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ICT MEDIATED GAMIFICATION IN EDUCATION DEGREES: A COMMITMENT TO SUSTAINABILITY

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Abstract

This research explores the perception of university students of Degrees in Education towards gamification mediated by Information and Communication Technologies (ICT) as an innovative teaching strategy, aligned with the principles of educational quality of the UN Agenda 2030. A quantitative, descriptive, cross-sectional and inferential research has been carried out, based on the survey technique. Research sample includes first year students of Degree in Early Childhood, Primary and Social Education, enrolled at the University of Jaen during the 2022-23 academic year (n=521). A questionnaire was used as an instrument for data collection. Data analysis was carried out using the SPSS software package: descriptive analysis, comparison of means and regression analysis. Results reflect a positive receptiveness on the part of the students towards ICT-supported gamification, considering it fun and dynamic. This strategy is widely known by students, which favors its implementation in the university environment. Specifically, quiz games and classroom management games stand out as the best-known ICT-supported gamification strategies. However, students of the Primary Education Degree show greater knowledge about gamification tools; students who plan to use gamification in their future professional practice have more favorable perceptions towards this didactic strategy. Gamification is considered an active and innovative methodology being a key element for quality improvement in Higher Education.

Keywords – Active methodology, Educator, Gamification, Higher education, Sustainability.

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1. Introduction

In recent years, a process of pedagogical renewal has been promoted in the university context that involves the implementation of various active methodologies that lead to improved student learning. This is due, among other social casuistry, to the necessary achievement of the Sustainable Development Goals set by the 2030 Agenda promoted by the United Nations in 2015; especially Goal 4 which aims to "ensure inclusive, equitable and quality education and promote lifelong learning opportunities for all".

Authors such as Albareda-Tiana, García-González, Jiménez-Fontana and Solís-Espallargas (2019), Danaher, Wu and Hewson (2021) and Yllana-Prieto, Jeong and González-Gómez (2021) stress the need to implement a process of socially active methodological and curricular sustainability, including contents and methodologies that facilitate the establishment of relationships between environmental, social and economic aspects and their impact on the practical reality of educational institutions (Tejedor, Segalàs, Barrón, Fernández-Morilla, Fuertes, Ruiz-Morales et al., 2019; Triviño, Chaves & Alejo, 2021). Iglemo and Quiroga (2018) or Mayorga, Madrid and de la Rosa (2021) consider that the best way to implement the ecological literacy process is through the development of methodological strategies that are active, participatory and with social impact.

Among the various active methodologies promoted to achieve quality education for all is gamification, as it facilitates the design of a personalised teaching and learning process, as well as ensuring that students have autonomy and self-regulate their learning (Tomas, Evans, Doyle & Skamp, 2019; Yllana-Prieto et al., 2021). This way of carrying out the didactic act is also a way of achieving the sustainability of the educational curriculum in university degrees (Martínez-Valdivia, Pegalajar-Palomino & Burgos-Garcia, 2023), thereby helping to achieve the goals set out in the 2030 Agenda. Therefore, gamification has become an innovative teaching strategy in university education, which involves the use of game dynamics or mechanisms in non-game contexts (Alsawaier, 2018; Valencia & Orellana, 2019; Werbach & Hunter, 2014), with the aim of involving students in complex processes and favouring a positive predisposition towards learning (Villalustre & del Moral, 2015). According to Cornellà, Estebanell and Brusi (2020), gamification is based on using game elements to design learning experiences that are more attractive and motivating for students, while Game-Based Learning consists of using the game to learn through them, so that the game becomes a vehicle for learning or for working on a specific concept.

Thus, gamification makes possible a series of benefits for the teaching-learning process of the university student, among which the following stand out: it allows the student to be the protagonist and builder of their own learning; it favours comprehensive learning in the student, while increasing their motivation to study, resulting in improved academic performance; develops a high level of interest in gamified subjects and, as a result, shows greater persistence and effort in completing tasks, as well as promoting group cohesion and collaborative work among peers (Alsawaier, 2018; Madagán-Díaz & Rivas-García, 2022; Moreno-Fuentes, 2019; Pérez & Gertrudix, 2021; Romorosa, Dahe, Colanggo, Resabal, Anlicao, Boquia et al., 2023). Other authors such as Igelmo and Quiroga (2018) and Mayorga et al. (2021) highlight that gamification also leads to achieving ecological literacy or, in other words, to the promotion of education towards Sustainable Development, which is so necessary nowadays, as it involves developing the student's commitment to the transformation of society (Martínez-Valdivia et al., 2023). Finally, Pacheco and Causado (2018) affirm how student learning from a gamified subject involves technological literacy, focused on the handling of the computer, applications or software and, in turn, can develop a multitasking mentality that involves the development of reading on one or more screens as well as stopping at certain relevant details in the operation of the game.

However, the implementation of this innovative teaching strategy suffers from some limitations and it is essential to take them into account in order to solve them in time and make the application of this methodology in the university classroom more effective, such as (Valencia-Quecano & Orellana-Viñambres, 2019): on a technological level, there may be technical errors, related to the infrastructure required for its implementation; from a pedagogical perspective, related to the lack of teacher training in the use of educational technology, as well as the necessary rigour in the design of the teaching-learning process; as for the student, they may have certain reticence regarding the use of technology, collaborative work or having had previous experiences that are not favourable for their learning; finally, there are limitations related to the inadequate design of gamified strategy.

1.1. Gamification and Information and Communication Technologies

Gamification supported by the use of Information and Communication Technologies (ICT) is characterised by unifying the use of educational technologies towards more active, cooperative and

interactive learning (Silva, Rodrigues & Leal, 2020). Moreover, it facilitates the didactic experience, allowing students to achieve a high level of awareness of their learning (Gay & Burbridge, 2016; Howel, Tseng & Colorado, 2017; Medvedovska, Skarlupina & Turchyna, 2016) and the development of academic, cognitive and social skills and competences (Manzano-León, Camacho-Lazarraga, Guerrero, Guerrero-Puerta, Aguilar-Parra, Trigueros et al., 2021). This teaching methodology, in addition to promoting student motivation, is a way for the teacher to innovate in the classroom, facilitating the design of fun, creative and strategic activities with the aim of improving the student's predisposition towards the subject and the study of it (Cornellà et al., 2020).

There are different ICT tools that enable the implementation of learning strategies based on gamification in the university classroom, allowing the development of:

- Question and answer games, through applications such as Kahoot!, Socrative, Trivial, etc., make it possible to formulate questions of different types (test, short, true or false, etc.) and can be carried out in groups or individually.
- Content management activities, using applications such as Storify, Educations, Symbaloo, etc., which facilitate research, organisation and selection of information related to the topic of study.
- Memorisation games and digital flashcards, through tools such as Quizlet, Brainscape, etc., which help to learn key vocabulary and concepts.
- Creation of interactive videos, using tools such as EdPuzzle, MovieMaker, Plotagon, etc...
- Adventure and escape games, using applications such as Breackout Edu, Genially, EduScaperoom, etc., in which participants must overcome challenges or solve tests in a given time and space.
- Virtual simulation and role-playing games, through serious games and video games, allow the interpretation and representation of a real situation similar to the one you will encounter in your future professional career.
- Cooperative work projects, based on tools such as Google Sites, Wikidot, Wikia, etc., which help students to work in groups, regardless of the spatial-temporal variables in which the teaching-learning process takes place.
- Classroom management activities, using tools such as Edmodo, Google Classroom, Classdojo, etc., which make it possible to create online learning communities with which to share information.

The new communication tools and learning environments based on web 2.0 technology represent a real potential towards the development of a new learning process, being a focus of interest towards Education for Sustainable Development (Boulahrouz, Lahmidi, Medir & Calabuig i Serra, 2019). Education, from this perspective, must respond to social demands in order to train students in a comprehensive manner and establish relationships between classroom teaching and the society in which it is developed (Boni & Calabuig, 2017).

In this sense, it is of interest to analyze the impact of ICT-mediated gamification in the initial training of educators, in the context of a Higher Education that is sensitive to the provisions of the 2030 Agenda. However, as Pegalajar-Palomino (2021) states, the development of methodologies based on gamification must be transversal to the didactic process proposed by university lecturers, which requires an initial analysis that examines the starting point of the educational agents involved. Therefore, this paper aims to answer the following research question: What is the initial assessment made by the university student of Education towards the use of learning strategies based on gamification mediated by ICT?

The literature review reveals the proliferation of research in Spain on gamification linked to the areas of Engineering and Architecture, compared to others such as Communication and Education (Peñalva, Aguaded & Torres-Toukoumidis, 2019). In addition, the works of Gallegos, Tesar, Connor and Martz (2017), Hussaini, Ibrahim, Wali, Libata and Musa (2020), Moya and Soler (2018), Perera and Hervás (2019)

or Syakur (2020) stand out, who analyze the design of gamified products and their application, as well as the impact of their implementation in different academic disciplines. In contrast, other research studies the perceptions of students who interact with gamification tools (Aldemir, Celik & Kaplan, 2018) and their level of knowledge regarding the pedagogical use of gamified strategies in the classroom (Adukaite, Van Zyl, Er & Cantoni, 2017; Pérez-López, Rivera-García & Trigueros-Cervantes, 2017).

2. Methodology

This research analyzes the perception of university students of Education Degrees towards gamification mediated by Information and Communication Technologies, for a quality initial teacher training based on the sustainability goals of the 2030 Agenda.

In order to meet this aim, the following specific objectives are proposed:

- To examine the university education student's assessment of ICT-supported gamification as an innovative teaching strategy.
- To analyse the future educator's perception of the limitations of ICT-supported gamification in the teaching-learning process.
- To find out the level of knowledge and use of ICT-supported gamification tools by students of the University of Jaén Degrees in Education.
- To analyse the existence of statistically significant differences in the perceptions of university students of Education on the use of gamified learning strategies supported by ICT according to certain variables (Degree and expectations for applying this strategy in their future professional practice).
- To identify the variables that predict to a greater extent the degree of knowledge of gamification tools supported by the use of ICT in future educators.

2.1. Design

This work is part of a Teaching Innovation Project, obtained in competitive call and funded by the University of Jaén (Plan PIMED-UJA 2019-23): "Gamification as a learning strategy in Higher Education: plural implementation of emerging tools". The aim of the project is to promote the execution and implementation of new gamification tools supported by the use of ICT, for the development of a teaching-learning process for students of Degrees in Education sensitive to the provisions of the 2030 Agenda. However, prior to its development, we are committed to detecting the expectations and attitudes of students towards this innovative teaching practice.

To this end, it is based on a quantitative, descriptive, cross-sectional and inferential design, based on the survey technique. Its intention is to describe and systematically measure certain facts and characteristics of a given population or area of interest in an objective and verifiable way, according to the precepts established by Hernández, Fernández and Baptista (2018).

2.2. Sample

The research is carried out taking as the study population students enrolled in the first year of the Degrees in Early Childhood, Primary and Social Education of the University of Jaén during the academic year 2022-23 (N=687). The sample under study has been calculated from the simple random probability sampling proposal, being composed of 521 students who have agreed to fill in the questionnaire provided for data collection. Table 1 describes the most relevant socio-demographic characteristics of the sample.

2.3. Instruments

An ad hoc questionnaire was used for data collection, focusing on the initial assessment of university students' perceptions, attitudes, level of knowledge and level of use of gamification strategies in Higher Education.

Variable	*n* (%)
Gender	Man: 151 (29%) Woman: 370 (71%)
Degree	Early Childhood Education: 140 (26.9%) Primary Education: 317 (60.8%) Social Education: 64 (12.3%)
Interest in the subject in which gamified learning experiences are proposed	Nothing: 2(0.4%) Little: 3(0.6%) Something: 57 (10.9%) Quite: 324 (62.2%) A lot: 135 (25.9%)
Ease of passing the subject	Nothing: 13 (2.5%) Little: 78 (15%) Something: 333 (63.9%) Quite: 84 (16.1%) A lot: 13 (2.5%)
Previous experience with gamification-based learning strategy	Yes: 511 (98.1%) No: 10 (1.9%)
Possibility of using gamification in a future professional practice	Little: 8 (1.5%) Something: 66 (12.7%) Quite: 319 (61.2%) A lot: 128 (24.6%)

Table 1. Socio-demographic data

The "Questionnaire for the evaluation of gamification as a didactic strategy in Higher Education" responds to a Likert-type scale with 5 response options (1=strongly disagree and 5=strongly agree) and includes a first block of items on socio-demographic data (closed-choice, dichotomous) and opinion in relation to gamification, as well as a total of 63 items grouped according to the following areas:

- Potentialities of gamification in Higher Education, focused on the analysis of the university student's assessment of this innovative teaching strategy (37 items).
- Limitations of gamification in the university environment, referring to the study of the disadvantages of gamification in the teaching-learning process in Higher Education (10 items).
- Degree of student knowledge of the different gamification tools, classified according to: content creation and management; quiz games; memory games and digital flashcards; creation of interactive videos; adventure and escape games; simulation and role-playing games; cooperative work; classroom management (8 items).
- Level of use of the gamification tools described above in the university student's teaching-learning process (8 items)

The validation of the questionnaire was carried out using a twofold procedure. On the one hand, by means of expert judgment, using the Delphi method. Experts made an overall assessment of the questionnaire as well as of each of the items. The analysis includes an evaluation (on a scale of 0-10 where 0 is not relevant at all and 10 is very relevant) of the degree of relevance of each of the items to the object of study (content) and the level of precision and adequacy in the definition and wording of each of the questions (form). The panel of experts was made up of ten university lecturers with extensive experience in the area of Didactics and School Organization. After analyzing the instrument, they gave favourable feedback, as most of the items were assessed as correct and appropriate for the questionnaire's recipients. However, they have pointed out as improvements for the optimization of the tool, the elimination of one item and the reformulation of others that had not been drafted in a clear, direct and precise manner, and whose reading could lead to an erroneous response from the participants. Next, and based on a pilot test with students of the Degrees in Early Childhood and Primary Education, an exploratory factor analysis was carried out. The extraction of principal components with Varimax rotation reveals a Kaiser-Meyer-Olkin (KMO) sample adequacy index of 0.78, with Bartlett's test of 5591.529 (p=0.00).

Finally, the reliability analysis of the instrument was calculated using Cronbach's Alpha method, obtaining a value of 0.92. In addition, the method of two halves has been applied, reaching a value of 0.94 for the first part and 0.88 for the second part.

2.4. Procedure

This study was carried out during the 2022-23 academic year, with different processes taking place that allowed the research to materialise. Firstly, the sample selection and the procedure for the construction and validation of a data collection instrument was carried out to gather information about the students' perceptions and attitudes, as well as their level of use and knowledge of gamification as a learning strategy supported by the use of ICT.

The research team has proposed this study based on the collaboration of the teaching staff responsible for core/basic subjects in the first year of the Degrees in Early Childhood, Primary and Social Education at the University of Jaén, these being: General Didactics in Early Childhood Education, General Didactics in Primary Education and General Didactics for Social Education. In this case, the initial evaluation of the student has been requested in order to know their perceptions, attitudes and level of knowledge and use of these tools in their initial training process. However, this research is more ambitious and, once this initial assessment has been carried out and the data analyzed, it is committed to implementing innovative didactic experiences based on the implementation of gamified learning strategies supported by the use of ICT to improve the initial training of students in the Degrees in Education at the University of Jaén. Data collection was carried out using a Google Forms form, with an estimated response time of 10 minutes. The questionnaire was completed in person in the classroom by the research team in order to speed up and ensure that the questionnaire was answered correctly. In addition, prior to the questionnaire's completion, informed consent was obtained from the participants. The students were also informed of the aim of the research, as well as of the anonymity of the answers obtained and the confidentiality of the data collected, requesting their voluntary participation. As this is a study involving the collection of data from individuals, all the planned actions follow the ethical standards of the Declaration of Helsinki.

2.5 Data Analysis

Once the data had been collected, they were analyzed using the SPSS software package (version 28). Firstly, descriptive statistics were used to identify the levels of response for each of the variables under study. In addition, an analysis of difference of means (ANOVA) was performed to study the existence or not of statistically significant differences between the dimensions studied in the questionnaire and certain variables of interest such as the grade in which the student under study is enrolled, his or her degree of interest in the subject and his or her assessment of being able to use gamification as a learning strategy in his or her future professional practice as an educator. Finally, and with the intention of examining the variables that predict the degree of knowledge of the new Education student about gamification tools supported by the use of ICT, a multiple linear regression analysis was carried out, confirming the fulfilment of the assumptions necessary for its use, both at the level of predictors (revision of linearity with the endogenous variable and non-collinearity) and in the residuals (normality, homoscedasticity and independence).

3. Results

3.1. Student Perceptions Towards ICT-Mediated Gamification

The assessment of new students of the University of Jaén Degrees in Education on ICT-mediated gamification as a learning strategy, more specifically, on its possibilities and limitations for quality improvement in Higher Education, provides very relevant data. Thus, future educators reveal very favourable perceptions of the opportunities that this didactic strategy offers them in their initial training process (M=4.32; SD=0.45), while they are less convinced about its disadvantages (M=2.96; SD=0.77). More specifically, and taking the potential of gamification as a reference, it is worth highlighting how the students of the Degrees in Education consider that gamified teaching strategies, based on the use of ICT,

can make the learning process more fun, providing a positive experience for the student and being appropriate for carrying out complementary activities. In terms of limitations, the respondents consider that ICT-supported gamification requires prior establishment of the rules of the game with the participants and implementation of a learning process based on prizes and rewards. However, they are less convinced that this didactic strategy requires a reorganization of the space-time variables in the classroom, favours student distraction from the learning process or causes conflicts between students.

Variable	Ítem	M	SD
Possibilities	Make the learning process more fun	4.71	0.58
	It creates a positive learning experience	4.62	0.56
	It is suitable for complementary activities	4.60	0.57
	Helping the student to plan successfully	3.93	0.88
Limitation	It requires clear rules of the game	3.83	0.96
	Encourages reward and reward-based learning	3.69	1.02
	Requires reorganisation of classroom space and furniture	3.08	1.24
	Distracts the learner from acquiring knowledge	2.58	1.27
	Provokes negative reactions and conflicts between colleagues	2.45	1.19

Table 2. Descriptive analysis: possibilities and limitations of gamification

3.2. Knowledge and Use of ICT-supported Gamification Strategies

The assessment made by students of the University of Jaén's Bachelor's Degrees in Education regarding the degree of knowledge and level of use of ICT-supported gamification tools during their initial training period reveals very satisfactory data. Thus, those surveyed confirm having a higher degree of knowledge of these teaching strategies (M=3.55; SD=0.91), while the level of use and implementation of gamification based on the use of ICT for their training process is lower (M=3.35; SD=1.05).

More specifically, and taking into account the classification of the different tools, among the most well-known are those that allow the practice of question and answer games using applications such as Kahoot, Socrative, Trivial, etc. (M=4.35; SD=0.80) and tools for classroom management using Edmodo, Google Classroom, Classdojo, etc. (M=4.21; SD=0.94). However, they show greater indifference when questioned about their level of knowledge of tools for content creation and management using Storify, Educations, Symbaloo, etc. (M=2.91; SD=1.40).

On the other hand, the most used tools among future educators are classroom management tools (M=4.15; SD=1.01) and question and answer games (M=4.08; SD=1.04), with content creation and management strategies (M=2.86; SD=1.54) and simulation and role-playing (M=2.86; SD=1.52) being the least used by these students.

Gamification tools	Knowledge		Use	
	M	SD	M	SD
Content creation and management	2.91	1.40	2.86	1.54
Quiz games	4.35	0.08	4.08	1.04
Memory games and digital flashcards	3.50	1.35	3.20	1.45
Creating interactive videos	3.34	1.34	3.16	1.37
Adventure and escape games	3.47	1.30	3.17	1.44
Simulation and role-playing	3.11	1.47	2.86	1.52
Cooperative work	3.46	1.34	3.36	1.39
Glassroom management	4.21	0.94	4.19	1.01
Total	3.55	0.91	3.35	1.05

Table 3. Descriptive analysis: knowledge and use of gamification tools

3.3. Differences According to Qualifications

The analysis of difference of means (ANOVA) carried out has identified the existence of differences in means for all the dimensions of the questionnaire and the socio-demographic variable: Grade in which the student is enrolled. This is a polytomous variable with the following response options: Degree in Early Childhood Education, Primary Education and Social Education.

The analysis reveals statistically significant differences for all the dimensions analyzed: possibilities of gamification ($F(2,513)=4.297$, $p<.00$), limitations for the teaching-learning process ($F(2,500)=4.363$, $p<.00$), degree of knowledge of these tools ($F(2,511)=8.532$, $p<.01$) and level of use of gamification tools in their training process ($F(2,489)=8.744$, $p<.01$). The Tukey test carried out a posteriori shows how these differences are found between students enrolled in the Degree in Early Childhood Education and those in Primary Education, being more favourable in the latter, as shown in the following table.

	ANOVA		Tukey *M(SD)*		
Variables	**F**	**Sig.**	**Early Childhood Education**	**Primary Education**	**Social Education**
Possibilities	8.744	.00*	4.26(0.46)*	4.38(0.43)*	4.14(0.45)
Limitations	8.532	.00*	2.77(0.68)*	3.07(.080)*	2.84(0.67)
Knowledge	4.297	.01*	3.38(0.88)*	3.64(0.89)*	3.45(0.99)
Use	4.373	.01*	3.15(1.02)*	3.46(1.03)*	3.27(1.13)

*Mean differences significant at the .05 level.

Table 4. ANOVA for the dimensions of the questionnaire according to the independent variable: student's degree

3.4. Differences According to the Student's Expectations for Using Gamification in Future Professional Practice

The analysis of variance reveals statistically significant differences in students' perceptions of gamification according to their expectations for using this teaching strategy in their future professional practice. Particularly, the differences are located in the dimensions related to the analysis of the possibilities that this didactic strategy has for the improvement of Higher Education ($F(3,488)=20.454$, $p<.00$) and limitations for the improvement of initial training ($F(3,510)=2.601$, $p<.05$).

The Tukey test carried out subsequently reveals how, for the dimension related to the possibilities of gamification for improving university education, the differences are located between students who believe that they will use this teaching strategy "somewhat" ($M=4.03$; $SD=0.47$) and those who are committed to using it "a lot" in their future professional practice ($M=4.46$; $SD=.039$), with the perceptions and attitudes being more favourable for the latter. In the case of the limitations and/or disadvantages of gamification in the teaching-learning process, the differences are located between those who believe that they will use this learning tool "somewhat" ($M=3.13$; $SD=0.61$) and those who will use it "quite a lot" ($M=2.98$; $SD=0.80$) or "a lot" ($M=2.82$; $SD=.076$), the evaluations being more favourable for the former, as shown in the table.

	ANOVA		Tukey M(S.D.)			
Variables	**F**	**Sig.**	**Little**	**Something**	**Quite**	**A lot**
Possibilities	20.454	.00*	3.57(.46)	4.03(0.47)*	4.34(0.43)	4.46(0.39)*
Limitation	2.601	.05*	3.06(.63)	3.13(0.61)*	2.98(0.80)*	2.82(0.76)*
Knowledge	1.129	.33	3.12(.83)	3.42(0.83)	3.58(0.89)	3.55(1.00)
Use	.841	.47	2.79(1.01)	3.30(0.94)	3.37(1.03)	3.36(1.16)

*Mean differences significant at the 0.05 level.

Table 5. ANOVA for the dimensions of the questionnaire according to the independent variable: student's expectation to use this strategy in their future professional practice

3.5. Predicting Student Knowledge of ICT-Supported Gamification Tools

Next, it is of interest to carry out a predictive analysis between certain dimensions included in the "Questionnaire for the evaluation of gamification as a teaching strategy in Higher Education" on the dependent variable related to the "degree of student knowledge of gamification tools supported by ICT". Specifically, the following were selected as independent variables: assessment of the possibilities of these tools, analysis of their limitations in the teaching-learning process and level of use of these tools for their initial training.

The multiple linear regression analysis yields a model with statistically significant results. The coefficient of determination obtained in the model explains 76.8% of the variance; likewise, the adjusted multiple correlation, for the effect of the sample and the independent factors, obtained through the estimation of R^2, reaches a similar value at 76.6% of the variance. In addition, the Durbin-Watson statistic obtains a value of less than 2 points, which allows us to affirm the independence of the data. Figures 1 and 2 provide graphical evidence of these results from the histogram and the normal probability plot. In the first case, it is shown that the bars have a behavior similar to the normal curve, while for the second case the data are concentrated around the line, therefore, the assumption of normality is accepted.

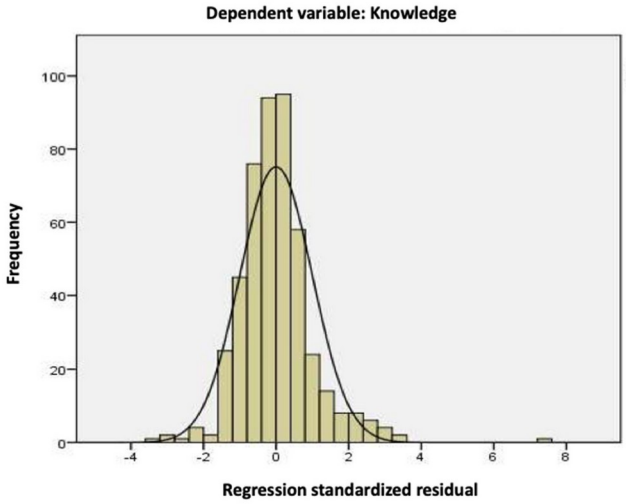

Figure 1. Histogram

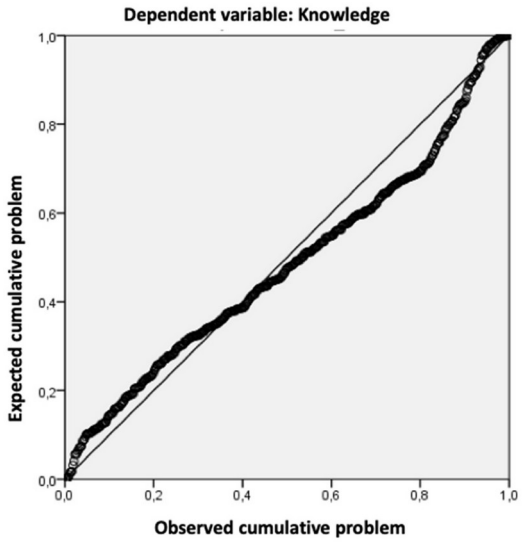

Figure 2. Normal probability

The validation of the model was carried out by means of an analysis of variance (ANOVA), obtaining a statistically significant predictive model (F=513.423, p=.00). Taking into account certain dimensions considered independent variables for the estimation of the predictive model, the most significant ones are those in which the relationships and the p-value is less than .00 and, somewhat weaker, although also significant, those in which the p-value is below .05.

The results obtained show a positive and significant influence on two of the independent variables under study (Table 6). Thus, it can be affirmed that the student's assessment of the possibilities that gamification tools have for the improvement of initial training (p=.04), as well as the student's level of use in their initial training process (p=.00) contribute significance to the model, the latter being the one that acquires the greatest weight.

	R= .876		**R2=.768**	**Ajusted R2 =.766**	**ET= .442**
	Non-standardised coefficients		**Standardised coefficients**		
Model	**B**	**Error est.**	**B**	**T**	**Sig.**
(Constant)	.562	.20		2.718	.00**
Use	.743	.02	.860	37.044	.00**
Limitation	.031	.02	.027	1.179	.23
Possibilities	.091	.04	.046	2.008	.04**
ANOVA		**Sum of squares**	**gl**	**Square Mean**	**F(sig.)**
Regression		301.723	3	100.574	513.423(.000)
Residue		91.285	466	.196	
Total		393.008	469		

Table 6. Multiple Linear Regression Model for the dependent variable "Student's level of knowledge towards gamification tools"

4. Discussion and Conclusions

This research shows the perception of university students of the Bachelor's Degrees in Education towards gamification as an innovative teaching strategy, which seeks to respond to the demands of quality education proposed by the 2030 Agenda. Taking the specific objectives set out in the design of the research as a reference, a very positive perception is shown among the Education students at the University of Jaén regarding the implementation of active methodologies; specifically, they provide an affirmative assessment of gamification supported by ICT as a learning strategy during their initial training process. Respondents consider that learning is much more fun, dynamic and, moreover, it is very appropriate for the design of complementary activities related to the subject of study, as corroborated in many previous works by Alsawaier (2018), Magadán-Díaz and Rivas-García (2022), Moreno-Fuentes (2019) or Pérez and Gertrudix (2021).

In addition, the respondents consider that gamification requires clearly establishing the rules of the game and knowing the procedure in advance and clearly in order to obtain the prizes and progress through different levels (Kapp, 2012; Zichermann & Cunningham, 2011). However, the students do not agree that this methodology leads to conflicts between classmates, that it is a distraction for them or that it is necessary to determine very specific spaces and times for its development. In this case, they disagree with the work carried out by Valencia and Orellana (2019) who point out some disadvantages of gamification, especially related to the barriers related to the teacher or the student, so much so that they consider it necessary to use it in their future professional practice as educators.

This didactic strategy is well known by the university students of Degrees in Education. This favors its implementation in Higher Education; specifically, the most known and used ICT-mediated gamification strategies among the students are question and answer games and classroom management games. This

result may be supported by the new demands that Higher Education has placed on university students thanks to the process of pedagogical renewal that we have witnessed in recent years. Thus, the student must be an agent committed to the group and responsible in the distribution of tasks, resolute and with the habit of listening and with a participative attitude towards conflict resolution (Fernández-Cabezas, Pascual & Romero, 2018). Furthermore, as Pegalajar-Palomino (2020) reveals, their most common learning strategies are related to exam preparation and intellectual work on the content of the subjects of the Bachelor's Degree in Education, among others.

Other research, such as that carried out by Moya and Soler (2018) or Perera and Hervás (2019), who point to the Kahoot! or Socrative applications as the most effective and suitable ICT tools based on gamification for teaching in Higher Education, is also noteworthy. In the case of classroom management, students point out Classdojo or Google Classroom among the best-known ICT applications. Such applications are investigated in works such as the one carried out by Hussaini et al. (2020) and Syakur (2020) which aim to know the students' perceptions, where they conclude that these tools are very effective in improving access to knowledge and students' attention as they help them to be protagonists in their teaching- learning process.

The students' prior knowledge of the use and implementation of these ICT tools based on gamification during previous years may have been fostered by the pandemic situation experienced by Covid-19 in 2020. This entailed a redesign of the didactic act by the university teaching staff, using gamified learning strategies that helped to carry out distance and networked work, in addition to the positive development it entails in the student towards learning and increased motivation, as highlighted in different studies and research (Díaz, Ruiz & Egüez, 2021; Kummeta, Guntuka, Boini & Mukherjee, 2022; Magadan-Díaz & Rivas-García, 2022; Pryke, 2020).

Furthermore, this research has shown that students of the Degree in Primary Education at the University of Jaén show a higher level of knowledge and use of ICT tools that make gamification possible, compared to students of the Degree in Early Childhood Education. On the other hand, better evaluations of the possibilities of ICT-supported gamification are shown among those respondents who plan to use this strategy in their future professional practice. In addition, students who are less receptive to using gamification in their professional future as educators are those who detect the greatest disadvantages for development in their initial training process. .

Thus, the expectations of the future educator towards the practice of innovative teaching methodologies, specifically gamification supported by ICT, is a variable of great interest that allows empowering the university student of the Bachelor's Degrees in Education towards the development of a fairer and more sustainable society for all. Their initial training must respond to the needs of today's society and focus their efforts on achieving improvements to achieve this objective through innovation (Jiménez-Fontana & García-González, 2019). In this sense, authors such as Albareda-Tiana et al. (2019), Danaher et al. (2021) and Yllana-Prieto et al. (2021) stress the need to activate curricular sustainability processes in the initial training of educators, based on active, participatory methodologies with social impact (Iglemo & Quiroga, 2018; Mayorga et al., 2021).

Undoubtedly, gamification is defined as an active methodology for curricular sustainability that is included in the didactic-disciplinary training process of the future educator. This is a commitment to educational innovation as a key factor for improving quality in Higher Education (Tello, 2014), which responds to the needs of today's society (Christensen, Raynor & McDonald, 2015). It seeks to introduce values and principles related to the Sustainable Development Goals, so that the graduate student can contribute to the achievement of a more sustainable society (Murga-Menoyo, 2017) from a perspective of social justice (Olsson, Gericke, Sass & Pauw, 2020) and equal opportunities (Westheimer, 2020). Thus, curricular sustainability in Bachelor's Degrees in Education is a priority in terms of the basic literacy of future citizens (Álvarez-García, Sureda-Negre & Comas-Forgas, 2018; Calero, García, Ull & Vilches, 2019; Cebrián, Junyent & Mulá, 2020).

Finally, it is worth noting that the best predictor of the degree of knowledge of ICT-supported gamification tools in Bachelor's Degree in Education students is determined by their level of use. Thus, it is possible to confirm that students who are more familiar with ICT gamification tools are those who use them the most, enjoying some of their potential to improve their learning process (Igelmo & Quiroga, 2018; Martínez-Valdivia et al., 2023; Mayorga et al., 2021; Pacheco & Causado, 2018; Pérez & Gertrudix, 2021).

By way of conclusion, it is worth highlighting how this research seeks to establish the starting point for the practice of innovative teaching experiences in the training process of university education students. It is necessary for university lecturers involved in the training of future educators to identify their perceptions, attitudes, level of knowledge and degree of use of the different ICT tools that enable the implementation of gamified learning strategies.

The philosophy of the European Higher Education Area, as well as the new social, economic, technological changes, etc., require the description of a new profile for university teaching staff, with different roles to those traditionally accepted (Fernandez-Cabezas et al., 2018). In this context, the University is understood as an institution focused on training people and an essential pillar for facing social challenges (Aznar, Ull, Martínez-Agut & Piñero, 2017; Cheang, So, Zhan & Tsoi, 2017; Kioupi & Voulvoulis, 2019); it is the most appropriate environment for leading the creation of educational scenarios focused on Sustainable Development (Martínez-Lirola, 2018), providing students with knowledge and skills to address the SDGs based on academic and professional experiences aimed at implementing solutions from the perspective of sustainability.

However, and as possible limitations of the research, the impossibility of generalizing the results to other samples stands out, given that it has focused on students of the Degrees in Education at the University of Jaén. In addition, the use of the questionnaire may imply problems among respondents with social desirability and sincerity. Therefore, and as a prospective of the research, it is proposed to extend the analysis carried out, accessing students of Higher Education who are studying degrees attached to other areas of knowledge and even from other national and international universities, being able to establish comparative analyses between them. It may also be significant to know the university teaching staff's assessment of the implementation of active methodologies based on gamification and the use of ICT for the development of a quality Higher Education consistent with the provisions of the 2030 Agenda.

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