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Expected Usefulness of Interactive Learning Platforms and Academic Sustainability Performance: The Moderator Role of Student Enjoyment

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Abstract: (1) This document explores the impact of an interactive learning platform on students' academic performance through a teaching innovation project. (2) The study involved 127 students in financial economics and accounting courses at a Spanish university. Preliminary and post-learning phase surveys, along with instructor evaluations, were conducted to assess students' expectations, satisfaction, and performance using the Kahoot platform. The data underwent analysis using PLS-SEM and multivariate techniques. (3) Remarkably, 42.5% of students achieved high academic performance, surpassing their average scores. Notably, those who enjoyed using Kahoot and had higher expectations showed significantly higher performances (48.3% vs. 26.4% and 64.1% vs. 18.3%, respectively). These results highlight the positive impact of perceived usefulness on satisfaction and academic performance. The study also emphasizes the moderating role of students' enjoyment in enhancing satisfaction and learning outcomes through Kahoot. (4) The document concludes with insights into students' motivation to use Kahoot and its effectiveness in improving learning outcomes, providing valuable implications for interactive learning platforms in education.

Keywords: interactive learning platforms; academic sustainability; Kahoot; enjoyment; performance

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1. Introduction

In the ever-evolving landscape of education, the integration of interactive learning platforms has become increasingly prevalent, shaping the way students engage with academic content [1]. Educational technology has emerged as a transformative force in higher education, offering innovative approaches to enhance learning experiences. One such tool gaining prominence is Kahoot, a game-based learning platform designed to engage students in a pedagogical setting [2].

Kahoot, a popular interactive learning platform, can play a significant role in promoting sustainability education. Through Kahoot's gamified quizzes, surveys, and challenges, educators can create engaging experiences that reinforce concepts of sustainability in various academic disciplines. Firstly, Kahoot quizzes can be tailored to test students' knowledge of sustainability principles, such as renewable energy sources, waste management, and environmental conservation. By incorporating questions related to sustainability issues, students are prompted to actively engage with and internalize these concepts. Secondly, Kahoot surveys can be used to gather data on students' attitudes, behaviors, and awareness regarding sustainability topics. This feedback can inform educators about areas needing more emphasis and help track changes in students' perspectives over time [2]. Interactive learning involves active participation, engagement, and collaboration among learners, often facilitated by technology or group activities. In academic sustainability, interactive learning fosters deep understanding and the application of sustainable principles through real-world problem-solving, simulations, and case studies. It encourages critical thinking, creativity, and collaboration, preparing students to address complex sustainability challenges effectively. By promoting interactive learning, academia empowers learners to

develop innovative solutions, integrate interdisciplinary knowledge, and become change agents for sustainable development [3].

Moreover, Kahoot challenges can encourage friendly competition among students to apply sustainable practices in their daily lives. For instance, challenges could involve eco-friendly habits like reducing energy consumption, recycling, or promoting biodiversity. Furthermore, Kahoot's interactive nature fosters collaboration and discussion among students, allowing them to share ideas and solutions for addressing sustainability challenges both locally and globally. By leveraging Kahoot as a tool for interactive learning, educators can effectively integrate sustainability into the curriculum, inspire students to adopt eco-conscious behaviors, and cultivate a generation of environmentally responsible citizens poised to tackle pressing sustainability issues.

This study delves into the nexus between the expected usefulness of interactive learning platforms and academic performance, with a nuanced exploration of the moderator role played by student enjoyment. While exploring this academic field, it is imperative to contextualize these findings within the broader paradigm of sustainability in education [3].

The transformative potential of interactive learning platforms, exemplified by their capacity to engage students and enhance the learning experience, aligns seamlessly with the principles of sustainability in education [4]. Sustainable education transcends the mere transmission of knowledge; it encompasses fostering an environment where students not only acquire academic proficiency but also develop a lifelong commitment to sustainable practices. In this context, the integration of technology, such as interactive learning platforms, becomes a pivotal component in cultivating an educational landscape that is not only efficient but also sustainable in the long run [5].

The focus on the expected usefulness of interactive learning platforms takes center stage. Understanding students' perceptions of the utility of these platforms provides a foundation for assessing their impact on academic performance [6]. Concurrently, in this study, the variable of student enjoyment as a potential moderator is introduced into the analysis, recognizing the intricate interplay between the perceived usefulness of technology and the holistic educational experience [7].

In an era when the discourse on sustainability extends beyond environmental considerations to encompass socio-economic and educational aspects, our exploration of interactive learning platforms' expected usefulness and the moderating influence of student enjoyment aligns with the broader vision of fostering sustainable educational practices [8]. This study focuses on the implications extended beyond immediate academic outcomes, paving the way for a sustainable educational landscape that empowers students to thrive in a dynamic, knowledge-driven future [9].

This study aims to bridge the gap in the existing literature by examining the interconnected dynamics of expected usefulness, student enjoyment, and academic performance. By unraveling the moderator role played by student enjoyment, we seek to elucidate the mechanisms through which interactive learning platforms contribute not only to academic outcomes but also to the broader sustainability goals within the educational realm. Thus, based on the above argument, the two research questions (RQ) are as follows:

RQ1: What is the influence of student expectations about the usefulness of Kahoot on academic performance? and RQ2: How does student enjoyment mediate the relationship between expectations and academic performance?

The paper has been structured as follows. First, the introduction section sets the stage by acknowledging the evolving landscape of education and the increasing prominence of interactive learning platforms. It introduces Kahoot as a game-based learning tool and outlines the research problem of examining the relationship between expected usefulness, student enjoyment, and academic performance. Additionally, it emphasizes the importance of placing these findings within the context of sustainability in education. A theoretical framework was included, in which the significance of sustainability in education and the role universities play in fostering sustainability in education are explained. A Materials and Methods section is presented, in which the hypotheses are formulated. Also, this

section outlines the participants' characteristics, the design of the pedagogical experience using Kahoot, data collection methods involving questionnaires and evaluations, and the statistical analysis techniques employed, such as Partial Least Squares Structural Equation Modeling (PLS-SEM) and multivariate analyses. In the Results section, a descriptive statistic of students' expectations, satisfaction, and academic performance are presented. Also, it identifies significant percentages of students achieving high academic performance based on enjoyment and expectations. Finally, the discussion section interprets the findings in the context of research questions and hypotheses. It discusses the implications of the results for educational practice and points out the limitations of the study.

Theoretical Framework

In contemporary education, the integration of sustainability principles and the Sustainable Development Goals (SDGs) has become pivotal. Universities play a critical role in fostering education for sustainability through innovative pedagogical approaches such as interactive learning platforms (ILPs) [10]. Sustainability entails meeting present needs without compromising the ability of future generations to meet their own needs. The SDGs, adopted by the United Nations, provide a comprehensive framework for addressing global challenges, including poverty, inequality, and environmental degradation [11].

Universities serve as hubs for knowledge dissemination and intellectual growth. They have a responsibility to instill sustainability principles across disciplines, equipping students with the competencies needed to address complex societal and environmental issues. ILPs leverage technology to facilitate active learning experiences, fostering student engagement, collaboration, and critical thinking [12]. Through ILPs, students can explore real-world sustainability challenges, interact with diverse perspectives, and develop practical solutions. In addition to their role in fostering education for sustainability, universities are also increasingly recognized as living laboratories for sustainable practices. Many universities are implementing eco-friendly initiatives, such as reducing carbon emissions, implementing sustainable transportation options, and promoting waste reduction and recycling programs [13]. These efforts not only contribute to environmental sustainability but also serve as tangible examples for students, faculty, and the broader community, reinforcing the importance of sustainable practices in everyday life [14].

Research suggests a positive correlation between education for sustainability initiatives and academic performance. Engaging in sustainability-focused coursework enhances students' analytical skills, creativity, and problem-solving abilities, consequently improving their academic outcomes. ILPs offer a dynamic environment for integrating sustainability concepts into curricula. By incorporating interactive simulations, case studies, and multimedia resources, ILPs enable students to apply theoretical knowledge to real-world contexts, fostering deeper understanding and retention [15]. Furthermore, the integration of sustainability principles into university curricula extends beyond academic disciplines to encompass campus operations and management. Sustainable practices in areas like energy efficiency, water conservation, and green building design not only reduce environmental impact but also offer cost savings and promote a culture of sustainability within the university community [16]. By aligning institutional operations with sustainability goals, universities demonstrate a commitment to holistic sustainability that extends beyond the classroom, shaping students' attitudes and behaviors towards environmental stewardship and social responsibility [17].

The integration of sustainability principles, SDGs, university studies, and interactive learning platforms is essential for nurturing environmentally and socially responsible global citizens. By embracing innovative pedagogies and fostering interdisciplinary collaboration, universities can empower students to become agents of positive change, driving sustainable development and advancing academic excellence simultaneously [18].

Hence, the following points could be hypothesized:

Hypothesis 1 (H1): *Student expectations about the usefulness of Kahoot positively affect academic performance.*

Hypothesis 2 (H2): *Student enjoyment has a mediating effect on the link between the expected usefulness of Kahoot and academic performance of the students.*

2. Materials and Methods

The participants in this study were 127 university students enrolled in four different master's/degrees during the academic year 2022–2023 in a Spanish public university. They participated in a pedagogical experience with Kahoot developed to evaluate their acquisition of skills in subjects from the area of knowledge of financial economics and accounting.

To approach this experience, the case method was chosen, which has become widespread in university education, primarily due to its potential to bring students closer to real-life situations where they can conduct detailed studies. Thus, the students applied part of what they learned in each subject, including both theoretical content and the necessary procedures to address the analyses, such as analyzing information, elaborating diagnoses, and presenting critical reflections. In summary, this method facilitates the development of student competencies.

Additionally, the educational experience was approached in an e-learning context that included the use of Kahoot as an opportunity for learning, as well as the use of laptops, digital tablets, and smartphones in the classroom, YouTube video sessions, and the Blackboard Collaborate Ultra platform as a repository of materials, which are examples of good teaching practices.

Kahoot is defined as a web service for social education and gamification, since it behaves like a game, and is useful for learning and reviewing concepts in an entertaining way [19]. This e-learning platform offers free quizzes to teachers, which students can use and share. It is easy to use and allows users to create their quizzes according to their preferences and goals. To develop the educational experience of this work, the authors designed four questionnaires for their subsequent implementation in the practical sessions.

Regarding the classroom session with Kahoot, before taking the quiz, students had to search, collect, and read information on the main topics of the subjects, and identify the sources consulted for it. To this end, reference was made to the elements that identify the document from which the information was extracted, whether they were articles, books, book chapters or electronic resources.

At the subject level, each Kahoot quiz included six questions, with an additional question corresponding to the corporate reporting subject (25 questions in total). These questions were related to a previous text provided to the student (company examples), upon which they were required to assess the actions of their company (the analyzed company in their independent work) and respond to the Kahoot questions formulated for the student to evaluate the actions and performances of their case–company in economic, environmental, and social matters, as well as costs and provisions (in the case of accounting subjects), and an additional question related to information disclosure in the corporate reporting subject.

The method to incorporate the gamification of such content with Kahoot was designed through the following phases: (1) present the Kahoot tool and show an example of its use to the students; (2) share the students' class documents, case studies, etc., i.e., material that had been previously selected and designed by the authors of this work, according to the subject in which the students were enrolled, to be included in the Kahoot session; (3) apply the intervention based on answering twenty-five questions related to the class content at the end of the corresponding session; and (4) once the Kahoot session was applied in the different class groups, the teachers asked the students to fill out a questionnaire about the satisfaction they experienced in the use of this platform for learning.

On the other hand, the empirical data for conducting the research work were obtained through evaluation and questionnaires. The evaluation revealed the scores of the students' learning achievements, emphasizing their sustainable aspect, which incorporated the

acquisition of skills and abilities by the student. The student's ability to analyze and synthesize information, as well as their ability to learn autonomously, were evaluated based on the results of Kahoot. Regarding other empirical data, a questionnaire showed students' expectations about the utility of this resource in facilitating the learning of the subject's contents. Subsequently, at the end of the Kahoot-based learning phase, another questionnaire provided detailed opinions from the students about their own satisfaction and enjoyment in using this platform for learning.

The empirical analysis procedure is described in the following steps: (1) descriptive analysis of both the student' scores on Kahoot, and the questionnaire responses (see Appendix A); (2) analysis of the measurement model for students' expectations regarding the utility of Kahoot (EXP variable), students' satisfaction and enjoyment in using this platform for learning (SAT variable), and academic performance (PER variable), their reliability and validity, through PLS-SEM; (3) path analysis on the students' expectations–academic performance relationship, and the moderator role of students' satisfaction on this path, using PLS-SEM. Given the objectives of the research, the preferred methodological approach was the PLS-SEM for two main reasons. First, because it permits the testing of the conceptual measurement model of complex structure variables categorized from observable indicators (i.e., EXP, SAT, and PER variables), and second, it permits the measuring of the cause–effect relations between the variables. It is widely accepted that PLS-SEM is a suitable analysis methodology for testing measurement models conceptualized as reflective models, and for predicting the key latent variables [20]. In our study, SmartPLS4 software (version 4) was used for PLS-SEM analyses. We also used Stata IC 12 software (version 12) to address other multivariate analyses, and the Pearson chi2 test to analyze differences in proportions between groups of students.

3. Results

Before the pedagogical experience with Kahoot was applied in the different classroom groups, teachers asked students to fill out a questionnaire related to their expectations regarding the utility of it as a resource for learning. Through the questionnaire, the data of 127 students (response rate 90.07%) were collected, concerning the four different subjects of the master's/degrees (Table 1).

Table 1. Sample distribution per subject.

Degree/Master	Subjects	Sample (n)	Male		Female	
			n	%	n	%
Master's in Business Management	Corporate Reporting	7	3	42.9%	4	57.1%
Degree in Tourism	Financial Statements and Cost Accounting	9	1	11.1%	8	88.9%
Degree in Labor Relations and Human Resources	Accounting	15	5	33.3%	10	66.7%
Degree in Business Administration and Management	Management Accounting	96	40	41.7%	56	58.3%
	N (% total)	127	49 (38.6%)		78 (61.4%)	

The questionnaire included the following two questions aimed at assessing the degree to which the student believed that using Kahoot as a method for learning would help them improve their technology's performance (students' expectations variable, EXP):

(1) EXP-I: "Using Kahoot will increase the opportunities to achieve important goals for my learning", and
(2) EXP-II: "Using Kahoot will help me acquire skills more quickly".

To determine the mean of these variables, a Likert-type scale was used, with a range from 0 (totally disagree) to 5 (totally agree). More than 50% of the students recognized, with scores of 4 and above, their high expectations regarding the utility of Kahoot (Figure 1).

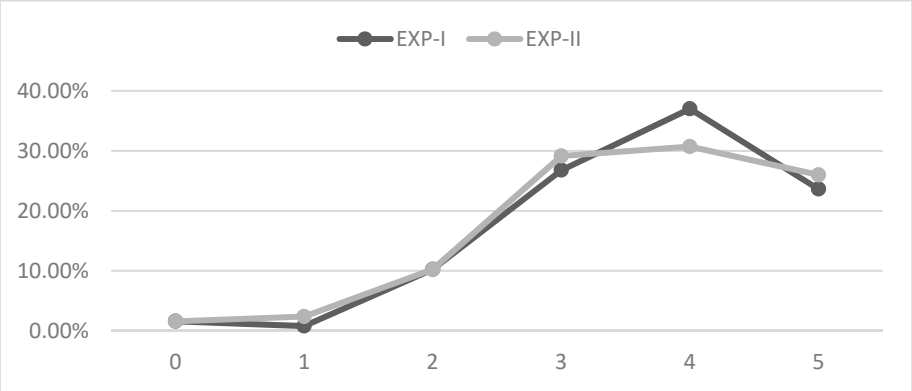

Figure 1. Students' expectations regarding the utility of Kahoot.

As shown in Appendix A, the students gave a "very positive" mean score to each of the variables, EXP-I and EXP-II (above 3.6 on the Likert scale). These variables formed the measurement scale of the student expectations regarding the utility of Kahoot, as it was defined by [21].

3.1. Satisfaction and Enjoyment in Using Kahoot for Learning

The questionnaire included the following two questions aimed at assessing the student satisfaction and enjoyment variable (SAT variable):

(1) SAT-I: "Using Kahoot motivates me to learn", and
(2) SAT-II: "Using Kahoot makes me enjoy learning".

In this case, students evaluated the two satisfaction variables from a Likert-type scale, with a range from 0 (totally disagree) to 5 (totally agree). The students gave a "very positive" mean score to each of variables, SAT-I and SAT-II (3.5 and 3.9, respectively, on the Likert scale).

More than 60% of the students recognized, with scores of 4 and above, their high satisfaction with, and enjoyment from, using Kahoot (Figure 2).

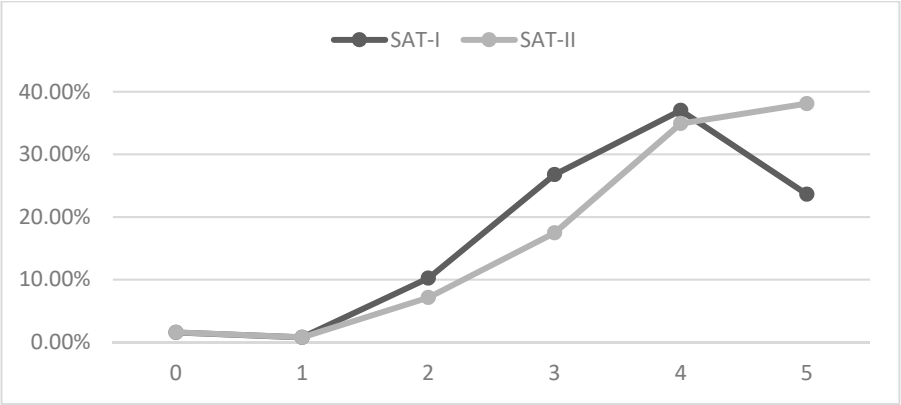

Figure 2. Students' satisfaction and enjoyment using Kahoot.

3.2. Student Expectations and Satisfaction towards Kahoot and Students' Academic Performance

We used a formative assessment to evaluate students' academic performance, since it leads [9] to the evaluation of the students' development of competencies and skills, enhancing students' growth and progress of learning. Two main aspects were evaluated

in Kahoot, the student capacity for analysis and synthesis (PER-I), and the autonomous learning ability (PER-II).

The score achieved by the students in each of these aspects (from 0 to 5 points) comprised the variables that formed the measurement scale of the students' academic performance (PER variable). As shown in Table 2, the evaluation of the students' Kahoot by the teachers yielded a high average score (higher than 3.4 on the Likert scale) in each of the performances evaluated, PER-I and PER-II.

Table 2. Evaluation of the measurement model. Reliability and validity.

Construct	**Descriptive Statistics**		**Loadings**
EXP Variable	**Mean**	**Std. Dev.**	**Stand. Loadings ($p < 0.001$)**
EXP-I	3.68	1.07	0.89
EXP-II	3.63	1.14	0.79
	CR = 0.83; AVE = 0.71		
SAT Variable	**Mean**	**Std. Dev.**	**Stand. Loadings ($p < 0.001$)**
SAT-I	3.57	1.15	0.91
SAT-II	3.94	1.14	0.89
	CR = 0.89; AVE = 0.81		
PER Variable	**Mean**	**Std. Dev.**	**Stand. Loadings ($p < 0.001$)**
PER-I	3.61	1.01	0.86
PER-II	3.49	1.23	0.91
	CR = 0.88; AVE = 0.78		

Table 2 illustrates the descriptive statistics of the variables that loaded on each construct (EXP, SAT, and PER). For testing the reliability and validity of the measurement model, a PLS-SEM was conducted. The results of it showed a good overall fit for the measurement scales, obtaining good fits expressed in factor loads (above 0.7 in all cases), as well as an acceptable composite reliability index (CR > 0.7) and convergent validity of the model (AVE > 0.5).

Additionally, three main criteria were employed to ensure the measurement scale had an adequate discriminant validity (Table 3). These criteria included the cross-loading matrix, the Fornell–Larcker criterion method, and the heterotrait–monotrait method ratio (HTMT). As shown in Table 3, the outer loading (bolded) of each latent unobserved variable was higher than the cross loading (with other measurements). In addition, regarding inter-construct correlations and the square root of AVE, the bolded diagonal AVE values were greater than the inter-variable correlation coefficient, which is indicative of high discriminant validity [22]. Finally, this study's HTMT levels were significantly lower than the 0.9 value. Taken together, the previous results confirm and support the scale reliability, convergent, and discriminant validity, as approved in the evaluation of the measurement model.

Remarkably, 42.52% of students (54 of 127 students) achieved high academic performance, surpassing their average scores (Table 4). Figure 3 illustrates that this percentage was higher among students who derived more enjoyment from using Kahoot (48.3% compared to 26.4%) and among those who had higher expectations of its usefulness (64.1% compared to 18.3%). Scores of the SAT variable above its average define a high degree of enjoyment from using Kahoot (scores observed for 93 of the 127 students). Likewise, values of the EXP variable above its average define the high expectations of the usefulness of this resource (scores observed for 67 of the 127 students). The differences observed in the percentages of students were significant at the 5% level for the SAT variable (chi2 = 4.89 $p = 0.027$) and the 1% level for the EXP variable (chi2 = 27.22 $p = 0.000$) in the Pearson chi2 test.

Table 3. Discriminant validity.

Criteria	**Constructs**		
Factor Cross-Loading Matrix	EXP	SAT	PER
EXP-I	**0.889**	0.529	0.618
EXP-II	**0.791**	0.403	0.457
SAT-I	0.529	**0.915**	0.550
SAT-II	0.480	**0.888**	0.467
PER-I	0.496	0.462	**0.860**
PER-II	0.640	0.534	**0.909**
Fornell–Larcker Criterion Method	EXP	SAT	PER
Student expectations (EXP variable)	**0.841**		
Student satisfaction and enjoyment (SAT variable)	0.561	**0.902**	
Academic performance (PER variable)	0.649	0.566	**0.885**
Heterotrait–Monotrait Ratio (HTMT) Matrix	EXP	SAT	PER
Student expectations (EXP variable)			
Student satisfaction and enjoyment (SAT variable)	0.814		
Academic performance (PER variable)	0.859	0.748	

Table 4. Percentage of students who had low/high enjoyment and expectations.

	Low Enjoyment	High Enjoyment	Total
Low Performance	25 (73.53%)	48 (51.61%)	73 (57.48%)
High Performance	9 (26.47%)	45 (48.39%)	54 (42.52%)
Total	34 (100%)	93 (100%)	127 (100%)
Pearson chi2(1) = 4.893 Pr = 0.027			
	Low Expectations	High Expectations	Total
Low Performance	49 (81.67%)	24 (35.82%)	73 (57.48%)
High Performance	11 (18.33%)	43 (64.18%)	54 (42.52%)
Total	60 (100%)	67 (100%)	127 (100%)
Pearson chi2(1) = 27.221 Pr = 0.000			

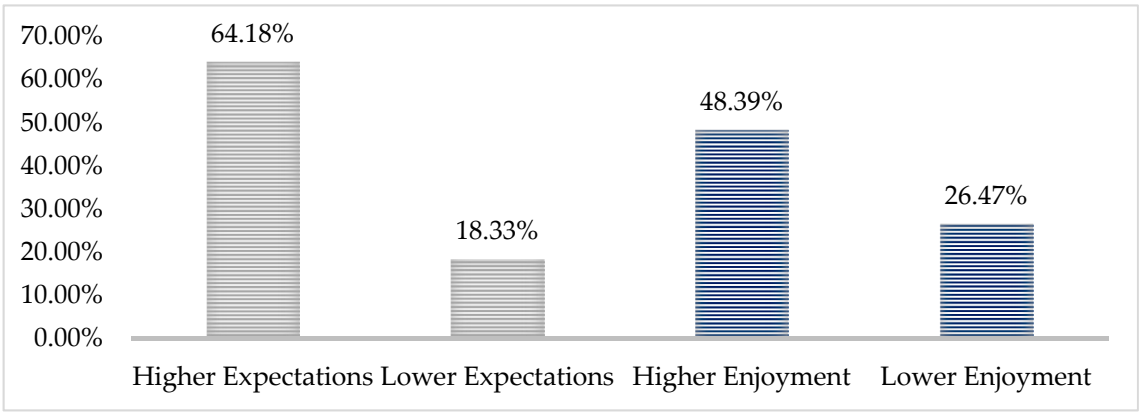

Figure 3. Percentage of students who achieved high academic performance.

3.3. Assessment of the Structural Model

Once the measurement model of variables was evaluated and its reliability and validity were confirmed, we could move forward with the structural outer model to test the study hypotheses. With the objective to analyze the cause–effect relation between the students' expectations regarding the utility of Kahoot (EXP variable) and the students' academic

performance (PER variable), a path analysis was conducted by PLS-SEM. The results are shown in Figure 4.

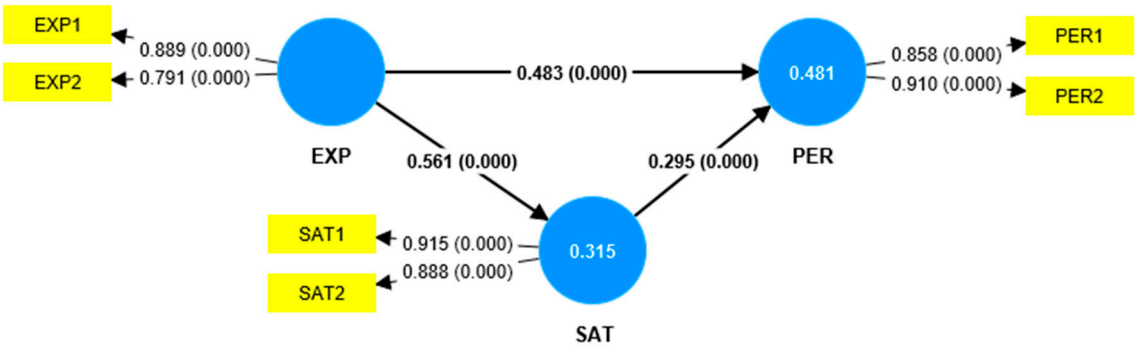

Figure 4. Utility expectations and students' academic performance relationship.

To assess the significance of the path coefficient of the structural model, bootstrapping was used with 5000 resamples [23]. The path coefficient from the utility expectations variable (EXP) towards the academic-performance-dependent variable (0.48 $p = 0.000$) shows, as expected, the positive and significant influence of students' expectations regarding the utility of Kahoot on their academic performance; consequently, hypothesis H1 was supported. The results shown in Table 5 also indicate empirical support for the positive and significant indirect effect (0.16 $p = 0.000$) of the utility expectations variable on academic performance, by the satisfaction and enjoyment variable, supporting hypothesis H2. These findings reveal that the students' satisfaction and enjoyment using Kahoot moderated the positive influence of Kahoot's utility expectations on the students' academic performance. We used the SRMR as a goodness-of-fit measure for PLS-SEM [24], which allows for assessing the average magnitude of the discrepancies between observed and expected correlations as an absolute measure of the model fit criterion. A value of less than 0.10 or 0.08 (in a more conservative version; see [25]) is considered a good fit. The SRMR index displayed, in our data, a value of 0.068, indicating a good model fit to the data [26]. The explanatory power of the tested model was high, as shown by the model R2 (48%). The predictive relevance of the model was also confirmed by the value reached by the Stone–Geisser cross-validation redundancy index (Q2 = 0.41).

Table 5. Estimation results for the structural equation model.

Cause–Effect Relations	Path Coefficients	t-Value	Percentile Bootstrap 95% Confidence Level	
			Lower	Upper
EXP => PER	0.483	6.448 ***	0.322	0.616
EXP => SAT	0.561	5.769 ***	0.323	0.716
SAT => PER	0.295	4.002 ***	0.103	0.387
Indirect Effects EXP => PER	0.165	3.206 ***	0.084	0.282
Variances explained R2	R2 satisfaction and enjoyment variable (SAT) = 31.5% R2 academic performance variable (PER) = 48%			
Stone-Geisser's Q2	Q2 satisfaction and enjoyment variable = 0.287 Q2 academic performance variable (PER) = 0.411			

*** $p < 0.001$.

4. Discussion and Conclusions

The results obtained in this study provide a comprehensive understanding of the influence of utility expectations, student satisfaction, and academic performance in the context of implementing Kahoot as a pedagogical tool. By contextualizing these findings within the framework of educational sustainability, key aspects highlighting the relevance

and positive impact of integrating interactive technologies in the educational domain are emphasized.

Firstly, it is crucial to note that more than 50% of the students expressed high utility expectations regarding Kahoot before its implementation. This result suggests a widespread acknowledgment by students that the platform can significantly contribute to their learning objectives. The alignment of these expectations with the perspective of sustainability in education is evident, as the incorporation of effective technologies can contribute to more efficient and, consequently, sustainable long-term learning [26].

Student satisfaction, assessed through motivation and enjoyment when using Kahoot, also showed equally positive results. Over 60% of the students expressed high levels of satisfaction and enjoyment. This finding reinforces the idea that the use of gamified technological tools, such as Kahoot, can not only enhance student engagement but also promote a positive and, ultimately, sustainable learning experience [27].

The results of academic performance, evaluated through the capacity for analysis and synthesis, as well as autonomous learning ability, align with the existing literature on the effectiveness of gamification in enhancing cognitive skills [28]. Notably, 42.52% of students achieved high academic performance, surpassing their average scores. These results suggest that gamification with Kahoot can be an effective strategy to foster the development of critical skills, consistent with the goals of sustainable education that aims to prepare students for a dynamic future [18].

The relationship between Kahoot's utility expectations and academic performance was confirmed through a path analysis. A positive and significant influence of utility expectations on academic performance was observed. Additionally, the moderating role of student satisfaction and enjoyment in this relationship reinforces the notion that a positive experience with technology can further enhance academic outcomes [29].

From a sustainability perspective, these results indicate that the effective integration of interactive technologies not only improves immediate educational efficacy but also contributes to shaping students committed to sustainable practices throughout their lives. The adoption of tools like Kahoot can cultivate not only educational efficiency but also students' willingness to embrace continuous learning and adaptability in a knowledge-driven world [30].

As limitations of the study, it can be highlighted that the study primarily focuses on short-term outcomes and perceptions of Kahoot's effectiveness. Long-term effects on students' learning and behavior need further exploration to fully understand the sustainability of its impact. Also, the research primarily relies on self-reported data, which may be subject to biases such as social desirability or recall inaccuracies. Combining self-reports with objective measures could enhance the validity of the findings. The study's sample size and demographics may limit the generalizability of the findings. Future research could include a more diverse population to ensure broader applicability.

Longitudinal studies could track students' academic progress and behavior over an extended period to assess the sustained impact of Kahoot on learning outcomes and engagement. Comparative studies could investigate the effectiveness of Kahoot relative to other interactive learning platforms, considering factors such as user interface, content flexibility, and adaptability [31].

In conclusion, this study underscores the importance of considering expectations, student satisfaction, and academic performance in the implementation of interactive learning platforms, such as Kahoot. The connection between these elements not only enhances immediate educational effectiveness but also contributes to the development of sustainable educational practices, preparing students to face future challenges in an informed and engaged manner.

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Appendix A

Table A1. Survey Instruments Used.

Expectations and enjoyment		Please indicate the extent to which you agree with the following aspects in various learning decisions. (0 = totally disagree, 5 = totally agree):		
Question	Indicators	Minimum	Maximum	Measure
Q1.	Using Kahoot will increase the opportunities to achieve important goals for my learning	0	5	Likert 0–5
Q2.	Using Kahoot will help me acquire skills more quickly	0	5	Likert 0–5
Q3.	Using Kahoot motivates me to learn	0	5	Likert 0–5
Q4.	Using Kahoot makes me enjoy learning	0	5	Likert 0–5
Academic performance		Formative assessment to evaluate students' academic performance. (0 = minimum score, 5 = maximum score)		
Question	Indicators	Minimum	Maximum	Measure
Q5.	Student capacity for analysis and synthesis	0	5	Likert 0–5
Q6.	Autonomous learning ability	0	5	Likert 0–5
			Descriptive statistics	
Question	Indicators	Mean	Median	S.D.
Q1.	Using Kahoot will increase the opportunities to achieve important goals for my learning	3.68	4.00	1.07
Q2.	Using Kahoot will help me acquire skills more quickly	3.63	4.00	1.14
Q3.	Using Kahoot motivates me to learn	3.57	4.00	1.15
Q4.	Using Kahoot makes me enjoy learning	3.94	4.00	1.14
Q5.	Student capacity for analysis and synthesis	3.61	4.00	1.01
Q6.	Autonomous learning ability	3.49	4.00	1.23
			First-order constructs	
Question	Indicators	Factor 1 (student expectations)	Factor 2 (student satisfaction)	Factor 3 (academic performance)

Table A1. *Cont.*

Q1.	Using Kahoot will increase the opportunities to achieve important goals for my learning	*0.889* ***		
Q2.	Using Kahoot will help me acquire skills more quickly	*0.791* ***		
Q3.	Using Kahoot motivates me to learn		*0.915* ***	
Q4.	Using Kahoot makes me enjoy learning		*0.888* ***	
Q5.	Student capacity for analysis and synthesis			*0.860* ***
Q6.	Autonomous learning ability			*0.909* ***
Mean		0.000	0.000	0.000
Median		0.181	0.249	−0.047
S.D.		1.000	1.000	1.000
Composite reliability (CR)		0.828	0.897	0.878
Extracted variance (AVE)		0.708	0.814	0.783
Goodness of fit: SRMR = 0.068				

(***) Significance of 99%; Standardized loading of items (*in italic*).

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