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Gamification in Higher Education Instructors from Ecuador, Spain and Mexico

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Abstract— This research is oriented to the study of university teachers as a fundamental part of the teaching-learning process. To this end, an exploratory study is carried out in the Ecuadorian, Spanish and Mexican context through a sample of 260 teachers from both public and private universities of Social Sciences and Humanities with the objective of identifying the level of knowledge of teachers about gamification, subdividing the analysis into two macro-dimensions: generalities and pragmatic application. The results show that teachers in higher education institutions have more pragmatic than conceptual knowledge about gamification. Similarly, it was shown that teachers in public universities have more instruction about gamification than those in private universities.

Keywords— videogames, university teaching, public universities, teacher training, gamification, engineering

I. INTRODUCTION

The video game industry has developed exponentially over the decade. In 2010 in America alone, total consumer spending on the games industry amounted to \$25.1 billion [1] surpassing revenues from other entertainment industries such as music and film. Also, the amount of time that young people specifically consume is approximately 6 to 10 hours per day of content [2]. Hence, the possibilities for incorporation in the educational field are even more feasible.

Based on this trend, the popularity of serious games and gamification quickly rose, the latter's popularity is evident from 2014 as an emerging technology [3], likewise, the EU research fund, Horizon 2020 with a budget of approximately 80 billion euros available from 2014-2020, presented the funding call called 'Advanced gaming technology / digital gamification', in which innovation projects have been issued on this field of study [4].

Therefore, gamification has been carried out from an international context, addressing it as the use of game design elements in non-ludic contexts to motivate and increase user activity, retention and interaction [5]. In the educational context, gamification has been based on extracting the mechanics and dynamics of games that facilitate the promotion of fun in order to adapt them to the teaching process [6]. In fact, the benefits of their application have focused on motivation [7] and participation [8] and on all those variables that make up what are known as 21st century skills or transformative skills [9].

II. GAMIFICATION IN HIGHER EDUCATION

Considering the different educational settings, higher education students as the objective audience in which a greater variety of game-based models have been applied followed by non-specific educational contexts, tutorials and training, language learning and primary education [10]. The main

reason for this argument is modality, meaning that in understanding teaching through online and blended modes there is some proclivity to use gamification [11].

Gamification has been a complex task at the level of higher education. Actually, the increasingly interdisciplinary and multidisciplinary academic programs of universities, accompanied by international mobility programs cause specific learning situations, which can be managed more effectively in terms of gamification [12]. Despite such situation, gamification in university classrooms can be more productive than in other fields [13]. The university and institutions of higher education put pressure on students through tests, exams, readings and other evaluation resources by decreasing motivation. Therefore, enhancing the experience through game elements allows for a closer reflection of the benefits of learning, encouraging teaching within an ecosystem that is conducive to all types of students, not just the self-motivated achiever [14].

From a teaching perspective, gamification optimizes the way students and teachers stay connected to each other [15]. This interconnection is generated by balancing extrinsic motivation with the development of intrinsic motivation in order to promote real education. Feedback agendas and reflective practice have a transformative impact on teaching practices and curriculum development; that change is an inevitable consequence of student feedback, because teachers learn something new or unknown that challenges previous practices and is useful in engaging students [16]. In the end, the teacher's role is key to demonstrating that gamification is a tool and that its instruction cannot be reduced to the classification and use of games, but rather to the use of playful elements in both the explanation of subjects and their evaluation.

III. GAMIFICATION IN HIGHER EDUCATION FROM IBEROAMERICA

Reviewing the experiences of gamification in Ibero-America according to the international databases, Web of Science and Scopus until 2017, using 'Name of the Ibero-American country', the Boolean operator 'AND' accompanied by 'Gamification', Spain is in first place with 25 publications, on which its application in environmental benefits by reducing energy consumption [17] and development and improvement of attitudes in the classroom [18], among others. For their part, the experiences in Mexico are precisely dedicated to learning, especially oriented to mathematics [19], algebra [20] and physics [21]. Finally, Ecuador contains only one research [22] analyzing gamification as a tool for carrying out autonomous tasks at the Central University of Ecuador.

TABLE I. Iberoamerican experiences of gamification

Country	Number of manuscripts related to gamification experiences
Spain	25
Brazil	13
Mexico	8
Colombia	4
Portugal	4
Ecuador	1

With regard to the evidence, this study seeks to explore the level of knowledge of gamification in university teachers in Ecuador, thus determining as a starting hypothesis whether teacher training on this topic may have influenced the scarcity of gamified experiences.

IV. METHODOLOGY

The research aims to explore the level of theoretical and practical knowledge of university teachers in Ecuador, Spain and Mexico, as well as the differentiation between public and private universities. The dimension directed to the theoretical knowledge tries to recognize the generalities of gamification, including its concept, elements of game, aspects to gamify an activity, distinction between educational games and serious games, related psychological aspects and types of performance of the teaching staff. On the other hand, the practical dimension is oriented to the pragmatic application of gamification, which seeks to measure the teaching experience with respect to the use of gamification in the classroom, evaluating the way of designing a narrative to work on the curricular contents, the way of reformulating the learning objectives, using a point system, creating a list of adequate rewards assigning them an appropriate value in the point system, managing a ranking based on the work and behaviour of the students, designing a list of achievements, optimising the classroom administration.

In sum, the starting hypothesis [H0] "university teachers affiliated with Ecuadorian, Mexican and Spanish universities have knowledge of gamification". Checking in turn the following: H1] university professors affiliated with Ecuadorian, Mexican and Spanish universities have knowledge of gamification at the conceptual level. H2] university professors affiliated with Ecuadorian, Mexican and Spanish universities have knowledge of gamification at a pragmatic level. Finally, the third hypothesis [H3] is that teachers belonging to public higher education institutions have greater knowledge than private ones.

For this purpose, a closed questionnaire was conducted in line with a Likert scale [23] from 1 to 5 where 1 means nothing, 2 little, 3 medium, 4 quite and 5 a lot. The questionnaire was composed of 4 introductory questions and 15 questions on the subject, the latter being divided into 5 questions oriented towards the theoretical dimension and 10 oriented towards the practical dimension.

The content of the survey was validated by 10 PhDs of education and psychology, who evaluated the formal and functional aspects by means of a questionnaire with a Likert scale from 0 to 4, calculating the content validity in terms of the experts' opinion on the questionnaire for the subsequent application of the survey. The percentage of agreement among judges is therefore 56%, indicating a low inter-judge agreement for this item. Therefore, on content validity, it can be concluded from this data that all judges think that:

"The enunciation of the questions is clear"

"The vocabulary used is suitable for the recipients"

"The issues are stated in a way that is understandable to the recipients"

"There is a coherent progression"

"They are significant and demand relevant information."

Under this circumstance, the survey was applied to 260 teachers from Ecuador, Spain and Mexico from public and private universities of Social Sciences and Humanities for a period of 3 months.

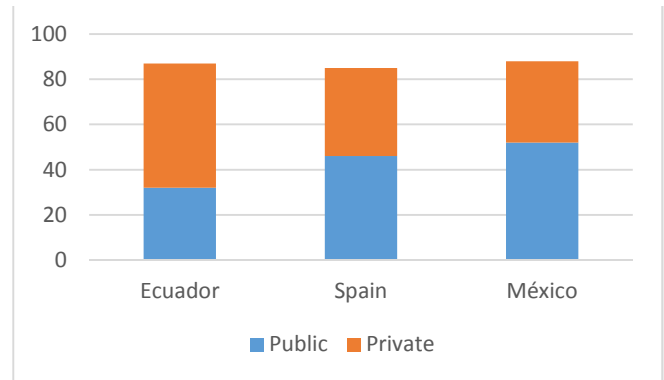


Fig. 1. Data from the selected sample according to countries and type of institution

Specifically, 87 teachers from Ecuador, 32 from public universities, including the University of Cuenca, the University of Guayaquil and the Central University of Ecuador, the Technical University of Machala and 55 teachers from private universities: the Salesian Polytechnic University, the Andean University Simon Bolivar, the Technical University of Loja, the University of Azuay, the University of the Hemispheres and the University of Espiritu Santo. In Spain, the total sample corresponds to 85 university professors, 46 from public universities, highlighting the University of Santiago de Compostela, University of Huelva, University of Seville, University of Malaga, University of Cantabria and University of Valladolid, while the remaining 39 are affiliated with the following private universities: International University of La Rioja, University Nebrija, University Isabel I and European University of Madrid. For its part, Mexico contributes a total sample of 88 professors, 52 of whom belong to private institutions, including the Instituto Tecnológico de Monterrey, Universidad del Valle de México and Universidad Intercontinental, while 36 belong to the following public institutions: Universidad de Guadalajara, Universidad Nacional Autónoma de México and Universidad Autónoma de Chihuahua.

Thus, we proceeded to check the assumptions of the data collected in the distribution through the Student's t-test, the reliability with Cronbach's Alpha and the validity of the internal structure through the exploratory factor analysis in order to know the trend of the collected data.

V. RESULTS

The hypotheses of the study would be Hypothesis 0 (null): university professors affiliated to Ecuadorian, Mexican and Spanish universities have knowledge about gamification. H1: university professors affiliated with Ecuadorian, Mexican and Spanish universities have knowledge of gamification at a conceptual level. H2: university professors affiliated with

Ecuadorian, Mexican and Spanish universities have knowledge of gamification at a pragmatic level.

With respect to the null hypothesis [H0], the contrast of hypotheses of a mean offers a statistical significance (p-value), which being less than .05 indicates that H0 is rejected, and therefore, H1 is maintained. But in order to make this contrast with a Student's t-test, which is a more powerful analysis than non-parametric ones, the assumption of Normality must be fulfilled.

TABLE II. Test for a sample

	Test value = 3					
	t	Gl	Sig.	mean difference	95% Confidence interval for the difference	
					Lower	Upper
Total	7.739	260	.00	.51494	.3817	.6482

The p value is less than .05 ($p < .05$), so the H0 is rejected, which indicated that the mean is less than or equal to 3. In other words, the H1 can be maintained, indicating that the mean is greater than 3.

The results suggest that teachers, in general, regardless of whether they belong to public or private universities, have knowledge about gamification. The data obtained for H1: Teachers have knowledge at a conceptual level about gamification and for H2: Teachers have knowledge at a pragmatic level about gamification, the following is evident:

TABLE III. Descriptive of H1 and H2

CON CT	Stats		
	Average		
Confidence interval for the mean at 95%	Lower limit	3.5034	
		3.3212	
Upper limit	3.6857	Asymmetry	
		-1.127	
Kurtosis	1.127	Average	
		3.5207	
Confidence interval for the mean at 95%	Lower limit	3.3574	
		3.6839	
Upper limit	3.6839	Asymmetry	
		-.952	
Kurtosis	.989	Average	
		3.5207	

Taking into account the values of asymmetry and kurtosis, we see that in pragmatism the values do not reach 1 or -1, so we can say that the distribution is approximately normal. As for the conceptual dimension, the kurtosis exceeds the value 1. However, the values that are usually used for limits are -3 and +3. From these values, the distribution is considered not normal. In addition, in table 3, we see that statistically the distribution of this Normal dimension can be considered ($p > .05$). In the contrasts of the assumptions what we are looking for is that the H0 is maintained, so we want the significance to be higher than the value $p = .05$.

TABLE IV. Student's t-test.

	Test value = 3					
	T	Gl	Sig.	Average diff.	Confidence interval for the mean at 95%	
					Lower	Upper
CONCT	5.53	260	.00	.50345	.321	.685
PRAGM	6.38	260	.00	.52069	.357	.683

The Student's t-test for a mean rejects in both hypotheses that the H0 of means equal to or less than 3 is rejected, so the alternative hypothesis is maintained, establishing that the means are greater than 3 for both the conceptual and pragmatic dimensions. Therefore, teachers have knowledge at both the conceptual and pragmatic levels.

In regard to the segmentation by country, although the data extracted show that higher education teachers in Ecuador, Spain, and Mexico have knowledge at the conceptual and pragmatic levels. It can be seen that 67% of teachers have knowledge at the conceptual level. In detail, 52% of Ecuadorian teachers, 87% of Spanish teachers, and 64% of Mexican teachers theoretically recognize the gamification process. While 85% of the teachers interviewed admit having used it in the classroom. Precisely, 87% of teachers in Ecuador, 78% in Spain, and 89% in Mexico have applied gamification in class.

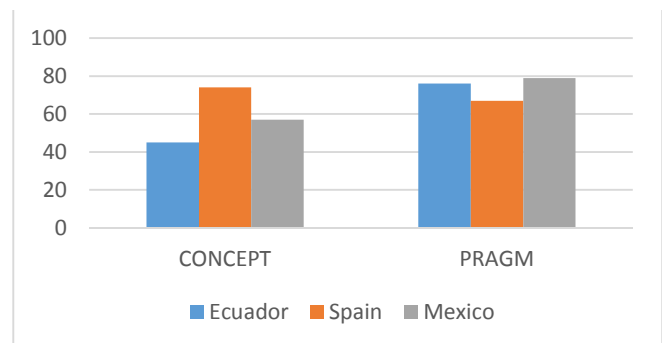


Fig 2. Sample data according to level of conceptual and pragmatic knowledge in gamification

Further detailing the level of knowledge of higher education teachers in Ecuador, the third assumption [H3]: public institutions are more knowledgeable than private ones, can be corroborated as follows:

TABLE V. Testing of independent samples

		Levene test for equal variance		T-test for equality of means		
		F	Sig.	t	gl	Sig.
TOTAL	Equal variances	3.77	.058	2.30	51	.025

According to Table 5, there is equality of variances, the assumption of homocedasticity is maintained ($p = 0.58$). As for the contrast of hypotheses, it appears statistically significant ($p = .025/2 = .0125$, it is divided by two because our hypothesis is unilateral). This indicates that there are differences in the level of knowledge of gamification depending on whether the institution is public or private.

TABLE VI. Group Statistics

	Institution	N	Average	St. Dev.	St. Error
TOTAL	Public	130	3.67	.38594	.07569
	Private	130	3.36	.57416	.11050

In fact, according to the averages of each group (Table 6), teachers in public higher education institutions maintain

greater knowledge about gamification than those in private institutions.

VI. CONCLUSIONS

In short, the research carried out shows that the initial hypothesis is rejected, giving rise to the confirmation of [H1] and [H2]. In a peculiar way, the results show that teachers apply gamification without framing it within a theoretical definition.

Specifically, in the conceptual dimension, 65% of those surveyed know the definition of gamification and 62% identify the different elements that make up a game. In contrast, only 43% recognize the existence of basic psychological aspects (emotional, cognitive and behavioral) related to gamification.

In turn, the trend within the pragmatic dimension of gamification is evident in 69% towards recognition of the types of actions of teachers to manage the classroom. Under the same percentage, teachers admit that they know how to create a list of rewards appropriate to the university context and assign them an appropriate value based on a point system. On the other hand, at the other end of the scale, only 50% agree on how to manage a ranking based on student behaviour.

In correspondence to the [H3] public institutions, that is, in Ecuador the University of Cuenca, University of Guayaquil and Central University of Ecuador, Technical University of Machala, while in Spain the University of Santiago de Compostela, University of Huelva, University of Seville, University of Malaga, University of Cantabria and University of Valladolid and finally in Mexico the University of Guadalajara, National Autonomous University of Mexico and University of Guadalajara, National Autonomous University of Mexico and Autonomous University of Chihuahua. have more knowledge regarding gamification than teachers affiliated with private universities, which in this case were analyzed those coming from the Salesian Polytechnic University, Simón Bolívar Andean University, Technical University of Loja, University of Azuay, University of the Hemispheres and University Espíritu Santo, International University of La Rioja, Nebrija University, Isabel I University and European University of Madrid, Technological Institute of Monterrey, University of Valle de México and Intercontinental University.

Regardless of the reasons that affect this lack of knowledge about this technique in private universities, among which is the presumed understanding of the concept of gamification, confusion with other terminologies such as game based-learning and serious games, lack of dissemination and incorporation in university classrooms, the theorization of gamification should be encouraged, preparing teachers on its proper use in the subjects and their teaching units, proposing courses where they know new mechanics of game elements thus seeking to promote alternatives that motivate the participation and interest of students. In future researches, the sample should be increased and other variables such as gender, age, knowledge area, among others, should be developed in detail.

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