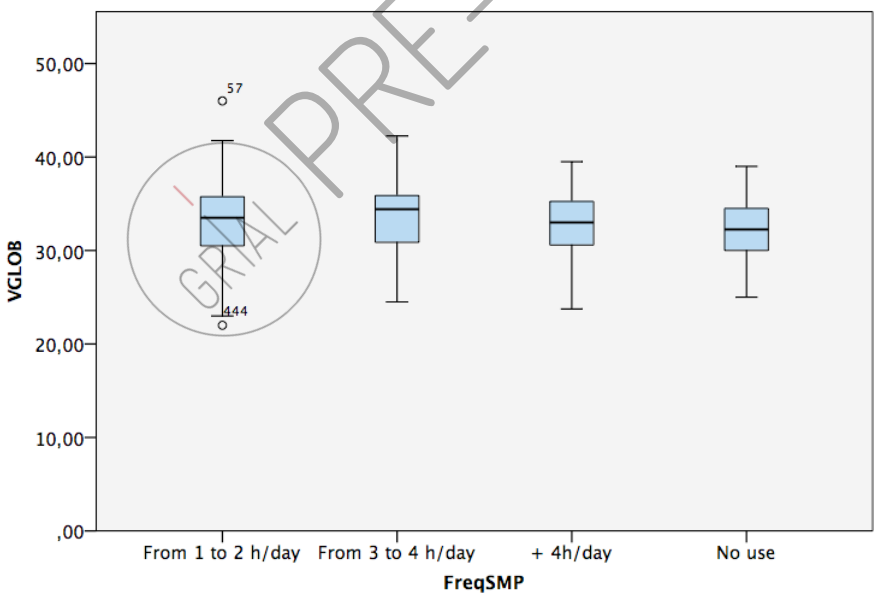

Figure 1. Global evaluation of M-learning taking into account the frequency use of Smartphone.

We want to estimate the degree and correlation of relationship of these variables ($Freq_{SMP}$ and the VGLOB). As we are comparing one nominal variable with a numerical variable, it is necessary to check if they fulfil the needed requirements to use parametric techniques (Field,

2000). We use Kolmogorov-Smirnov Test to check the normality condition and we obtain in all cases that ρ>0,05 so we can assume that the variables are normal. Besides, we perform as well the test of Levene to assess the homogeneity and we obtain as well that ρ>0,05. Therefore, we can use the parametric variance technique to contrast the variables. In this case, the null hypothesis is that there is no relationship between the frequency use of Smartphone and the global evaluation. The results (F=0,582 and ρ=0,676) reveal that at α=0,05, there is no evidence enough to fail to reject the null hypothesis that there is no relationship between both variables.

Then, we perform the same analysis with frequency of use of Tablet. The results are also showed in Figure 2.

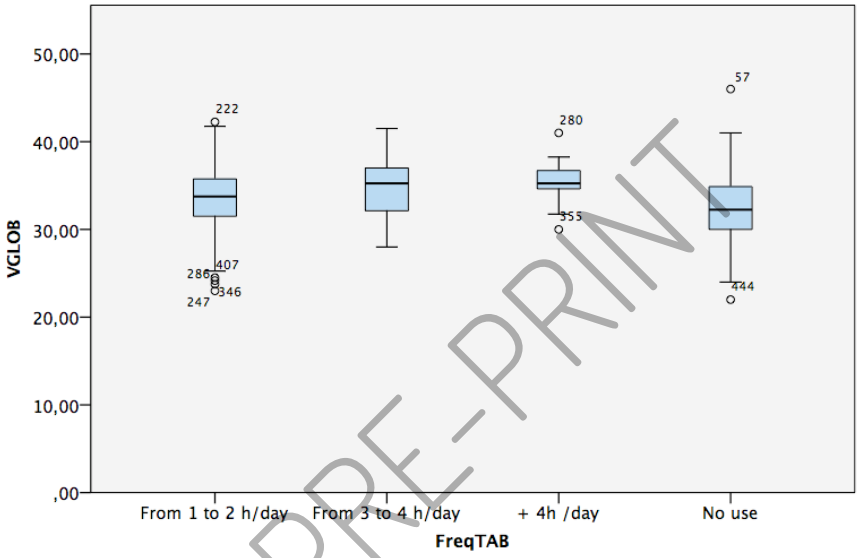

Figure 2. Global evaluation of M-learning taking into account the frequency use of Tablet.

We carried out again the same process, obtaining that they fulfiled the requirements to use parametric technique (the variables are normal and they are homogeneous). The null hypothesis wass that there is no relationship between the frequency of use with Tablets and the global evaluation of m-learning. In this case, according to the results (F=9,722 and ρ=0,000), we could suggest that at 0,05 level of significance there is evidence enough to reject the null hypothesis and consider there is a relationship between both variables.

Use of Apps

According to the results, students were mainly using the Smartphones to download Apps (77,8%) and 47,1% of them were using the Tablet. Besides, 55,6% of participants downloaded from 1 to 10 Apps last month with Smartphone and 37,8% with Tablets.

Then, we checked the normality requirement for all variables and we obtained that all of them could be considered as normal (ρ >0,05) and all fulfil the homogeneity test (ρ >0,05) so it is possible to use parametric techniques in all cases. The null hypothesis in all cases is that

there is no relationship between the predictor variable and the global evaluation of m-learning. The table 3 shows the output data obtained with the suitable technique applied. In all cases, we obtain that at 0,05 level of significance, there is enough evidence to reject the null hypothesis that consider both variables independents and we could suggest that among students, there is a relationship between the number of Apps downloaded with the Smartphone, with the Tablet, the type of device used and the global evaluation of m-learning.

Table 3. Results of contrasting test used between the use of Apps and global evaluation of m-learning

Predictor Variable	Dependent Variable	Technique	Result	
			F	ρ
$N^{o}App_{SMP}$	VGLOB	Analysis of Variance	4,285	0,000
$N^{o}App_{TAB}$	VGLOB	Analysis of Variance	6,398	0,000
DEV	VGLOB	Analysis of Variance	4,199	0,006

In addition, we also obtained information of the relevant characteristics that students took into account when they downloaded an App. In fact, according to the results, the ranking of the factors are shown in Figure 3.

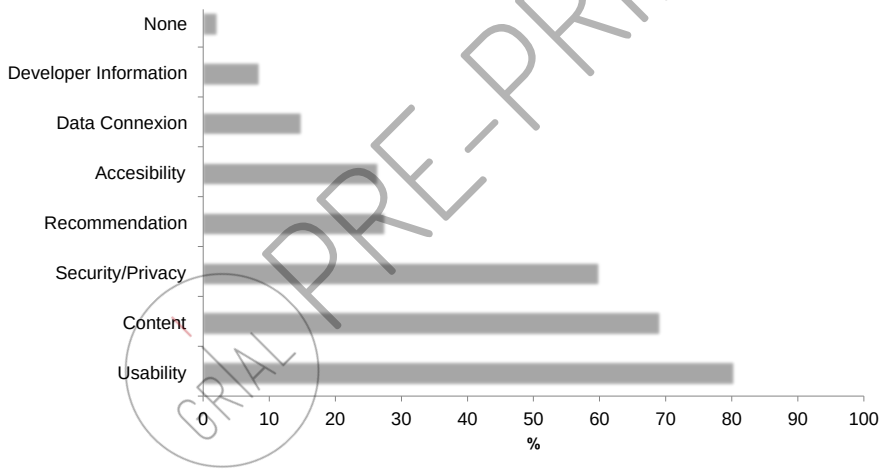

Figure 3. Ranking of relevant factors to download Apps.

We performed the same analysis as well, checking the normality and homogeneity test. In this case, the variable VGLOB did not fulfil the requirement of normality (ρ>0,05) with the independent variable $CHAR_{APPS}$ for Security/Privacy, Content and Usability.Therefore, it was necessary to use the non-parametric tecnique U-Mann Whitney. On the other hand, for the rest of values, the normality wass positive and the test of homogeneity showed that the variable $CHAR_{APPS}$ for accesibility (F=0,948, ρ=0,331), data connexion (F=0,938, ρ=0,333), Recommendation (F=2,498, ρ=0,115), developer information (F=0,022, ρ=0,883) and none of those characteristics (F=0,251, ρ=0,617) are all homogeneous so in all these cases, it was possible to use a parametric test (t Student). The Table 4 represents the outcome data obtained with the different techniques applied. The null hypothesis was that there is no relationship between the independent variable and the global evaluation of m-learning (VGLOB). The

results suggested that there is no evidence enough to reject the null hypothesis (ρ>0,05) for the participants that selected Accessibility, Recommendation and Developer information as relevant factors to download apps. On the contrary, according to the results and at 0,05 level of significance, there is evidence enough to reject the null hypothesis considering that participants who have selected Security/Privacy, Content, Usability, Data Connexion and none of them as relevant factors could give more scores to the evaluation of m-learning.

Table 4. Results of contrasting test used between the relevant factors to download Apps and global evaluation of m-learning

Independent Variable	Technique	Results	
		t/Z	ρ
$CHAR_{APPS\ security/privacy}$	U-Mann Whitney	-3,195	0,001
$CHAR_{APPS\ Content}$	U-Mann Whitney	-2,279	0,023
$CHAR_{APPS\ Usability}$	U-Mann Whitney	-2,443	0,015
$CHAR_{APPS\ Accessibility}$	t Student	-0,352	0,725
$CHAR_{APPS\ Data\ Connexion}$	t Student	-3,999	0,000
$CHAR_{APPS\ Recommendation}$	t Student	0,305	0,760
$CHAR_{APPS\ developer\ Information}$	t Student	-0,203	0,839
$CHAR_{APPS\ None}$	t Student	3,338	0,011

Finally, we analysed the type of Apps that the participants used the most. Figure 4 shows that Apps of Social Networks and Entertainment are the ones most used. In this case, the educational Apps were only used by 20,1% of participants. This type of apps was considered as the most interesting to contrast with the global evaluation of m-learning. Therefore, we applied again the parametric technique t Student (we checked previously normality and homogeneity test) and according to the results (t=-3,696, ρ=0,000), we can suggest that there is enough evidence to reject the null hypothesis and accept the alternative one that indicates that there is a relationship between the participants who have used educational Apps and the global evaluation of m-learning.

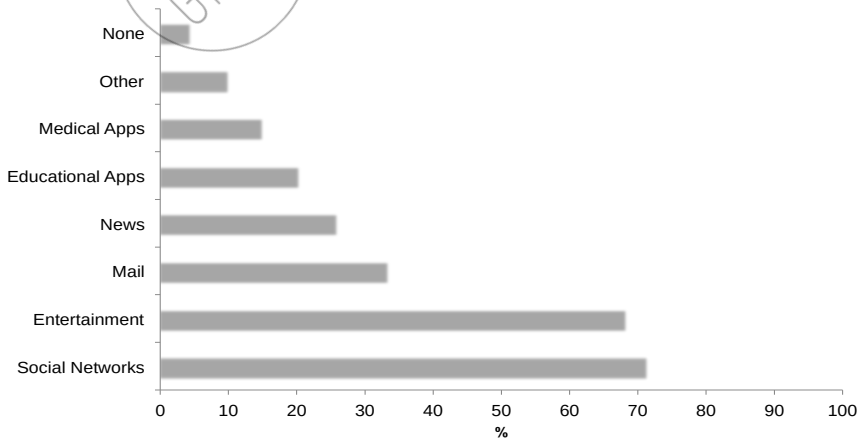

Figure 4. Type of Apps that participants used the most.

Challenges

Other important information obtained within this research was the students' reasons of no using educational Apps. This data could be very valuable in order to analyse the main barriers and challenges that the institutions or organizations should get over in order to adopt m-learning as a new curricular technique.

The results indicate that no necessity and unawareness as the main factors for not using them, so it is important to establish a pedagogical goal of this type of Apps in order that participants will find them useful and promote their use and their access in order to make them more popular.

Table 5. Students' reasons for no using educational Apps

Reason	Frec	%	Reason	Frec	%
No necessity	73	17,9%	No access	5	1,2%
Unawareness	38	9,2%	Utility	4	0,9%
Not enough quality	20	4,8%	No technical skills	4	0,9%
Better Books or computer	22	5,3%	No interest	3	0,7%
N/A	11	2,6%	Storage of device	2	0,5%
No trust	8	1,9%	Few apps	1	0,2%
Price	6	1,4%	No time	1	0,2%

DISCUSSION AND CONCLUSION

The results of this research provide some insights about the use of Apps in Higher Education and the most important factors that could drive to give more evaluation of using m-learning. We used a cohort of Spanish and Portuguese students and the results indicate that 96,9% of participants owned a mobile device (Smartphone or Tablet), which is also confirmed by other researchs to highlight the rapid expand of these devices among students (Chen et al., 2015; Briz-Ponce et al., 2014a, 2014c).

Besides, we obtain that there is a relationship between the frequency of use of Tablet and the global evaluation of M-learning by students. Also, there is a relationship between participants that have downloaded more apps during the last month and the assesment of m-learning. Regarding the use of Apps, we obtained that participants who have selected Security/Privacy, Content, Usability, Data Connexion and none of them as relevant factors could give more scores to the evaluation of m-learning. Finally, participants who have used educational Apps scored m-learning higher than the ones who have not used them.

These results may contribute to define new behaviour patters to use mobile technologies as the one performed with women in Education (Briz-Ponce, Juanes-Méndez, & García-Peñalvo, 2016) and allow focus on the main challenges to adopt these new type of technologies: No necessity and unawareness. Other researches analyse also the advantages or disadvantages of using these new technologies (Briz-Ponce et al., 2014c; Chu et al., 2012) or even the potential instructional uses of these tools for learning (Briz-Ponce, Juanes-Méndez, García-Peñalvo, et al., 2016; Briz-Ponce & García-Peñalvo, 2015; Briz-Ponce & Juanes-

Méndez, 2015) bringing to light that it is necessary to deal with different barriers and claiming that the leadership of Universities and Organizations must support them and provide an awareness-raising campaign about the use of educational Apps. This challenge will allow a special continuos education and promote life long learning, which is one of the purposes of the organizations. There are some guides that could be useful for them in order to adopt these changes and modify the behaviour in their Institutions (Michie et al., 2014).

Finally, the promotion and incentivation of individuals, self regulation and their soft skills may contribute to enhance the usage of mobile devices and Apps and capacitate individuals to be prepared for the new digital world.

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