Assessing Quizizz as a gamified teaching tool in higher education: A study of Spanish Education undergraduates' perceptions based on academic performance

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Abstract
Gamification in higher education supports instruction and develops key competences. Quizizz is an extended gamified tool increasingly used in teaching contexts. While previous studies have primarily focused on their motivational potential, fewer studies have examined how students' academic performance relates to their perceptions of these tools. Understanding whether higher-achieving students assess gamified tools more positively can provide educators with insights for designing more effective learning environments. This study, framed within a quantitative ex-post facto design, aimed to explore education undergraduates' assessments of Quizizz as a teaching resource. A total of 263 Spanish university students enrolled in two education-related programs at the University of Salamanca (Spain) participated. Additionally, significant differences were observed in students' assessments based on both their subject exam and final grades. Students who obtained "Excellent" marks consistently gave more favourable assessments of Quizizz, especially in terms of its perceived benefits for reviewing content, increasing motivation, and supporting learning, among others. These findings highlight the importance of considering academic performance when interpreting student feedback on educational tools. In conclusion, while gamification is generally well received, it should be applied thoughtfully and in combination with other analogue and digital resources to ensure a balanced and pedagogically sound learning environment.
Keywords: gamification, undergraduate students, perceptions, academic performance, educational technology.

Оценка Quizizz как геймифицированного средства обучения в высшем образовании: исследование восприятия испанского образования студентами-бакалаврами (на основе академической успеваемости)

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Аннотация
Геймификация в высшем образовании способствует процессу обучения, развитию ключевых компетенций. Quizizz – это игровой инструмент, который все чаще используется в преподавании. Существующие исследования характеризуются фокусом на мотивационный потенциал геймифицированных инструментов, при этом лишь небольшое количество исследований посвящено тому, как академическая успеваемость студентов связана с восприятием вышеуказанных инструментов. Понимание того, как учащиеся с более высокими образовательными результатами оценивают геймифицированные инструменты, поможет преподавателям в создании более эффективных условий обучения. Данное исследование, разработанное в рамках количественного анализа постфактум, было направлено на изучение того, каким образом студенты бакалавриата оценивают Quizizz в качестве учебного ресурса. В общей сложности в исследовании приняли участие 263 студента, обучающихся по двум образовательным программам в Университете Саламанки (Испания). Были выявлены существенные различия в оценках обучающихся, включая оценивание на экзаменах по предмету, а также итоговую аттестацию. Обучающиеся на «отлично» неизменно давали более положительные оценки инструменту Quizizz, особенно его преимуществам, способствующим изучению программного материала и повышению мотивации. Полученные результаты свидетельствуют о важности учета успеваемости при интерпретации тех отзывов, которые дают обучающиеся в отношении образовательных инструментов. Исследование позволяет сделать вывод о том, что, несмотря на то что геймифицированные инструменты в целом хорошо воспринимаются студентами-бакалаврами, их следует применять обдуманно, возможно, в сочетании с другими аналоговыми и цифровыми ресурсами для обеспечения сбалансированности и методической обоснованности образовательного процесса.
Ключевые слова: геймификация, студенты-бакалавры, восприятие, академическая успеваемость, образовательные технологии.

Introduction

In the last two decades international emphasis has been placed on the need to acquire skills and knowledge that will enable future generations to adapt to the challenges of the 21st century (Macias Galeas, 2024). Higher Education is considered to be in a period of transition with respect to teaching methods. There is a need for innovation, which

is understood as a process that implies a change in the conception of pedagogical and didactic educational processes (González García, 2024). In this sense, it is important that teachers create resources and implement pedagogical strategies in the classroom, enabling greater participation among students (Aguas-Viloria & Buelvas-Sierra, 2024). In this way, we currently have the possibility of using various digital tools, among which we highlight applications or platforms that favour the processing of information, improve communication, promote collaboration and optimise work processes in different areas of work, including education (Valera et al., 2023). On this basis, it is of importance to integrate technology into the educational contexts to transfer the multiple potentialities they offer to the teaching-learning processes, for example, to assess the teaching-learning process (Suárez-De La A et al., 2025). However, as Latchem (2018) points out, the integration of technology is a complex and multi-dimensional task, and while technology can offer many educational benefits, if it is poorly managed, it can also have negative effects. Therefore, as noted by Karsenti et al. (2020), the efficiency of the educational process depends on how the use of digital technologies is organized and on the pedagogical strategies and principles that are employed.

Gamification is defined as the implementation of both elements and principles of games such as mechanics or dynamics in non-game contexts (Dahalan et al., 2023; Kaya & Ercag, 2023; Olivas Ripoll, 2022; Sánchez-Rivas et al., 2024). In addition, it is worth highlighting that it favours active learning in virtual environments in the post-pandemic context, characterised by a lack of motivation for learning (Olmedo-Flores et al., 2024). However, authors such as Anil et al. (2021) highlight that the implementation of digital gamification works better than those designed in the traditional way. In line with the above, Zainuddin et al. (2020) state that educational platforms based on test-type exercises increase student motivation through playful elements such as medals, points, etc. In this regard, the most popular gamified platforms are Quizziz, Kahoot, Socrative, Quizaliza and Blooket (Dextre-Vilchez & Vásquez-Mercado, 2022). Nevertheless, there is no agreement on which is more effective for academic learning (Fabre Mitjans, 2023). Among the aforementioned platforms, it is worth highlighting that Quizziz enables individualised learning, due to its ability to adapt to different learning styles, as well as providing instant feedback (Robles-Gonzales et al., 2022). In this way, we can define Quizziz as a web platform with a quiz-like game in which students compete on the basis of questions posed by the teacher about the subject or subject matter in question (Degirmenci, 2021). Additionally, due to the dynamism of the technological environment, the evaluation process using Quizziz is motivating for students, increasing their proactivity (Ramírez Caraguay et al., 2024).

Research literature positively supports the use of Quizziz as a tool with positive results in the learning of different areas such as natural sciences (Suárez-De La A et al., 2025), English (García-León et al., 2024), accounting (Ramírez Caraguay et al., 2024) or history (Quinde Ponce et al., 2024). In line with the above, studies such as the one carried out by Vera-Vera and Bazurto-Rosado (2024) show an increase in grades due to the regular implementation of Quizziz in the teaching-learning process. On the other hand, Jiemsak and Jiemsak (2020) found that the implementation of Quizziz both as an educational tool and as an assessment instrument was considered adequate by students and increased positive results.

Based on the before, it becomes particularly relevant to understand undergraduate students' perceptions of this tool, as any other, since their opinions always become essential for the success of the teaching-learning process (Shafira & Rosita, 2022). While previous studies have primarily focused on teachers' attitudes toward gamification (Sajinčič et al., 2022), or whether gamification tools increase student motivation (García-

Rodríguez & Pérez-Cornejo, 2021; Rojas-Viteri et al., 2021), it is also necessary to examine undergraduate students' perceptions of these tools in relation to their academic performance. Analysing whether students who achieve higher grades tend to assess such tools more positively can provide valuable insights for educators when designing more effective learning environments. Therefore, this study aims to explore how undergraduate students in education-related programs assess the use of Quizizz as teaching resource in higher education, and whether their assessments differ depending on their academic performance in the subject exam and their final grade in the subject.

Method

Study design

This study employs a quantitative ex post facto design, as it focuses on events that had already occurred at the time of data collection (Mateo Andrés, 2009). The main objective is to explore how undergraduate students, specifically those studying degrees related to education, assess the use of Quizizz as a teaching resource in higher education. In addition, the study investigates whether undergraduate students' assessments of Quizizz differ depending on (1) their exam scores in the subject and (2) their final grades in the subject.

Three hypotheses were formulated:

– H1. Undergraduate students in the field of education have a positive assessment of Quizizz as a teaching resource in higher education.

To examine whether students' assessments of Quizizz differ depending on their exam scores and their final grades in the subject, we propose the following hypotheses, which will be tested using inferential statistical methods:

– H2. Undergraduate students in the field of education who score higher on the subject exam will have a more positive assessment of Quizizz as a teaching resource in higher education.

– H3. Undergraduate students in the field of education who achieve higher final grades in the subject will have a more positive assessment of Quizizz as a teaching resource in higher education.

The study therefore centres on three key variables: undergraduate students' assessment of Quizizz, their exam scores in the subject, and their final grades in the subject.

Participants

A total of 263 undergraduate students participated in the study: 159 from Early Childhood Education degree (60.5%) and 104 from Pedagogy degree (39.5%). The sample was one of convenience, as the undergraduate students were enrolled in subjects taught by one of the authors.

Contextualization

The study was carried out within the framework of a Teaching Innovation Project entitled "Implementation of digital games and gamification through Quizizz and Genially for learning about school legislation and the creation of teaching materials" (ID2021/161). The project was approved by the University of Salamanca (Spain) as part of its Call for Grants for Teaching Innovation and Improvement Projects, supported by the Vice-Rectorate for Teaching and Educational Innovation and the Vice-Rectorate for Postgraduate Studies and Continuing Education.

The study was conducted within the subjects School Organization in the Early Childhood Education degree, and School Organization and Management in the Pedagogy degree.

Before taking part in the study, undergraduate students were informed about the procedures and asked to sign an informed consent form in duplicate, confirming their

voluntary participation. In addition, the guidelines of the British Educational Research Association [BERA] (2018) have been followed.

Data collection

Data were collected using an adapted version of the "Evaluation of Kahoot as a teaching resource" questionnaire (Hernández-Ramos et al., 2020). In this study, the original questionnaire was adapted by replacing the term "Kahoot" with "Quizizz". Additionally new items were added to the questionnaire to specifically address the two uses of Quizizz implemented in the teaching practice of the subjects from which the data were collected. Two of these items related to the creation of Quizizz question games by undergraduate students, while the other two focused on games created by university teachers. Appendix A presents 24 Likert-type items included in the questionnaire in English (translated from Spanish). Appendix B contains the same 24 items in their original Spanish version, as they were administered to participants in that language. Participants were asked to indicate their level of agreement with each item using a five-point scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

Cronbach's alpha was calculated obtaining a value of .931. The score indicates high internal consistency. To further assess reliability, we also calculated Cronbach's alpha for groups of related items, following the structure proposed by the original authors (Hernández Ramos et al., 2020). The first block of ten items, which addressed the use of Quizizz as a teaching tool, yielded a Cronbach's alpha of .862. The second block, consisting of the next five items, resulted in a Cronbach's alpha of .831, referring to the comparison of the subject in which Quizizz was implemented with others where it was not implemented. The third block, also with five items, focused on students' general perspective as future teachers and educators, yielded a Cronbach's alpha of .805. Finally, the fourth block, which comprises the four additional items created specifically in this study, resulted in a Cronbach's alpha of .777.

Regarding the subject exam, it consisted of a 40-question multiple-choice test, with four answer options per question and a penalty applied for incorrect responses. Students had 1 hour and 30 minutes to complete the test, which covered all units of the subject in a balanced and proportional manner. The final grade for the subject was calculated based on some components: the exam score, the average of three practical assignments, the score for the final assignment, and the grade for the oral presentation of the final assignment. Grades were scored as follows (in accordance with Spanish regulations): Fail (0 to 4.9), Pass (5 to 6.9), Very Good (7 to 8.9), and Excellent (9 to 10).

The questionnaire was delivered digitally through the university's Moodle platform and made available within each subject's virtual classroom.

Regarding the specific implementation, the questionnaire was administered during the academic years 2021-2022, 2022-2023, and 2023-2024, in the final class session of the subjects School Organization (Early Childhood Education degree) and School Organization and Management (Pedagogy degree) at the University of Salamanca (Spain). Both subjects are part of the first year of their respective degree programs and are worth 6 ECTS credits (European Credit Transfer and Accumulation System). Both subjects cover the same content related to the organization and management of schools.

Data Analysis

Statistical analyses were performed using IBM SPSS Statistics (IBM Corporation, Armonk, NY, USA), and figures were generated using Microsoft Excel from the Microsoft 365 suite (Microsoft, Redmond, WA, USA).

Inferential analyses were carried out to examine whether students' assessment of Quizizz differ depending on the exam grades and final subject grades. In both cases,

nonparametric tests were used, as the normality of the distribution was assessed using the Kolmogorov-Smirnov test, giving a result of 0.000. These results meant that we were unable to assume normality of the distribution and, therefore, nonparametric tests were considered appropriate.

Kruskal-Wallis test was used (α=.05) considering the four scores -Fail (0 to 4.9), Pass (5 to 6.9), Very Good (7 to 8.9), and Excellent (9 to 10)-. When significant differences were found, pairwise comparisons were carried out using the Mann-Whitney U test with Bonferroni correction.

Results

Undergraduate students' assessment of Quizizz as a teaching resource in higher education

Overall, as shown in Figure 1, undergraduate students in the field of education gave positive feedback of Quizizz as a teaching resource in higher education. All items showed a response pattern between "Strongly Agree" (items 5, 9, 16, 17, 18, 20, 21, 22, 23, and 24) or "Agree" options (items 1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, and 19). Moreover, when combining the “Agree” and “Strongly Agree” responses, all items show high levels of agreement. These combined percentages range from 60% (for item 4 “The use of Quizizz has helped me solve practical problems”) to 97.4% for two items (item 20 “This gamified methodology is more motivating for students than traditional teaching”, and item 21 “The creation of Quizizz questions by the student helps to review the content”).

Based on the descriptive statistics presented in Table 1, students showed a generally positive assessment of Quizizz as a teaching resource in higher education. Mean scores for the questionnaire items ranged from 3.67 (SD = 0.87) for item 4 (“The use of Quizizz has helped me solve practical problems”) to 4.64 (SD = 0.58) for item 16 (“If I were to take the subject again, I would like the use of Quizizz to be maintained”).

Table 1. *Descriptive statistics for each questionnaire item (total sample)*

	n	*Min.*	*Max.*	*MD*	*SD*	*Skewness*		*Kurtosis*	
						Statistic	*Standard Error*	*Statistic*	*Standard Error*
I1	263	1.00	5.00	4.09	0.73	-0.840	0.150	1.478	0.299
I2	263	2.00	5.00	4.14	0.67	-0.622	0.150	0.929	0.299
I3	263	1.00	5.00	3.90	0.82	-.0547	0.150	0.146	0.299
I4	263	1.00	5.00	3.67	0.87	-0.269	0.150	-0.410	0.299
I5	263	2.00	5.00	4.45	0.61	-0.944	0.150	1.341	0.299
I6	263	2.00	5.00	4.25	0.69	-0.719	0.150	0.733	0.299
I7	263	2.00	5.00	4.29	0.70	-0.936	0.150	1.204	0.299
I8	263	1.00	5.00	3.82	0.87	-0.576	0.150	0.122	0.299
I9	263	1.00	5.00	4.39	0.68	-1.260	0.150	2.814	0.299
I10	263	1.00	5.00	3.84	0.93	-0.392	0.150	-0.482	0.299
I11	263	1.00	5.00	4.29	0.75	-1.122	0.150	2.083	0.299
I12	263	1.00	5.00	4.25	0.69	-0.947	0.150	2.083	0.299
I13	263	2.00	5.00	4.02	0.77	-0.277	0.150	-0.634	0.299
I14	263	2.00	5.00	4.11	0.73	-0.525	0.150	0.113	0.299
I15	263	2.00	5.00	4.37	0.65	-0.797	0.150	0.749	0.299
I16	263	2.00	5.00	4.64	0.58	-1.569	0.150	2.707	0.299
I17	263	1.00	5.00	4.53	0.60	-1.425	0.150	4.330	0.299
I18	263	1.00	5.00	4.41	0.68	-1.230	0.150	2.588	0.299
I19	263	2.00	5.00	4.28	0.72	-0.849	0.150	0.631	0.299

	n	*Min.*	*Max.*	*MD*	*SD*	*Skewness*		*Kurtosis*	
						Statistic	*Standard Error*	*Statistic*	*Standard Error*
I20	263	2.00	5.00	4.51	0.58	-0.946	0.150	1.213	0.299
I21	263	2.00	5.00	4.55	0.58	-1.106	0.150	1.541	0.299
I22	263	2.00	5.00	4.46	0.62	-0.898	0.150	0.784	0.299
I23	263	2.00	5.00	4.47	0.61	-0.893	0.150	0.831	0.299
I24	263	1.00	5.00	4.37	0.70	-1.115	0.150	2.065	0.299

Note: MD=Mean; SD=Standard Deviation.

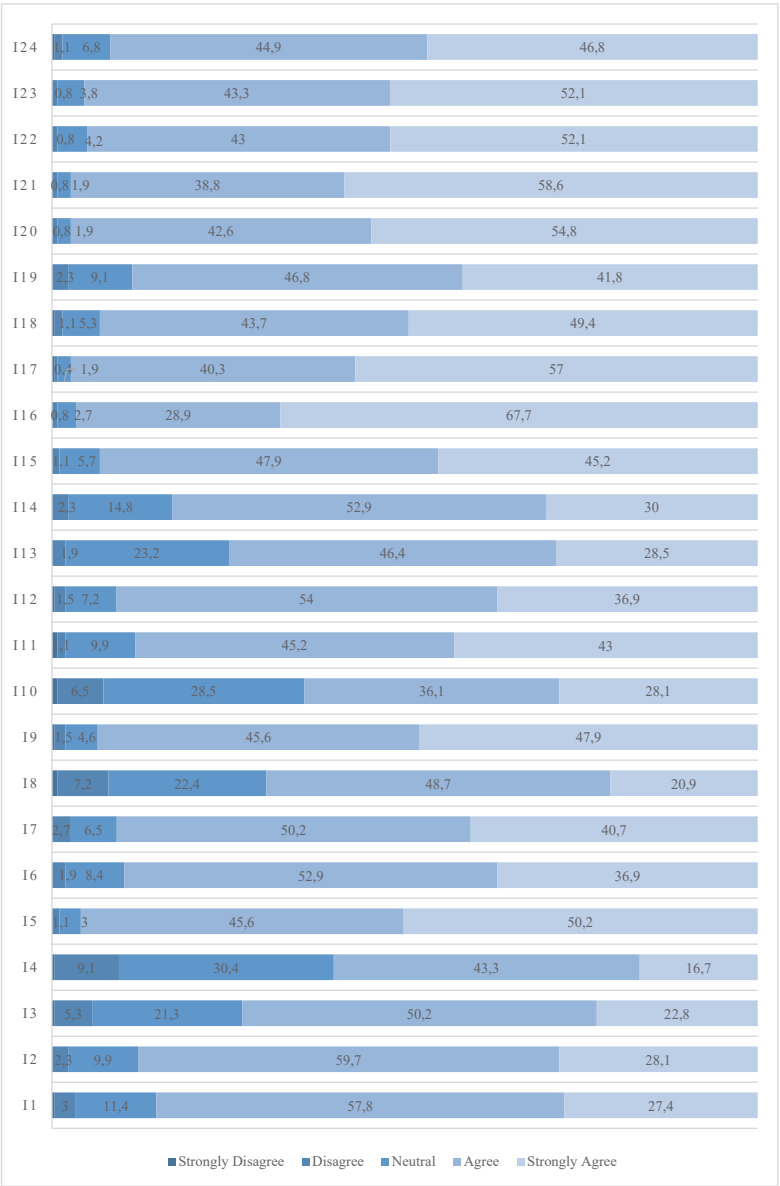

Figure 1. *Distribution of response options for each questionnaire item*

Differences in the undergraduate students' assessment of Quizizz based on the exam grades in the subject

Data collected showed high scores and positive feedback on the tool. Table 2 presents the descriptive statistics by group:

Table 2. *Descriptive statistics of questionnaire items by students' exam grades*

	Fail (n=3)		*Pass (n=115)*		*Very good (n=111)*		*Excellent (n=34)*	
Item	MD	SD	MD	SD	MD	SD	MD	SD
I1	3.67	0.58	4.13	0.79	4.05	0.70	4.09	0.67
I2	4.00	0.00	4.17	0.63	4.15	0.68	4.00	0.82
I3	3.67	0.58	3.92	0.81	3.98	0.74	3.56	1.05
I4	3.67	0.58	3.63	0.82	3.74	0.90	3.56	0.99
I5	4.00	0.00	4.43	0.64	4.45	0.61	4.56	0.56
I6	4.00	0.00	4.23	0.71	4.26	0.67	4.29	0.68
I7	4.00	0.00	4.17	0.73	4,37	0.67	4.44	0.70
I8	3.67	0.58	3.91	0.76	3.75	0.97	3.74	0.93
I9	4.00	0.00	4.32	0.77	4.41	0.62	4.62	0.56
I10	4.00	0.00	3,77	0.94	3.91	0.93	3.88	0.98
I11	3.67	0.58	4.23	0.79	4.28	0.76	4.53	0.51
I12	4.33	0.58	4.12	0.76	4.29	0.62	4.59	0.50
I13	4.33	0.58	3.96	0.75	3.98	0.80	4.29	0.72
I14	4.00	1.00	4.10	0.71	4.07	0.73	4.24	0.78
I15	4.33	0.58	4.30	0.65	4.40	0.68	4.56	0.50
I16	4.67	0.58	4.50	0.65	4.71	0.51	4.82	0.39
I17	4.33	0.58	4.47	0.65	4.56	0.56	4.57	0.56
I18	3.67	0.58	4.39	0.71	4.44	0.67	4.41	0.61
I19	4.00	0.00	4.29	0.76	4.29	0.68	4.26	0.79
I20	4.00	0.00	4.47	0.64	4.53	0.54	4.64	0.49
I21	3.67	0.58	4.49	0.60	4.59	0.56	4.74	0.45
I22	3.67	0.58	4.46	0.65	4.47	0.58	4.53	0.56
I23	4.33	0.58	4.36	0.68	4.53	0.55	4.65	0.49
I24	4.33	0.58	4.25	0.77	4.44	0.66	4.50	0.51

Note: MD=Mean; SD=Standard Deviation.

Table 3 displays the results of the Kruskal-Wallis test for each questionnaire item.

Table 3. *Statistical comparison of students' assessments of Quizizz based on exam grade*

Item	χ^2	*p.*	*Effect size r*
I1	2.879	.411	0.0215
I2	1.273	.735	0.0817
I3	5.661	.129	0.1015
I4	1.611	.657	0.0733
I5	3.582	.310	0.0474
I6	0.991	.804	0.0882
I7	7.939	.047*	0.1382

Item	χ^2	*p.*	*Effect size r*
I8	1.854	.603	0.0664
I9	6.510	.089	0.1162
I10	1.484	.686	0.0763
I11	6.052	.109	0.1084
I12	11.845	.008*	0.1848
I13	5.759	.124	0.1034
I14	1.751	.626	0.0693
I15	4.713	.194	0.0812
I16	11.229	.011*	0.1781
I17	2.746	.433	0.0315
I18	4.223	.238	0.0688
I19	1.104	.776	0.0857
I20	5.082	.166	0.0896
I21	11.247	.010*	0.1786
I22	4.853	.183	0.0847
I23	6.730	.081	0.1201
I24	4.425	.219	0.0743

As shown in Table 3, significant differences were found in items 7, 12, 16, and 21. For item 7 (χ^2=7.939; p=.047; effect size=0.1382), students who received an "Excellent" grade on the exam rated Quizizz more positively (MD=4.44; SD=0.70), particularly in terms of how it helped them memorize course content, compared to students in "Fail" group (MD=4.00; SD=0.00), as well as those in the "Pass" (MD=4.17; SD=0.73) and "Very Good" groups (MD=4.37; SD=0.67).

For item 12, the analysis revealed a significant difference (χ^2=11.845; p=.008; effect size=0.1848). Again, students with an "Excellent" exam grade gave the highest rating (MD=4.59; SD=0.50), compared to those who failed (MD=4.33; SD=0.58), passed (MD=4.12; SD=0.76), or received a "Very good" grade (MD=4.29; SD=0.62). This difference reflects students' perceptions of how this gamification tool helped them consolidate the course content compared to other subjects. As shown in Table 4, significant differences emerged specifically between the "Pass" and "Excellent" groups (U=1285.000; Z=-3,406; p=.001), with the "Excellent" group providing significantly higher assessments.

For item 16, the results were also significant (χ^2=11.229; p=.011; effect size=0.1781). Students in the "Excellent" group rated this item more positively (MD=4.82; SD=0.39), than those in other groups: "Fail" (MD=4.67; SD=0.58), "Pass" (MD=4.50; SD=0.65), and "Very good" (MD=4.71; SD=0.51). Their responses highlight the usefulness of Quizizz, particularly in the sense that if they were to take the course again, they would like its use to be continued. Pairwise comparisons showed significant differences between the "Pass" and "Excellent" groups (U=1449.000; Z=-2,710; p=.007), with the "Excellent" group again expressing a significantly more favourable assessment.

Finally, for item 21, the Kruskal-Wallis test revealed significant differences (χ^2=11.247; p=.010; effect size=0.1786). Students with an "Excellent" exam grade reported the most positive assessment (MD=4.74; SD=0.45) to the statement that creating questions helps them review the course content. This assessment was higher compared to the "Fail" group (MD=3.67; SD=0.58), "Pass" group (MD=4.49; SD=0.60), and "Very good" group (MD=4.59; SD=0.56). Furthermore, a significant pairwise difference was found between the "Fail" and "Excellent" groups (U=9.000; Z=-2.864; p= .004) (see Table 4):

Table 4. *Pairwise comparison in items according to exam grade obtained*

	Fail *z (p)*	*Pass* *z (p)*	*Very Good* *z (p)*	*Excellent* *z (p)*
Fail	-	No sig.	No sig.	I21: -2.864 (0.004)*
Pass		-	No sig.	I12: -3.406 (0.001)* I16: -2.710 (0.007)*
Very Good			-	No sig.
Excellent				-

*Significant differences (p < .0083) critical value by Bonferroni correction

In conclusion, the results indicate that significant differences were mainly observed in comparisons involving the "Excellent" group. This suggests that the overall differences identified in the analysis are not primarily due to the small size of the "Fail" group but rather reflect a distinct profile among students who achieved "Excellent" grades. These students consistently gave more favourable assessments of Quizizz, pointing to a differentiated pattern in their perception of the tool.

Differences in the undergraduate students' assessment of Quizizz as a teaching resource in higher education based on their final grade in the subject

A Kruskal-Wallis test was also conducted to analyse whether students' assessments of Quizizz as a teaching resource differed according to their final grade in the subject. The significance level was set at α=.05. Table 5 presents descriptive statistics:

Table 5. *Descriptive statistics for each item considering the final grade obtained in the subject*

	Fail (n=4)		*Pass (n=56)*		*Very good (n=159)*		*Excellent (n=44)*	
Item	*MD*	*SD*	*MD*	*SD*	*MD*	*SD*	*MD*	*SD*
I1	3.75	0.50	4.07	0.81	4.09	0.73	4.14	0.67
I2	4.00	0.00	4.00	0.69	4.21	0.67	4.07	0.70
I3	3.75	0.50	3.79	0.82	4.00	0.76	3.66	1.01
I4	3.50	0.58	3.55	0.87	3.73	0.85	3.61	0.97
I5	4.00	0.00	4.29	0.73	4.48	0.57	4.57	0.59
I6	4.00	0.00	4.05	0.77	4.30	0.65	4.34	0.68
I7	4.00	0.00	4.00	0.76	4.34	0.66	4.50	0.70
I8	3.75	0.50	3.79	0.76	3.84	0.91	3.80	0.93
I9	4.00	0.00	4.04	0.83	4.45	0.62	4.66	0.53
I10	4.00	0.00	3.63	1.00	3,88	0.90	3.98	1.00
I11	3.75	0.50	4.05	0.84	4.31	0.74	4.52	0.59
I12	4.25	0.50	3.98	0.82	4.25	0.65	4.61	0.49
I13	4.25	0.50	3.91	0.77	3.96	0.78	4.32	0.71
I14	4.00	0.82	4.00	0.71	4.09	0.74	4.30	0.70
I15	4.25	0.50	4.14	0.67	4.38	0.65	4.64	0.49
I16	4.50	0.58	4.28	0.75	4.71	0.49	4.84	0.37
I17	4.25	0.50	4.36	0.77	4.56	0.53	4.68	0.52
I18	3.75	0.50	4.30	0.71	4.41	0.69	4.57	0.59
I19	4.00	0.00	4.16	0.80	4.29	0.72	4.43	0.62
I20	4.00	0.00	4.36	0.70	4.53	0.55	4.70	0.46

	Fail (n=4)		*Pass (n=56)*		*Very good (n=159)*		*Excellent (n=44)*	
Item	*MD*	*SD*	*MD*	*SD*	*MD*	*SD*	*MD*	*SD*
I21	3.75	0.50	4.36	0.67	4.60	0.53	4.70	0.51
I22	3.75	0.50	4.34	0.72	4.50	0.57	4.55	0.59
I23	4.25	0.50	4.27	0.67	4.51	0.58	4.59	0.58
I24	4.25	0.50	4.11	0.73	4.42	0.70	4.43	0.70

Note: MD=Mean; SD=Standard Deviation.

Table 6 displays the results of the Kruskal-Wallis test for each questionnaire item:

Table 6. *Contrast statistics on whether the final subject grade implies differences in students' assessment of Quizizz as a teaching resource in higher education*

Item	χ^2	*p.*	*Effect size r*
I1	1.461	.691	0.0773
I2	5.130	.162	0.0906
I3	6.909	.075	0.1231
I4	2.185	.535	0.0559
I5	8.096	.044*	0.1401
I6	6.320	.097	0.1133
I7	16.632	.001*	0.2292
I8	0.466	.926	0.0990
I9	23.894	.000*	0.2838
I10	3.561	.313	0.0464
I11	12.430	.006*	0.1909
I12	20.073	.000*	0.1909
I13	8.838	.032*	0.1503
I14	4.960	.175	0.0872
I15	14.884	.002*	0.2144
I16	28.220	.000*	0.3121
I17	7.579	.056	0.1328
I18	8.447	.038*	0.1450
I19	4.154	.245	0.0669
I20	11.741	.008*	0.1838
I21	16.806	.001*	0.2311
I22	7.968	.047*	0.1386
I23	9.169	.027*	0.1541
I24	11.053	.011*	0.1762

As shown in Table 6, significant differences were found in the following items: 5 (χ^2=8.096; p=.044; effect size=0.1401), 7 (χ^2=16.632; p=.001; effect size=0.2292), 9 χ^2=23.894; p=.000; effect size=0.2838), 11 (χ^2=12.430; p=,006; effect size=0.1909), 12 (χ^2=20.073; p=.000; effect size=0.1909), 13 (χ^2=8.838; p=.032; effect size=0.1503), 15 (χ^2=14.884; p=.002; effect size=0.2144), 16 (χ^2=28.220; p=.000; effect size=0.3121), 18 (χ^2=8.447; p=.038; effect size=0.145), 20 (χ^2=11.741; p=.008; effect size=0.1838), 21 (χ^2=16.806; p=.001; effect size=0.2311), 22 (χ^2=7.968; p=.047; effect size=0.1386), 23 (χ^2=9.169; p=.027; effect size=0.1541), and 24 (χ^2=11.053; p=.011; effect size=0.1762).

In all of these items, the "Excellent" group gave the most positive assessment of Quizizz. These students rated Quizizz more favourably across a range of its perceived benefits, including: its usefulness in helping them understand key concepts and ideas (I5); its contribution to memorizing course content (I7); its role in supporting self-assessment of learning (I9); making the subject more motivating than others where Quizizz was not used (I11); aiding in content consolidation compared to other subjects (I12); improving the efficiency of reviewing subject notes (I13); allowing for self-assessment compared to other subjects (I15); their preference that Quizizz continue to be used if they were to take the course again (I16); their intention to use Quizizz as teachers in the future (I18); the motivational value of the gamified methodology compared to traditional teaching (I20); the value of students creating Quizizz questions for reviewing course content (I21) and for focusing on key aspects of the subject (I22); and the usefulness of creating Quizizz questions by teachers for both content review (I23) and for focusing on key aspects of the subject (I24).

Table 7 displays the pairwise comparisons between groups. Post hoc comparisons were carried out using the Mann-Whiney U test with Bonferroni correction to determine where significant differences occurred.

Table 7. *Pairwise comparison in items according to final subject grade*

	Fail *z (p)*	*Pass* *z (p)*	*Very Good* *z (p)*	*Excellent* *z (p)*
Fail	-	No sig.	I21: -2.768 (0.006) *	I20: -2.791 (0.005)* I21: - 3.078 (0.002)*
Pass		-	I7: -3.044 (0.002)* I9: - 3.588 (0.000)* I16: - 4.486 (0.000)* I24: - 3.086 (0.002)*	I7: -3.561 (0.000)* I9: - 4.255 (0.000)* I11: - 2.993 (0.003)* I12: - 4.280 (0.000)* I15: -3.796 (0.000)* I16: -4.434 (0.000)* I20: -2.696 (0.007)* I21: -2.916 (0.004)* I24: -2.653 (0.008)*
Very Good			-	I12: -3.374 (0.001)* I13: -2.684 (0.007)*
Excellent				-

*Significant differences (p < .0083) critical value by Bonferroni correction.

The post hoc analyses reveal that a large part of the significant differences involved the "Excellent" group, suggesting that this group demonstrated a distinct response pattern compared to the others. Additionally, significant comparisons were also found involving the "Pass" group, and to a lesser extent, the "Very Good" group. Notable, the "Fail" group showed the fewest significant differences in pairwise comparisons (only 3), although this result should be interpreted with caution due to the small sample size of that group.

Discussion and conclusions

The present study shows how teaching and learning processes supports instruction and fosters various key competences through the use of Quizziz. Understanding students' perceptions is essential for the success of the teaching-learning process. While previous studies have primarily focused on whether gamification tools increase student motivation (García-Rodríguez & Pérez-Cornejo, 2021; Rojas-Viteri et al., 2021), it is also necessary

to examine students' perceptions of these tools in relation to their academic performance. Analysing whether students who achieve higher grades tend to assess such tools more positively can provide educators with valuable insights when designing more effective learning environments.

In this regard, the study first aimed to explore how undergraduate students, specifically those enrolled in education-related degrees, assess the use of Quizizz as a teaching resource in higher education. As the findings show, students assessed the tool positively (which aligns with H1), which is consistent with previous research that highlights favourable perceptions of Quizizz (Magadán-Díaz & Rivas-García, 2022; Suharni et al., 2021), as well as other gamification tools (Gándara-Vila et al., 2021; Poblaciones et al., 2021; Tao & Zou, 2023). Furthermore, we examined whether students' assessments of Quizizz differ depending on their exam grades in the subject and their final grades in the subject. In this respect, students who achieved an "Excellent" grade in either the subject exam or the final course grade consistently gave more favourable assessments of Quizizz (which is in line with H2 and H3), revealing a distinct pattern in their perception of the tool. These students rated Quizizz more highly across a variety of its perceived benefits, including its usefulness in helping them understand key concepts and ideas, its contribution to memorizing course content, its support for self-assessment, and the value of both teachers and students creating Quizizz questions to review the content and focus on key aspects of the subject.

Regarding the limitations of the study, as previously noted, the small size of the "Fail" group should be considered when interpreting the results, as this limits the generalizability of findings for that group. However, the small number of students who failed the subjects also suggest that the majority of students successfully passed, a noteworthy outcome considering that the subjects (School Organization in the Early Childhood Education degree, and School Organization and Management in the Pedagogy degree) are often perceived as difficult due to its heavy theoretical and legislative content, and its lack of interest for first-year education students. This may indicate that the teaching approach implemented in the subjects – including various didactic strategies, among them the use of Quizizz – contributes positively to student learning, facilitating the achievement of learning objectives and outcomes. Another limitation lies in the study's exclusively quantitative approach. Future research could benefit from incorporating qualitative methods to explore students' perceptions in greater depth, particularly those of students who achieved "Excellent" grades. This would provide valuable insights to support the effective use of this tool and help maximize its potential in the learning process.

In conclusion, gamification tools such as Quizizz can be effectively integrated into teaching and learning processes in university programs within the field of education and are generally well received by students. However, caution is needed to avoid their overuse, especially when driven solely by the novelty factor – as tends to happen with emerging trends in educational technology (e.g. gamification, virtual reality, metaverse, generative artificial intelligence). It is important to use such tools judiciously, with a thoughtful understanding of their potential, considering students' perceptions, and combining them with other resources – both analogue and digital – to ensure a robust and coherent pedagogical strategy.

Statements on open data, conflict of interest, and use of artificial intelligence

The datasets used during the current study are available from the corresponding author on reasonable request.

The authors declare that they have no conflicts of interest.

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Appendix A

Assessment of Quizizz as a teaching resource. Adapted items from Hernández-Ramos et al. (2020) to the Quizizz tool (items 1-20) and ad hoc items for the study (items 21-24) (translated from Spanish to English).

1. The use of Quizizz has allowed me to develop my critical thinking around the subject content.
2. The use of Quizizz has helped me create personal syntheses of the content.
3. The use of Quizizz has allowed me to generalize theoretical content to real-life situations.
4. The use of Quizizz has helped me solve practical problems
5. The use of Quizizz has facilitated the understanding of basic concepts and ideas of the subject.
6. The use of Quizizz has facilitated the analysis and reflection on the studied content.
7. The use of Quizizz has made it easier to memorize the subject content.
8. The use of Quizizz has allowed me to express personal evaluations about the topics covered.
9. The use of Quizizz has enabled me to self-assess my learning in the subject.
10. The use of Quizizz has helped me organize my study.
11. The use of Quizizz makes the subject more motivating than others where it is not used.
12. The use of Quizizz facilitates the consolidation of content compared to other subjects.
13. The use of Quizizz allows me to check my notes more effectively compared to other subjects.
14. The use of Quizizz increases interest in the content compared to other subjects.
15. The use of Quizizz enables self-assessment of my learning compared to other subjects.
16. If I were to take the subject again, I would like the use of Quizizz to be maintained.
17. Thanks to Quizizz, the teacher has managed to incorporate play into teaching.
18. In the future, I would like to use Quizizz as a teacher.
19. This gamified methodology is more effective for teaching competencies than traditional teaching.
20. This gamified methodology is more motivating for students than traditional teaching.
21. The creation of Quizizz questions by the student helps to review the content.
22. The creation of Quizizz questions by the student helps to focus on the key aspects of the subject.
23. The creation of Quizizz questions by the teacher helps to review the content.
24. The creation of Quizizz questions by the teacher helps to focus on the key aspects of the subject.

Appendix B

Assessment of Quizizz as a teaching resource. Adapted items from Hernández-Ramos et al. (2020) to the Quizizz tool (items 1-20) and ad hoc items for the study (items 21-24) (in Spanish).

1. El empleo de Quizizz me ha permitido desarrollar mi pensamiento crítico alrededor de los contenidos de la materia.
2. El empleo de Quizizz me ha ayudado en la elaboración de síntesis personales sobre los contenidos.
3. El empleo de Quizizz me ha permitido generalizar los contenidos teóricos a situaciones reales.
4. El empleo de Quizizz me ha ayudado a resolver problemas prácticos.
5. El empleo de Quizizz ha facilitado la comprensión de los conceptos e ideas básicas de la asignatura.
6. El empleo de Quizizz me ha facilitado el análisis y la reflexión sobre los contenidos estudiados.
7. El empleo de Quizizz ha facilitado la memorización de los contenidos de la asignatura.
8. El empleo de Quizizz me ha permitido emitir valoraciones personales sobre los temas tratados.
9. El empleo de Quizizz ha permitido autoevaluar mi aprendizaje en la asignatura.
10. El empleo de Quizizz me ha facilitado la organización del estudio.
11. El empleo de Quizizz hace más motivadora la asignatura que la otra donde no se usa.
12. El empleo de Quizizz facilita la consolidación de contenidos en comparación con otras asignaturas.
13. El empleo de Quizizz permite comprobar los apuntes en comparación con otras asignaturas.
14. El empleo de Quizizz aumenta el interés por los contenidos en comparación con otras asignaturas.
15. El empleo de Quizizz permite autoevaluar mi aprendizaje en comparación con otras asignaturas.
16. Si volviera a cursar la asignatura, me gustaría que se mantuviera el empleo de Quizizz.
17. Gracias a Quizizz, el profesor ha conseguido incorporar el juego a la enseñanza
18. En el futuro me gustaría emplear Quizizz como docente.
19. Esta metodología gamificada es más efectiva para la enseñanza de competencias que la enseñanza tradicional.
20. Esta metodología gamificada es más motivadora para el estudiante que la enseñanza tradicional.
21. La creación de preguntas de Quizizz por parte del alumno ayuda a repasar los contenidos.
22. La creación de preguntas de Quizizz por parte del alumno ayuda a fijarse en los aspectos fundamentales de la asignatura.
23. La creación de preguntas de Quizizz por parte del profesor ayuda a repasar los contenidos.
24. La creación de preguntas de Quizizz por parte del profesor ayuda a fijarse en los aspectos fundamentales de la asignatura.