Impact of the Use of Gamified Online Tools: A Study with Kahoot and Quizizz in the Educational Context

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***Abstract*—Developing effective feedback is fundamental to meaningful learning. Therefore, understanding how gamification tools influence feedback can have a significant impact on improving the educational process and students' academic performance. By comprehending the impact of platforms like Kahoot and Quizizz on feedback for learning, educators can make more informed decisions on how to use these tools to maximize the benefits of online learning. In this context, the research aims to assess the impact of online gamification tools, such as Kahoot and Quizizz, on the feedback process of student learning. Pre-knowledge tests, quiz applications, and final tests were conducted as part of the methodology. Additionally, the applied methodology involved a sample of 24 students selected through convenience sampling. The questionnaires assessed prior knowledge, feedback, and assimilated knowledge. Multiple-choice questionnaires were created, and an assessment rubric was applied to evaluate the quality of the questionnaires. The research results demonstrate significant progress in the use of gamification platforms, highlighting the effectiveness in providing learning analytics. Quizizz was more effective than Kahoot in providing feedback. Questionnaire results indicated an increase in knowledge and understanding of the subjects. In conclusion, gamification influences feedback, enhancing learning, and motivating students. The tools enable instant review questions, visualization of rankings, and summary of participation. These findings strengthen the effectiveness of gamification in education and its contribution to the feedback process of learning.**

***Keywords*—gamification, Kahoot, Quizizz, feedback, teaching, learning**

I. Introduction

In the current context marked by the rise of gamification, emerging educational tools is not only redefining how we learn but also having a far-reaching impact on social and ethical aspects involving students and educators, particularly those employing Information Technology systems [1]. while gamification can be an effective strategy in a variety of contexts, it is critical that it is applied equitably and addresses issues of access and diversity. Its influence extends beyond engagement and motivation to broader issues of equity and access in education and beyond. One essential aspect involves promoting equitable access to these information systems, considering the development of various free online tools that align with the accessibility of Information Technology, particularly the Internet.

However, the limited availability of these gamification tools can create a digital divide, as people who do not have access to the technology may miss out on its potential benefits to promote learning [2]. According to Maraza-Quispe *et al.* [3], in an environment where society finds itself at a historical juncture demanding a full understanding and application of fundamental knowledge, there arises an urgent need to address not only "know-how" and "know-how-to-live-together" but also "knowing" and "knowing-how-to-be." These facets of learning are intrinsically linked to crucial life competencies, and their development is driven by education. In this quest for educational methods that are both challenging and engaging, gamification emerges as an innovative strategy. By incorporating digital tools into playful experiences, gamification seeks to provide constant and enriching feedback for learning, all within a fun and stimulating environment. In this context, a crucial challenge is that the educational experience must be a continuous exploration and constant reflection, where the student assumes a leading role in their own learning process [1].

This research focuses its analysis on the technology applications Kahoot and Quizizz, which are paradigmatic examples of gamified tools. The objective is to assess to what extent these gamification strategies, embodied in these applications, contribute to the process of providing feedback on student learning. Gamification involves the use of game-based mechanics, aesthetics, and playful thinking to engage people, motivate action, and promote learning [4]. This entails a process related to player thinking and game techniques to attract users and solve problems [5]. Gamification, which involves the application of game elements in non-game contexts to motivate participation and engagement, can be used in a wide variety of contexts. Some of the different contexts in which gamification can be used include: Human Resources, health and wellness, marketing, etc. [6]. As Hamari and Koivisto stated [7], the primary goal of gamification is to influence people's behavior. Gamification creates engaging experiences that motivate people, makes them feel autonomous and, as a result, brings about a significant change in their behavior. It also allows for the possibility of introducing different curricular activities that capture students' attention and engage them in the learning process [8]. The main objective of gamification is essential to motivate and stimulate continuous learning actions in an entertaining atmosphere, changing behaviors, creating an active and meaningful educational experience where learning sessions are dynamic, and students' attention is focused. Additionally, Marín [9] indicates that it was initially conceived as a strategy to introduce connectivity and

commitment to building a community to enhance meaningful learning through the use of certain game elements (badges, points, levels, progress bars, avatars, etc.). Players increase their dedication time and become much more involved in completing a specific activity [5]. Finally, Contreras and Eguia [10] conclude that educational gamification places the student at the center and focuses on how the student perceives the content being presented in class. Therefore, gamification promotes the achievement of educational objectives in terms of content and competencies (especially social) and values. It also promotes teamwork and the development of intellectual skills.

Gamification in education, involving the use of game elements in academic contexts, has gained research interest. The research conducted by González and Robles [11] analyzed scientific publications on gamification in education up to 2017 using Web of Science data. There was a steady increase in the number of research studies, although it decreased in the last year. However, an increase in research quality was highlighted, indicating a greater scientific interest and focus in this area.

Kahoot, due to its interactive nature, has developed social learning and intellectual curiosity, becoming a playful assessment tool [12]. Educators can use it for assessment purposes or challenge students to use research methods to create their own quizzes [13]. Quizizz is a gamified online quiz platform focused on creating, sharing, and evaluating educational content accompanied by avatars, leaderboards, themes, music, and memes. According to Quizizz's own description, it is a free formative assessment tool that allows for fun assessments in both classroom and homework modes. Additionally, the wealth of information provided by Quizizz in the reporting section allows us to evaluate not only how individual students are doing but also which concepts have been better or worse assimilated by everyone when statistics for certain questions are very low or very high [14].

Feedback on learning is defined by Reyes [15] as the information provided by an agent, which could be a teacher, a team member, a book, or oneself, about the academic performance of a learning activity. In this sense, Vives and Varela [16] comments that feedback is the ability of an external agent to provide specific information to the student about their performance to help the learner reach their maximum learning potential according to their stage of education. Maraza-Quispe *et al.* [3] Adds that feedback provides opinions, well-founded judgments about the learning process, with students' successes and errors, strengths, and weaknesses. Therefore, it must be descriptive, simple, and objectively clear and centered on the activity, in which case it reduces the emotional burden on students since the situation is represented as manageable [17]. Feedback is the metacognitive action directed (internally or externally) at learning and performance in a particular area. Considered an important activity in the teaching-learning process because it objectively allows seeing the learning achievements or non-achievements of students in simple and objective environments that enable strengthening and reducing the emotional load when learning. In this aspect [18], it is suggested that feedback provides individuals with information about what they are doing. Vital information for monitoring their performance, reinforcing changes made. It allows people to self-discover and helps them assess certain situations or behaviors. Furthermore, teachers establish a harmonious and collaborative relationship with parents [19]. In this way, it encourages people to do things better each time, boosting their self-esteem and confidence [20]. According to Reyes [15], feedback seeks to make the student aware of the discrepancy between what they understood and what they should have understood or how they performed to meet the learning objectives of each activity. In summary, feedback allows the student to be aware of what they are doing in their learning process, including links with parents, thus leading to the development of analytical, critical, confident, and motivated capacities. It also allows for self-discovery of the path of learning, valuing and evaluating their participation at the beginning, during, and after generating conclusions about their successes and errors to improve academic performance. This process should be present at all times during student learning as an advisory and guiding tool, notifying students if the specific subject's learning objectives are met, their performance in the proposed activities, and linking it to the subsequent activity to continue achieving the objectives.

Kahoot and Quizizz are online gamification and interactive learning platforms. They allow educators to create quizzes and educational activities in a game format to engage students in the learning process in a fun and participatory way. Students can answer questions in real time using their mobile devices or computers and receive instant feedback on their responses. These tools encourage friendly competition among students and provide an effective way to assess students' knowledge and progress [21]. As Artal [22] points out, games are fun, and reviewing a quiz or having a debate during the game can make these activities exciting and engaging for students. On the other hand, both the teacher and the student get good feedback on the assimilation of the material taught in the classroom. There is also a close relationship between the introduction of gamification in teaching methodologies and the improvement of student motivation, interest, and participation, as well as the classroom atmosphere, as a result [23]. The way they are developed using features like timed questions, immediate scoring, personal rankings, reinforcement messages or motivation, and subsequent detailed individual and collective information for each question and for the entire assessment allows students and teachers to have real-time information about student performance at each stage of the application process. This immediacy makes students aware of every action they take when learning, creating a constant feedback during and after the educational experience. In this sense, a reflective and motivating attitude is developed, as students know their strengths or weaknesses that should be considered each time, they learn something personally.

The relationship between online gamification tools Kahoot and Quizizz in providing feedback on learning objectives and performance has been confirmed through research, such as those conducted by Cano [24], where students were given learning objectives based on the formation of work groups to study a specific topic, create a scientific poster, and design three questions about the researched topic. Subsequently, a questionnaire was designed using the Kahoot platform,

which included nine questions about what was learned. According to the research, this activity allowed for maintaining attention and increasing students' motivation and participation in group work presentations.

Participants are players, and as such, they are at the center of the game and must feel involved, make their own decisions, feel that they are making progress, take on new challenges, participate in a social environment, be recognized for their achievements, and receive immediate feedback [25]. In short, they should have fun while achieving their gamified learning goals.

The scientific article is organized in such a way that in the first part, we present the introduction that introduces the research problem and objectives, followed by the methodology that describes the methods used, results that present the findings, discussion that interprets the results and contextualizes them in the existing literature, conclusions that summarize the key points, and a list of cited references.

II. Literature Review

Regarding similar research findings, Forssell and Hassan *et al.* [26] discussed the accessibility of educational games, particularly Kahoot and Quizizz, for older students. The studies highlight the barriers and challenges these students face when using these games, such as the game pace, classroom space design, and difficulties in logging in and understanding the rules of the game. However, the studies also show that older students are eager to participate in educational games when appropriate design and facilities are provided. It is found that the use of educational games is beneficial for teaching older students about cybersecurity threats and represents a positive and novel experience for them. The studies emphasize the need for more research on the accessibility of educational games for older adults and suggest integrating accessibility into game design. Likewise, research conducted by Göksün and Gürsoy [27] aimed to investigate the reflections of gamification activities (Kahoot and Quizizz) used as formative assessment tools on student performance and participation in learning environments. It also sought to investigate whether the use of a gamification application led to differences in student performance and participation. In the study, where two experimental groups and one control group were assigned, formative assessments were carried out at the beginning and end of each class using Quizizz in one experimental group and Kahoot in the other experimental group, following the participation and assessment steps of the 7E (model based on seven stages that guide the teaching and learning process) teaching model. In the control group, formative assessment was conducted with conventional questions and answers. The quantitative findings of the study suggested that gamification affected student academic performance and participation in the scientific research methods course. However, the inability to determine the direction of this impact through post hoc tests indicated the possibility of an effect due to an interaction between measurements. Therefore, the graphs produced by MANOVA were examined. In the graphs, it was observed that the impact of instructional activities based on Kahoot on student academic performance and participation was greater compared to the control group. On the other hand, educational activities conducted with Quizizz were less effective compared to the control group. The limited visual feedback capacity of the Quizizz application, the fact that questions advanced at an individual pace, and individual technological problems experienced by participants may have hindered student academic performance and participation, as indicated by qualitative findings. Similarly, Janković *et al.* [28] aimed to determine whether gamification through Kahoot and Quizizz contributes to the development of a deeper conceptual understanding and retention of terrestrial artificial habitat content taught to third-grade elementary students. 72 students (9–10 years old) were divided into the following groups: E1, which learned with Kahoot, and E2, which learned with Quizizz. The results of the ANCOVA analysis showed that both Kahoot and Quizizz contribute to the development of both variables, with Kahoot being much more efficient than Quizizz in terms of developing a deeper conceptual understanding and reasoning-level retention of the content learned. Kahoot was significantly more efficient than Quizizz at this level, which is likely related to the development and maintenance of student concentration during lesson implementation. Gamification as a tool should be applied in science classes, where preference should be given to the Kahoot platform, as it has a greater impact on developing student concentration during the lesson. The research conducted by [29] showed that Quizizz is preferable for participants compared to Kahoot! because in Quizizz, the questions and answers appear on the screens of individual participants' mobile phones or laptops, so they do not need to look at the screen before class as in Kahoot!; The response in Kahoot! consists of a symbol, whereas in Quizizz, the actual response consists of words, numbers, or figures; after completing the quiz, the answered questions can be reviewed to identify those that were answered incorrectly or that participants poorly mastered.

According to Cespón and Lage [30], they investigated the effectiveness of gamification in online teaching. Experiments were conducted with three groups of students, each experiencing different gamification approaches, including rewards. The results indicate that gamification and technology are not always as motivating as expected. Factors such as the teacher-student relationship, rewards, and isolation in online teaching affect participation. Low participation highlights the importance of considering all students. Furthermore, it is concluded that direct interaction with the teacher is crucial for student motivation in online learning.

Most research focuses on the immediate effects of gamification of feedback and learning. Investigating how these effects persist in the long term would be crucial to better understand the durability of gamification in improving learning. Additionally, research has been conducted in university contexts, but it is essential to explore how gamification and feedback work at lower educational levels, such as primary and secondary education. Examining how gamification and feedback vary in different cultural and educational contexts can provide valuable information about their effectiveness in various settings. Different areas of study may require specific gamification and feedback

approaches. Researching how these strategies are applied in specific academic disciplines may be essential. Often, research focuses on the student experience. However, it is essential to consider how teachers perceive and use gamification and feedback in the classroom. Since gamification can involve rewards and competitions, it is relevant to investigate the ethical aspects of its implementation in educational environments and how it can affect students' intrinsic motivation. The research to be developed aims to address these gaps. Therefore, the research's objective is to evaluate the impact of online gamification tools like Kahoot and Quizizz on student learning feedback.

Kahoot and Quizizz were selected for this study because the lead author, who conducted the field experiments, has regularly used them in teaching and learning in Regular Basic Education in different schools. Kahoot and Quizizz are internationally popular educational tools and have a similar design; however, they have slight differences that can provide information about which design may be more accessible [26]. For research purposes, we consider both to be intuitive and simple enough to use. A Kahoot game can be created and played on mobile phones, tablets, computers, or any Internet browser for free, and paid licenses with additional features can be purchased. It resembles a traditional questionnaire with one question displayed at a time and four answer choices to choose from. The question-and-answer options are displayed on a shared screen, and students can select their answer using their personal device. Typically, Kahoot games have a time limit and a live leaderboard showing the points earned and ultimately the game's winner. Quizizz is a similar software. A Quizizz game can be created and played for free using mobile devices, tablets, or computers. Quizizz, however, offers more freedom in terms of game types, features, and interactive lessons. For example, Quizizz can be played as a live "teacher-paced" quiz, where participants advance together, or in a "classic" mode where participants progress at their own pace. Both educational games, Kahoot and Quizizz, can be considered fairly lightweight uses of educational gamification. However, especially Kahoot is widely used and has shown various positive results in recent research [31].

III. Methodology

The methodology used follows an experimental quantitative approach, starting from the premise of adapting educational strategies to optimize the learning process. To carry out this research, several stages were conducted. First, pre-knowledge tests were administered to establish a baseline of knowledge in the students. Then, questionnaires and final exams were applied to assess the effectiveness of online gamification tools on learning feedback. The sample involved in the study consisted of 24 students. The topics evaluated were "Technology in Healthcare" and "Technology in Home and Leisure." The questionnaires consisted of multiple-choice questions, and an assessment rubric was designed to measure the quality of the questionnaires. The evaluation of the "Technology in Healthcare" and "Technology in Home and Leisure" topics in the research for the "Information and Communication Technology" course is based on their relevance, societal importance, connection with the student audience, potential for innovation, and the diversity of technological applications they offer. These topics provide a comprehensive view of how technology impacts different aspects of everyday and professional life. As can be observed in Fig. 1.

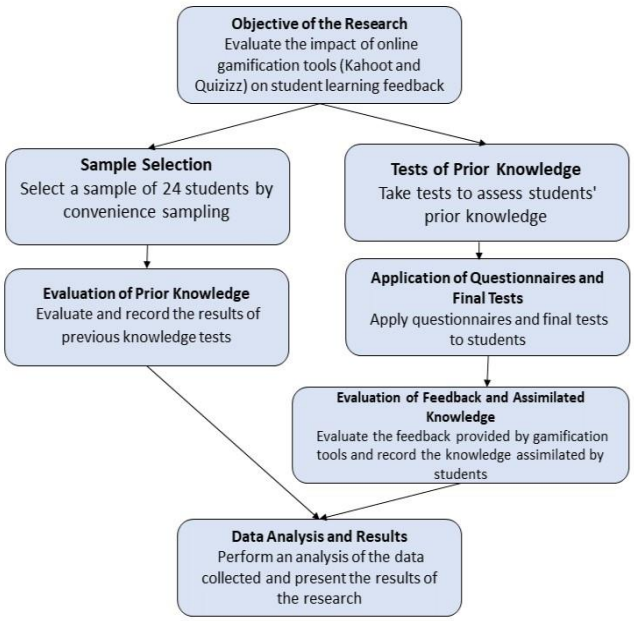

Fig. 1. Methodology used in the research.

Fig. 2 shows the relationship between the research variables and the research hypothesis.

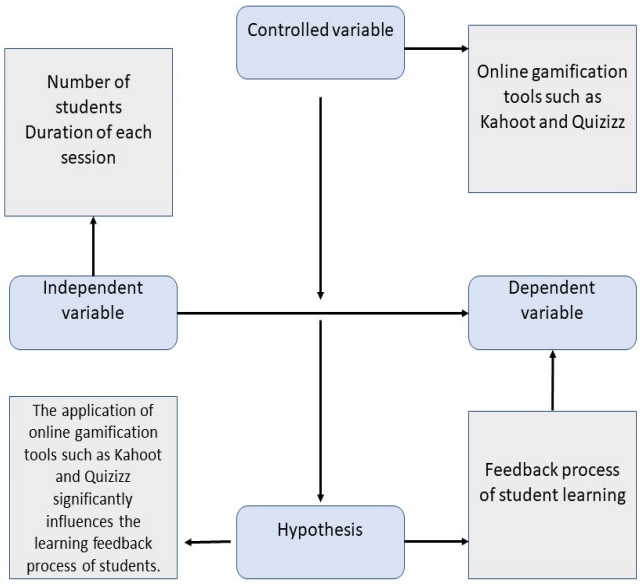

Fig. 2. Relationship among research variables and hypotheses.

A. Population and Sample

The population for this research consists of 100 third-year high school students. The research sample is comprised of 24 students who were selected through convenience sampling, taking inclusion criteria into account, such as access to technology and availability to participate in the experiment. Two specific topics were worked on: "Information

Technology in Health" and "Information Technology in Home and Leisure." To achieve this objective, knowledge assessments covering both mentioned topics will be carried out. These assessments are designed to measure students' understanding and level of knowledge regarding the applications of information technology in health and domestic and entertainment contexts.

Sample and application periods of the Kahoot and Quizizz gamification tools are shown in Table 1.

Table 1. Sample and application periods of the gamification tools Kahoot and Quizizz

Gamification Tool	Number of Students	Number of Teachers	Period of Days	Duration of Each Evaluation
Kahoot Application	24	1	30 days	20 min
Quizizz Application	24	1	30 days	20 min

B. Data Collection Instrument

The questionnaires were implemented on the Kahoot and Quizizz platforms, and their reliability was determined using Cronbach's Alpha. The Cronbach's alpha reliability test was conducted on a questionnaire consisting of 30 items (E1 to E30) answered by respondents. The table presents the responses of each respondent to the items, with the sum of responses for each item displayed in the rightmost column. The variance for each item is shown, with the total variance of the instrument calculated as 27.690. The formula for Cronbach's alpha reliability coefficient α is provided, which is a measure of the questionnaire's internal consistency reliability. In this case, the calculated Cronbach's alpha coefficient is 0.75, indicating a moderate level of reliability of the questionnaire with 20 items. This suggests that the questionnaire demonstrates a satisfactory level of internal consistency, where higher values of alpha generally indicate greater reliability.

The validity of the questionnaires was assessed through expert judgment. Some examples of questionnaires implemented in Kahoot and Quizizz are shown. Quizizz and Kahoot. The validation of the Kahoot and Quizizz questionnaires through expert judgment involved a thorough review of the questionnaires by a group of experts in the related field. These experts assessed the quality and suitability of the content, providing detailed feedback and recommendations for improvement, and rated the questions and answers according to predetermined criteria. The process included iterations to adjust the questionnaires based on the experts' suggestions and culminated in a validation report that documented the entire process. This validation ensured the reliability and validity of the questionnaires before their implementation in Kahoot and Quizizz.

The design will be primarily influenced by this factor. A key factor for success in the design of a gamified system is its suitability for different types of players [32]. Table 2 shows the criteria for applying the instruments.

Questionnaires are developed and designed in Kahoot and Quizizz with the following characteristics:

- Pre-knowledge questionnaire: This questionnaire will allow the teacher to assess the previous knowledge that students have before starting with the first topic.
- Learning feedback processes: Tool that will reinforce students' learning.
- Final questionnaire of assimilated knowledge: This final questionnaire will allow the teacher to verify if the appropriate techniques were applied correctly in the learning feedback process.

Table 2. Application criteria for the instruments

Tool	Questionnaire Type	Topic	Measurement Method
Kahoot	Pre-knowledge Questionnaire Progress of Subject Content and Feedback Final Assimilated Knowledge Questionnaire	Topic 1: Technology in Health	Measurement is done by counting correct and incorrect answers provided by the platforms once the questionnaires are completed in an Excel document.
Quizizz	Pre-knowledge Questionnaire Progress of Subject Content and Feedback Final Assimilated Knowledge Questionnaire	Topic 2: Technology in Home and Leisure	Measurement is done by counting correct and incorrect answers provided by the platforms once the questionnaires are completed in an Excel document.

Each questionnaire is evaluated according to the following criteria in Table 3.

Table 3. Evaluation criteria and scheme for creating questionnaires in Kahoot and Quizizz

Unit: Health Information Technologies	Competency to Develop: Operates in virtual environments generated by information and communication technologies (ICT)
Sessions: 3	Topic: Telemedicine
Justification	Telemedicine offers a range of advantages and opportunities to enhance healthcare, making it more accessible and personalized.
Didactic Objectives	Learn and understand ICT terminology
Contents	Distinguish between ICT concepts Research new information technology concepts Health Information Technologies Diagnostic and Therapeutic Tools Telemedicine Electronic Medical Records Electronic Prescription Expert Medical Systems
Evaluation Criteria	Knowledge and understanding of specific contents Application of tools

Overall, the Table 4 serves as a concise reference for understanding the composition of the assessment, the types of questions students will encounter, and the time constraints associated with each question. It aids in planning and managing the assessment process effectively.

Table 4. Question type, number of questions, and duration

Question Type	Question	Duration
Case Studies	1	4 min
	2	4 min
Technology Terminology	3	1 min
	4	1 min
Distinguishing Concepts	5	1 min
	6	1 min
True or False Statement Concepts	7	45 s
	8	45 s
Knowledge-Expanding Student Questions	9	2 min
	10	2 min
Total Number of Questions: 10		

C. Proposed Rubric for Assessment Implemented in Kahoot and Quizizz

With the purpose of evaluating the assessments implemented in the Kahoot and Quizizz platforms, the following assessment rubric is proposed, which assigns a score based on the quality of the proposed questionnaire.

The rubric is structured to provide a comprehensive evaluation of assessments in terms of these criteria, allowing for a detailed assessment of their quality. The scoring scale enables assessors to assign scores that reflect the level of performance in each criterion, providing valuable feedback for improvement. See Table 5.

Table 5. Proposed rubric to evaluate the quality of assessments in Kahoot and Quizizz

Criteria	Insufficient (0–4)	Acceptable (5–8)	Good (9–12)	Excellent (13–16)	Exceptional (17–20)
Content Accuracy	The quiz contains significant errors in information or concepts.	The quiz has some minor errors in information or concepts.	The quiz contains accurate information but could be more comprehensive.	The quiz is complete and precise in the presented information.	The quiz is exceptionally accurate and detailed in the presented information.
Question Clarity	Questions are confusing and poorly worded, making them hard to understand.	Some questions are clear, but others are ambiguous or imprecise.	Most questions are clear, although some could be improved.	All questions are clear and easily understandable.	All questions are exceptionally clear and well-worded.
Variety of Question Types	The quiz contains only repetitive question types.	The quiz includes various question types, but the variety is limited.	The quiz presents a good variety of question types.	The quiz includes a wide variety of question types in a balanced manner.	The quiz demonstrates an exceptional and well-balanced variety of question types.
Challenge Level	Questions are either too easy or too difficult for the students' level.	Some questions present an appropriate challenge level, but others do not.	Most questions present an appropriate challenge level for students.	All questions present an appropriate and suitable challenge level for students.	The challenge level of all questions is exceptionally appropriate and engaging.
Interactivity and Engagement	The quiz lacks interactive elements or engaging questions.	Some questions are interactive and appealing, but others fail to capture attention.	Most questions are interactive and maintain students' interest.	All questions are interactive, appealing, and maintain a high level of engagement.	All questions are highly interactive and achieve exceptional engagement.
Feedback and Explanations	Feedback is absent or minimally useful for students.	Some questions provide feedback, but it is limited in usefulness.	Most questions offer useful feedback for students.	All questions provide useful and relevant feedback.	All questions provide exceptionally clear and enriching feedback.
Visual Design and Presentation	The design is disorganized and unappealing, making navigation difficult.	The design is acceptable but could be improved in terms of organization and aesthetics.	The design is clean and attractive, facilitating student navigation.	The design is visually appealing, clear, and enhances the student experience.	The design is exceptionally attractive and significantly enhances the student experience.

The characteristics of this rubric are as follows:

- Evaluation Criteria: The rubric consists of several specific criteria used to assess different aspects of the questionnaires, such as content accuracy, question clarity, variety of question types, level of challenge, interactivity and engagement, feedback and explanations, and visual design and presentation.
- Performance Levels: Each criterion has five performance levels: Insufficient, Acceptable, Good, Excellent, and Exceptional. These levels indicate the extent to which each criterion is met and allow for grading the questionnaire's quality in that specific aspect.
- Level Descriptions: For each performance level in each criterion, a description is provided that explains what is expected in terms of quality and criterion fulfillment. These descriptions help evaluators understand and consistently apply the rubric.
- Evaluated Aspects: The rubric evaluates a variety of key aspects of the questionnaires, such as content accuracy, question clarity and wording, diversity of question types, level of challenge, the ability to maintain student interest, provided feedback, and overall visual design.
- Focus on Improvement: The rubric was designed to provide constructive evaluation that can guide questionnaire creators toward continuous improvement. By identifying strengths and improvement opportunities, the rubric encourages the development of more effective and higher-quality questionnaires.
- Equity and Consistency: The rubric helps ensure that questionnaire evaluation is fair and consistent, as it provides clear criteria and specific descriptions for each performance level. This assists evaluators in avoiding biases and maintaining consistent evaluation.

(Note: Some terms like "evaluators" and "questionnaires" might need to be adjusted based on the context of use.)

IV. Results

It is observed in Table 6 that 71% of students have a regular level of prior knowledge in information technology for health. It is also shown that 21% have a satisfactory level, while there is an 8% of students with a low level of prior knowledge. Finally, we have 0% of students in the excellence category.

The Kahoot execution process begins with the facilitator of the educational experience. It is set up through hardware (projector, laptop, tablet, smartphone) with a common connection to the platform via the internet [2].

Table 6. Results of Kahoot and Quizizz application, collection of prior knowledge

Achievement of Learning Outcomes	Kahoot	Quizizz
At the beginning (0–11)	5	2
In progress (12–14)	17	17
Expected achievement (15-17)	2	5
Outstanding achievement (18-20)	0	0

In Table 6, it can be observed that, in general, most of the students are at the "In progress" level after the application of Kahoot and Quizizz during the collection of prior knowledge. However, only a small number of students have reached the "Expected Achievement" level. This might suggest that gamification tools and prior knowledge collection could be helping students to progress along their learning pathway, although there is still room for more students to reach the expected achievement level. The absence of students at the "Outstanding Achievement" level could indicate the need to explore additional approaches to challenge and stimulate students to reach higher levels of achievement.

In Table 7, it can be observed that as the three Quizizz applications progressed, there was a general improvement in students' scores. The number of students in the "Achieved Expected Level" and "Achieved Outstanding Level" categories increased in successive applications, suggesting that students were gaining a deeper understanding of the evaluated topic. These results indicate a positive learning trend over time and can be attributed to the continuous use of the gamification tool and the active learning process it provides. The application of these questionnaires allowed for utilizing one of the greatest "benefits of both platforms since it allows for the use of simple questions or questions with images and videos [33].

Table 7. Summary of trends of applied Quizizz

Indicators	Quizizz 1	Quizizz 2	Quizizz 3
At the beginning (0–11)	2	2	0
In progress (12–14)	17	7	6
Expected achievement (15-17)	5	13	12
Outstanding achievement (18-20)	0	2	6

Table 8. Summary of trends from applied Kahoot

Indicators	Kahoot 1	Kahoot 2	Kahoot 3
At the beginning (0–11)	5	1	0
In progress (12–14)	17	17	12
Expected achievement (15-17)	2	6	12
Outstanding achievement (18-20)	0	0	0

In Table 8, the results of the three Kahoot quiz applications showed a positive trend in learning as the sessions progressed. There was an increase in the number of students reaching the "Expected Achievement" level in successive applications, suggesting that students were enhancing their understanding of the subject. While there were no students mentioned in the "Outstanding Achievement" range, it is important to note that the results indicate Kahoot tool contributed to improving students' comprehension and knowledge, underscoring its effectiveness as a gamification tool in the educational process. In this way, and due to the benefits of feedback, the implementation of these gamified quizzes was carried out optimally. Additionally, as Maraza-Quispe *et al.* [2] adds, the best feedback is given and received when there is trust, when it is requested and desired, when it remains among the people who have participated in it, when it is motivated by an atmosphere of continuous improvement, when it has specific purposes, refers to concrete situations and actions, and there is a genuine concern for others. Furthermore, its application led to an increase in our attentional capacity, an enhancement in performance and the effort we are capable of devoting to a task, a sense of temporary suspension, and a feeling of pleasure that aids our ability to work effectively.

V. Discussion

The results of this study closely align with the growing trend of gamification in educational settings, highlighting its relevance not only for learning but also its social and ethical implications for users and society at large. The focus on students and educators using Information Technology systems, especially through gamified tools like Kahoot and Quizizz, demonstrates a shift towards adaptive educational strategies aimed at optimal learning experiences.

A significant aspect highlighted in this study is the role of gamification in promoting equitable access to information systems. The availability of free online tools, as explored in this study, underscores the importance of internet access for effective gamification implementation. There is a risk of a digital divide, if students lack the necessary access to these tools, which could hinder their ability to benefit from gamified learning experiences.

The study also aligns with the concept of holistic learning that encompasses not only knowledge acquisition but also essential skills like critical thinking, cooperation, and adaptability. This agrees with the idea that education should cultivate well-rounded individuals with skills beyond mere content comprehension.

The integration of gamification in education emerges as a powerful strategy to motivate student engagement and participation. The allure of games harnesses humans' inherent motivation and, when applied to education, brings a sense of enjoyment and challenge that enhances learning experiences. This approach shifts the roles of both educators and students, transforming them from mere transmitters and receivers of knowledge into active participants in a dynamic educational journey.

The discussion about Kahoot and Quizizz underscores their effectiveness in supporting learning and feedback processes. Kahoot's interactive nature enhances social learning and curiosity, while Quizizz's comprehensive feedback system contributes to a deeper understanding of the material. This discussion reflects the notion that gamified tools cater to diverse learning styles, making them valuable assets in the educational arsenal.

The impact of gamification extends beyond learning outcomes, reaching into the realm of self-assessment and self-regulation. The constant and instant feedback offered by these tools fosters a reflective attitude, enabling students to recognize their strengths and areas for improvement without the burden of negative emotions.

The results of this study reinforce findings from other researchers stating that gamification is based on behavior formation. By providing an engaging and challenging experience, gamification seeks to motivate a consistent learning behavior, encouraging individuals to strive for continuous improvement.

Furthermore, the connection between gamification and the feedback loop emerges as a central theme. The real-time feedback offered by platforms like Kahoot and Quizizz empowers students to actively monitor their progress, promoting metacognition and self-directed learning. This aligns with the belief that feedback is a fundamental aspect of the learning process, acting as a bridge between existing knowledge and desired learning outcomes.

In summary, the study's results resonate with the broader discourse on the transformative role of gamification in education. The integration of gamified tools like Kahoot and Quizizz not only enhances learning outcomes but also aligns with contemporary educational philosophies that prioritize engagement, self-directed learning, and holistic skill development. As gamification continues to evolve, its impact on the dynamics of education remains a promising area of exploration.

Furthermore, the results are corroborated by the research conducted by Nguyen and Yukawa [34], whose purpose was to examine in-depth how teachers integrate technology for learning in order to generate a taxonomy of technology use for future research and for enhancing teaching practice. Teachers highlighted how technology provides efficiency for educators and learners, making daily routines like checking and grading assignments quicker and easier, which in turn helped teachers restructure their time to focus more on instructional planning and delivery.

VI. Conclusions

This research has provided compelling evidence regarding the positive impact of online gamification tools, such as Kahoot and Quizizz, on the feedback process within student learning in the field of Educational Technology. These platforms have consistently demonstrated their capacity to elevate comprehension and knowledge levels in the subject of Information Technology in Healthcare, primarily through effective feedback.

The research has reaffirmed the advantageous influence of gamification in education as an effective strategy for enhancing feedback mechanisms. By fostering a playful self-assessment environment, this methodology empowers students to constructively identify their mistakes without experiencing negative emotions, ultimately promoting resilience. Digital quiz platforms like Quizizz and Kahoot have demonstrated their ability to deliver a motivating and valuable feedback experience for students. Their straightforward design and interactive interface have successfully boosted student motivation and focus during assessments.

The findings have underscored the pivotal role of feedback processes in achieving learning objectives. Gamified tools have made significant contributions to enhancing students' self-awareness and performance in the realm of Educational Technology. Notably, it was observed that 15% of students who engaged in the quizzes across all three stages (pre-assessment, feedback, and final evaluation) experienced a notable increase in their scores, indicating tangible progress in their understanding.

Regarding effectiveness, it has been established that Quizizz surpasses Kahoot in terms of providing feedback on learning. Quizizz feature allowing each student to respond at their own pace has proven more conducive to effective feedback compared to Kahoot, which involves all students in a single competitive game. Furthermore, the fundamental advantages of these tools can be categorized into two pivotal aspects: the transformation of learning into an active and enjoyable experience, and the provision of instant feedback tailored to individual performance.

The novelty of the research results lies in several aspects. Firstly, the assessment of the impact of gamification tools such as Kahoot and Quizizz of feedback in learning provides a fresh and valuable perspective on how these platforms can enhance the online educational experience. Additionally, the focus on the reliability and validity of the questionnaires used on these platforms adds a critical dimension to the research, ensuring that assessments are accurate and dependable. Moreover, the application of pre-knowledge tests and final exams in the context of gamification offers a unique insight into how these tools affect knowledge acquisition. Lastly, considering different player types in the design of gamified systems underscores the importance of adapting educational strategies to individual student preferences and needs, representing an innovative contribution to pedagogy. Collectively, these findings offer a fresh and valuable perspective on the effective use of gamification in online education and its impact on the learning process.

VII. Limitations and Future Recommendations

This study, which compares the educational gamification tools Kahoot and Quizizz, is just one piece of the larger puzzle in the realm of gamified learning. The landscape of educational technology is dynamic and constantly evolving, with an array of other gamification platforms waiting to be explored. Consequently, there's a clear call for future research that delves into how these platforms compare and differ concerning feedback mechanisms and their influence on learning outcomes. Moreover, this research concentrated on specific study areas, "Technology in Health" and "Technology in Home and Leisure," but there's a pressing demand for investigations spanning diverse academic disciplines. Each field of study may react differently to gamification strategies and the feedback provided. Expanding the scope to include various study areas will enrich our understanding of the cross-disciplinary applications of these educational technologies. Additionally, this study involved a relatively limited participant pool of 24 Spanish university students. To bolster the robustness and generalizability of the findings, it is crucial to undertake research with larger and more diversified populations, incorporating individuals from different educational levels and cultural contexts. Short-term effects of gamification on feedback were observed in this study, but the long-term impact remains an uncharted territory. As education continues to evolve and adapt to a rapidly changing world, assessing whether the benefits of gamification persist over time is of paramount importance. Furthermore, the mode of teaching is undergoing a significant transformation, with both virtual and in-person classes coexisting. The study concentrated on an online environment, but future research should explore the influence of gamification and feedback within these distinct teaching formats. Notably, external factors such as teacher support and access to technological resources can significantly impact the effectiveness of gamified learning. Thus, there's a compelling need for research that specifically investigates how these external variables interact with and influence gamification strategies. While this study primarily relied on quantitative data, an untapped dimension in this field is the qualitative evaluation

of students' perceptions and experiences. Incorporating qualitative methods can yield a deeper and more holistic understanding of how students engage with gamification and the feedback mechanisms.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest in relation to the research carried out.

AUTHOR CONTRIBUTIONS

Benjamín Maraza Quispe implemented the methodological design, Lady Cristina Traverso Condori, reviewed the background, Selene Belén Torres Gonzales performed the statistical analysis, Rocio Elena Reyes Arco analyzed the data, Santos Toribio Tinco Túpac implemented the discussion, Edwin Reyes Villalba and Jenny del Rocio Carpio Ventura contributed the conclusions and recommendations. All authors had approved the final version.

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