A GAMIFIED DIGITAL FRAMEWORK IN HIGHER EDUCATION: IMPACT ON LEARNING AND MOTIVATION

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ABSTRACT

The use of gamified digital tools has become a key and dynamic component in the work of educators, playing a crucial role in shaping various educational tasks. These tools offer a more playful, effective, and interactive learning experience aimed at increasing student motivation and providing immediate feedback. Based on these principles, this study proposes to analyze the improvement in student learning and motivation following the application of a didactic experience using gamified digital resources (Nearpod, Genially, Educaplay, Breakout, and Quizizz) in an online university classroom. The implementation was carried out over a five-month period with pre-service teachers (n=147) from the Bachelor's Degree in Early Childhood and Primary Education and the Master's Degree in Secondary Education and Teacher Training at a private Spanish university. A pre-experimental design with pre- and post-intervention measurements was employed. The research results demonstrate that the use of these gamified digital resources enhances students' perceptions of music learning in an online university environment. The findings reveal a positive impact across all evaluated areas following the didactic intervention, with significant improvements ranging from perceptible to moderate in university students' perceptions of learning and motivation. Therefore, the study's findings have practical educational implications, highlighting the appropriateness of using these digital resources not only in music courses but also in other subjects within the curriculum, promoting active learning in the classroom.

Keywords: Gamification, higher education, digital tools, online learning, motivation, music education.

INTRODUCTION

The use of Information and Communication Technologies (ICT) has had a significant impact on all spheres of life—social, political, and economic—over recent years. Naturally, it has also influenced the academic world and the way we currently learn and teach. The use of ICT in education has fundamentally altered the traditional concept of the classroom and its key figures, the teacher and the student (Abendan et al.,

2023; Alnasib, 2023). In this regard, education is immersed in processes of change and innovation, aimed at addressing the needs of 21st-century society. As a result, nearly all countries have implemented extensive reforms in their educational systems, striving to strengthen the synergy between school and society. The challenges posed by the knowledge society require teachers to incorporate new didactic strategies into the teaching-learning processes (Anaktototy, 2023; Angelova & Nikolova, 2024).

Similarly, with the integration of Spanish universities into the European Higher Education Area (EHEA), there is an undeniable need to develop teaching approaches that foster innovation, quality, and the continuous improvement of educational practices. For several decades, educational innovation has been an integral part of institutional policies within universities. Training future educators is a crucial link in aligning teaching practices with these changes and implementing new didactic strategies that adapt to this evolving context. In response to this need, various authors (Basilotta et al., 2022; Deroncele-Acosta et al., 2023) have proposed innovative alternatives for educational settings that aim to transform the learning process through active methodologies. One such approach is gamification, which involves the use of games elements (mechanics, dynamics, and components) in non-game contexts to support learning processes, allowing students to learn through them (Hayak & Avidov-Ungar, 2023; Lei et al., 2022). Gamification has demonstrated to have a positive impact on users' behavior (Anagnostopolou et al., 2018; Koivisto & Hamari, 2019), making students more autonomous, competent and motivated (Sailer et al., 2017). The playful process gamification implies has long been one of the most effective ways to teach and learn (Nadeem et al., 2023).

In this context, we highlight the work and research of several scholars (Kleimola & Leppisaari, 2022; Mojarro, 2019; Mokhtari et al., 2021; Okai-Ugbaje et al., 2022) among others, who argue that significant changes are needed in higher education institutions. Specifically, learner-centered methods must take precedence in order to significantly improve both students' skills and teachers' ability to create a rich and constructive learning environment. This shift encourages student learning through new educational trends that integrate innovative experiences into teaching-learning processes supported by ICT, providing opportunities for students to engage in the process, promoting meaningful learning, autonomy, and metacognitive self-assessment skills. In this model, the teacher becomes a mediator and facilitator of learning environments and experiences, with an emphasis on changes in teaching strategies and the use of new materials that incorporate active and participatory methodologies.

For all these reasons, we contend that the fusion of ICT and gamification in education has undoubtedly opened up significant opportunities for improving teaching-learning processes. Playful processes in the classroom have always been one of the most effective ways to teach and learn, as joyful learning experiences with appropriate didactic parameters can increase students' satisfaction and motivation toward their studies. Numerous studies and research focused on this topic (Torrado & Diaz, 2022; Dahalan et al., 2023; De Carvalho & Coelho, 2022; Ishak, 2023; Wang et al., 2021) emphasize that the adoption of digital educational games, as explored in this work, represents an innovative didactic experience. It offers both students and teachers a different educational practice, promoting digital literacy, participation, and access to information. These competencies enable learning to be not only content-based but also experiential (Greipl et al., 2020; Rodriguez et al., 2023; Saleem et al., 2022).

Likewise, the academic community has increasingly recognized the importance of linking technology with education and has begun to appreciate the potential of gamification to enhance motivation, improve group dynamics, foster reflective thinking, and facilitate meaningful learning in students (Jaaska & Aaltonen, 2022; Wang, 2023; Yanuarto et al., 2023). Among the advantages observed, students show greater interest and improved performance in the subject when this technique is employed, as it stimulates the desire to learn by creating a fun and dynamic classroom environment. Consequently, this study presents a novel educational experience in online higher education by implementing gamified digital learning as a means of instruction and training in musical content, using digital tools such as Nearpod, Genially, Educaplay, Quizizz, and Breakout. The use and practical application of these digital resources aim to enhance and support music teaching-learning processes, demonstrating that these applications can be highly useful in the educational field for driving the methodological renewal that students are calling for (Burton, 2019; Carrion & Roblizo, 2022; Hakami, 2020; Marievych et al., 2022).

As we can observe, gamification is an active methodology with great potential that promotes learning and serves as a source of motivation for students. As argued by Khaldi et al. (2023) and Zou et al. (2021), it is a perfect way to breathe life into course content and give students a sense of purpose both in and outside the classroom. In light of the aforementioned points, it is important to add that teachers who employ gamification and ICT in the classroom must also become developers of educational games, general video game developers, and therefore understand their functionality (Maspul, 2024; Mat Dangi et al., 2022). Indeed, as Muammar et al. (2023) and Murillo et al. (2021) suggest, teachers are the main driving force in the application of games in the classroom, serving as promoters, designers, and creators.

Based on the discussion above, we propose the following research question: Can the use of gamified digital resources improve students' motivation and perception of learning music in an online university context? Little research has been conducted on students' perception of their own learning and motivation when being instructed with gamified resources. Chaves-Yuste (2023) conducted a study to analyze students' perception about gamification, with both digital and analogical resources that addressed different issues involved in the didactic intervention. The learning process was one of the issues tackled. This study pinpointed that students felt they learned the curriculum content very successfully while developing their academic interest. Fithriani (2021) argued that university students perceived that learning through mobile-assisted gamification improved their learning outcomes significantly. They also reported being more motivated when using gamified resources to revise content rather than conventional resources. However, these studies focus on English as a foreign language learning and on face-to-face educational contexts. Serrano and Casanova (2022) conducted a longitudinal study in which digital gamified resources were employed to teach music in face-to-face university teaching. Students felt that learning was more personalized, which worked in favor of socio-affective and emotional aspects whith positive impact on their learning outcomes, feeling that their learning experience was more inclusive and helped them overcome their learning difficulties. In this regard, Carrion and Roblizo (2022) conducted a study to evaluate the extent to which gamification tools and multimedia resources, such as Cuadernia, Kahoot, Quizizz, and Socrative, can function as learning strategies aimed at improving academic performance, participation, and motivation among future educators in music courses within the context of higher education. The results demonstrated that adequate teacher training in the pedagogical use of ICT can lead to positive educational outcomes, provided that these tools are employed effectively. Similarly, Gomes et al. (2014) highlighted the study *Musical Journey*, an immersive educational experience that leverages a gamified virtual environment to teach music history. The platform recreates various aesthetic periods and musical styles, allowing students to visually and aurally explore the sounds, instruments, and composers representative of each era. By incorporating gamification elements such as rewards, missions, and interactive challenges, the environment seeks to stimulate curiosity, enhance motivation, and maintain students' engagement throughout the learning process. This resource not only offers a more dynamic and participatory approach to studying music but also fosters autonomous and collaborative learning through activities that simulate historical musical discoveries. Finally, Wang (2023) investigates how gamification can enhance learning through the design and use of educational musical games tailored for both adult and young learners. The study examines the effectiveness of these games in terms of motivation, content retention, and the development of musical skills. The findings reveal that gamified resources significantly improve the learning experience by promoting active participation, autonomous learning, and collaborative interaction.

Our main contribution is to analyze whether the implementation of an active methodology based on activities and games supported by technological tools enhances student learning and motivation in various music subjects within an online university context. The article is structured as follows: the following section describes the research model used in this study, as well as an explanation of all the technological tools implemented—Nearpod, Genially, Educaplay, Quizizz, and Breakout. Later on, we will show the results obtained after applying a statistic analysis of the collected data. Then, we will discuss these results and finally, the implications of the findings are discussed, and conclusions and future research directions are drawn.

METHOD

Objetives and Hypotheses

This study aims to contribute to the scientific literature on the use of digital resources in university teaching. The objective is to analyze the improvement in student learning and motivation following the application of a didactic experience involving digital resources (Nearpod, Genially, Educaplay, Breakout, and Quizizz) in an online university classroom. Current research (Pineda et al., 2023; Weisberg et al., 2022; Wilkins et al., 2023; Zhao et al., 2022) has indicated improvements and demonstrated that these tools can effectively promote student participation, interaction, and learning when applied to higher education subjects, both in face-to-face settings (Cabrera-Solano et al., 2022; Erkinovna, 2024; Mohamed & Yousif, 2022) and online environments (Carrion, 2022; De La Pena et al., 2021; Lampropoulos & Sidiropoulos, 2024). In this regard, within the context of online education, the following questions are raised: after the didactic intervention using several digital tools, does the students' perception of their learning improve? And does their level of motivation increase after the intervention?

The proposed objectives (O) in response to these questions are as follows:

O1. To analyze students' perceptions of learning before and after the didactic experience.

O2. To examine students' perceptions of motivation before and after the didactic experience.

Based on the objectives, questions, and scientific literature, the following hypotheses are formulated:

H0: The use of gamified digital resources does not improve students' perceptions of their learning and motivation in an online university classroom.

H1: The use of gamified digital resources improves students' perceptions of their learning in an online university classroom.

H2: The use of gamified digital resources improves students' perceptions of their motivation in an online university classroom.

Design

The methodological approach of this research is quantitative, employing a pre-experimental design with two measurements: one before the didactic intervention with digital resources (PRE) and one after the intervention (POST). The graphical representation or nomenclature of this design is as follows: *G O1 A O2,* where *G* represents the group of participants, *O1* the PRE-test measurement, *A* the didactic intervention, and *O2* the POST-test measurement. This design employs a single group of participants selected through non-random sampling, meaning that not all participants share the same initial conditions. Consequently, the group functions as the experimental group, with no control group for comparison. These factors could pose questions regarding the internal validity of the study. Thus, to address potential concerns about internal validity, two measures were adopted. First, variables such as gender, age, and academic degree were controlled. Second, both PRE-test and POST-test measures were utilized to provide a baseline reference for the group's learning and motivation levels prior to the didactic intervention.

There is only one group of students, who undergo the didactic intervention over the course of four online pedagogical practices from February to June in the 2023-2024 academic year. In February, the PRE questionnaire, along with the informed consent form, is administered via Google Forms. From February to June, the didactic intervention is implemented in the online classes using digital resources (Nearpod, Genially, Educaplay, Breakout, and Quizizz). At the end of June, the same Google Forms questionnaire is administered again. This questionnaire aims to assess and analyze whether there is an improvement in students' learning and motivation following the didactic experience with digital resources in an online university context. The POST questionnaire is also administered via Google Forms. Both the PRE and POST questionnaires are identical to avoid bias and to allow for comparison of the results. Additionally, gender, age, and academic degree are controlled variables in this research to avoid biases in the obtained results. Below, in Figure 1, a graphical representation of the steps of the research can be observed:
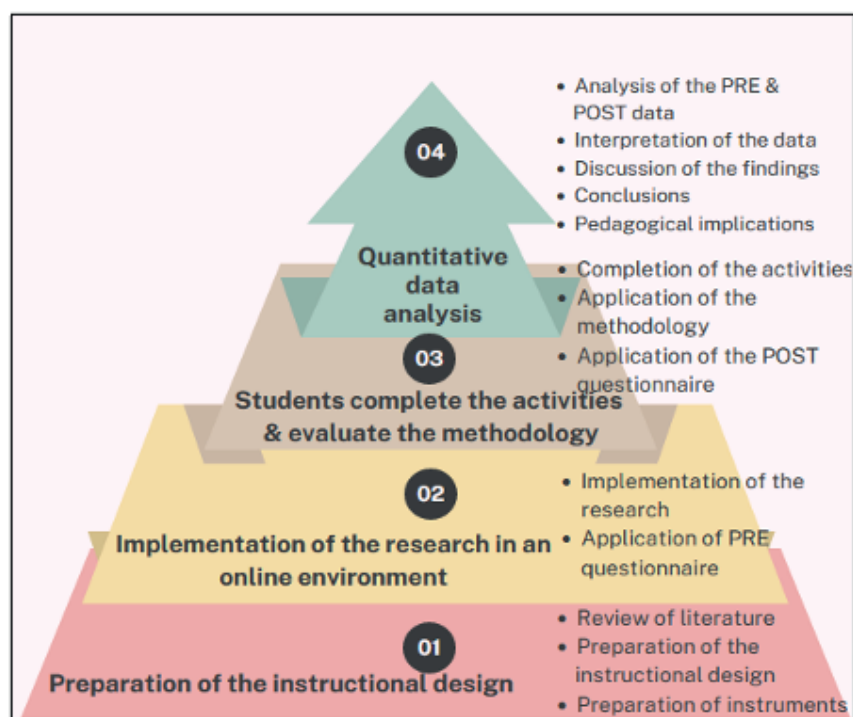
Figure 1. The steps of the research process.

Participants

The initial sample for the PRE questionnaire consists of 168 students, but 21 students are excluded due to missing attendance at some sessions of the intervention. Thus, the final sample comprises 147 students (79% female, 21% male), enrolled in the Bachelor's Degree in Early Childhood and Primary Education, and the Master's in Secondary Education and Teacher Training at an online private university. The subjects in which these digital materials were implemented include Didactics of Musical Expression as a core course in the Bachelor's program, and Music Education as an elective subject in the Master's program. The age distribution of participants is as follows: 41% are between 20 and 30 years old, 31% between 30 and 40, 25% between 40 and 50, and 3% are over 50. Regarding the academic degree distribution, 25% are in the Early Childhood Education degree, 49% in the Primary Education degree, 19% are specializing in Music Education, and 7% are enrolled in the Master's in Secondary Education and Teacher Training. Table 1 presents the distribution of the sample according to age, gender, and academic degree.

Table 1. Sample Distribution Count

	Early Childhood		Primary		Music		Master	
	Male	Female	Male	Female	Male	Female	Male	Female
20-30 years old	4	17	7	21	3	7	0	1
30-40 years old	0	8	5	18	2	6	4	3
40-50 years old	13	7	1	20	4	2	0	1
+50 years old	0	0	0	0	4	4	1	1

All students have Spanish as their mother tongue, and 93% regularly use digital tools for their studies. The sample was selected through non-probabilistic convenience sampling. This approach was used to include students enrolled in the Didactics of Musical Expression course at a private online university who voluntarily agreed to participate, leveraging their accessibility and proximity to the researchers. Inclusion criteria

included attending all sessions of the didactic intervention (including the initial and final questionnaire sessions), providing informed consent, and having no diagnosis of neurological or psychopathological issues. All participants were informed about the study and had to provide consent to participate. Any student was free to withdraw from the didactic intervention at any time. Additionally, all responses were individual and anonymous. The consent process and the research followed the guidelines of the Declaration of Helsinki. The research design and questionnaire were submitted to and approved by the Ethics Committee of the University of the Atlantico Medio (Spain) with the code N.º CEI/01-012.

Research Design

This educational innovation proposal is grounded in the use of gamification using Nearpod, Genially, Educaplay, Quizizz, and Breakout—offering a new approach to university learning contexts by turning learning into a real, dynamic, and meaningful experience. In this sense, we align with the views of numerous authors who justify the benefits of applying digital resources using gamification as a valuable methodology for increasing students' interest, motivation and participation (Dahalan et al., 2023; Subhash & Cudney, 2018).

Below is a description and explanation of the following didactic intervention and proposal, which allows students to work on the music-related content set by the university curriculum. The teaching method employed was a motivational and active approach in which students were involved at all times, enabling them to improve their motivation for learning while the teacher acted as a guide or facilitator throughout the process.

1st and 2nd Workshops: Nearpod Activities

During the first and second workshops, each lasting one hour, we used the Nearpod application, an online platform that supports student concentration and participation by serving as a digital tool for collaborative learning (Armas et al., 2023; Sanmugam et al., 2019). Nearpod offers two usage options: synchronous or asynchronous learning, allowing students to either participate live or student-paced. In our case, we primarily utilized the participate live option, which required each student to have a mobile device and the teacher a tablet or computer. The teacher initiated the lesson presentation by creating a session code, which the students used to join the class. Once all were present, the teacher progressed through the slides, giving students time to respond to the questions posed. The teacher could monitor the students' progress in real-time, identifying activities that required further explanation. The asynchronous option or student-paced was also offered to the students. A code valid for a specific period is shared via email or Google Classroom, enabling students to access the materials asynchronously.

The activities created with Nearpod were varied. The following is an example of one of the musical activities designed and implemented in the classroom using the Nearpod application during these two practical workshops, which can be found at the following web link:

https://app.nearpod.com/?pin=62CADA4BC6AD461766895AD947625B23-1&oc=user-created&utm_ source=link

The first activity was a quiz consisting of a multiple-choice test with three questions about the musical language content covered in class. In this case, the video option was used, allowing YouTube or custom videos to be attached, as was done here, and multiple-choice questions were added. This activity aimed to work on active listening, visually and auditorily, to foster student interest and meaningful learning.

The second game involves an activity in which students must complete blank spaces by inserting words or text. This game is an excellent alternative for reflection at the end of class or for assessing prior knowledge at the beginning. In this case, the activity aims to reinforce and work on musical alterations, such as sharp, flat, and natural signs.

The third game, titled "Time to Climb," (please, see below in Figure 2) is a quiz-based game that takes the form of a survey with questions. Each correct answer allows the player to climb the mountain, competing with other participants. This game consists of six questions on musical language, designed to review and reinforce key concepts such as clefs, American notation, musical notes, time signatures, bar lines, and repeat signs, among others.
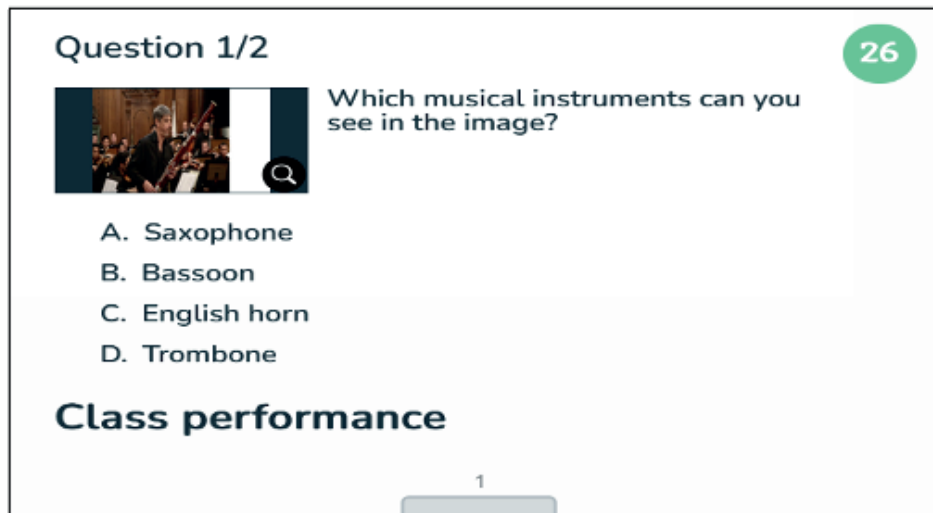
Figure 2. Time t o Climb. Question 1. (Own creation)

The fourth type of game consists of a video, with open-ended, questions to enable students to develop their responses, promoting analysis and meaningful learning. This activity focuses on auditory skills and active listening, reviewing and discussing aspects of music history.

The fifth type of game comprises open questions that students can respond via audio, video, or text. In this case, using an image of a musical score, students are asked to identify important aspects of musical language, such as note values, their types and durations, and the time signature shown in the score. Additionally, students are prompted to reflect on how they might modify the tone of the given song.

3rd Workshop: Genially and Educaplay Activities

During the third workshop, two quizzes were created using the Genially application (see an example of one of the quizzes in Figure 3), an online tool that facilitates the easy and rapid creation of all types of visual and interactive content, whether for individual or collaborative use (Dominguez Parrales, 2024; Tapia-Machuca et al., 2020). These games included quizzes that featured interactivity, predefined animations, and sound effects, enabling students to apply and practice the musical language concepts they had learned. In this case, the two digital games were structured as cooperative group activities to review, reinforce, and assess knowledge in the relevant subjects. A time limit of twenty minutes was set for completing each Genially activity, and the instructor supervised the entire process to ensure the task's completion within the allotted time.

Figure 3. Quizizz. Teaching & Music (https://view.genially.com/66ab6b49bac8d52d3d73bcc0)

To conclude the third workshop, students participated in a digital game created using the Educaplay application (see Figure 4), with a time limit of ten minutes to view and complete the activity. Throughout the process, the instructor managed the time and supervised the entire task.

Educaplay is a multimedia tool that allows educators to design, develop, implement, and track online learning activities grounded in gamification principles, such as crosswords, word searches, interactive maps, dictations, quizzes, word wheels, matching exercises, and classification and sequencing tasks, among others (Garcia-Martin & Garcia-Martin, 2020). In our case, we used it to present a video with interactive questions that addressed key concepts related to creativity, neuroeducation, and musical creativity, making it an optimal tool for implementation in higher Music Education, fostering active and meaningful learning in students.

Figure 4. Educaplay. Creativity and Neuroeducation. (https://es.educaplay.com/recursos-educativos/18317506-creatividad_y_neuroeducacion.html)

4th Workshop: Breakout and Quizizz Activities

To conclude this instructional experience, during the final workshop, students engaged in a digital Breakout activity using the Genially application, titled *"Protecting the Planet: Learning Music."* This online game was designed to collectively address musical content through Education for Sustainable Development (ESD). According to various authors (Makri et al., 2021; Moreno-Rodriguez et al., 2023), a breakout's goal unlock a box secured by locks, inside of which is a reward, after overcoming a series of challenges. In order to obtain the codes to unlock these locks, students must solve problems, answer quizzes, and decipher riddles. The use of this gamified tool in the classroom allows students to: (a) adapt to any curricular content, (b) promote collaboration and teamwork, (c) develop critical thinking and problem-solving skills, (d) improve communicative competence, (e) face challenges that require perseverance, (f) build deductive reasoning, (g) learn to work under pressure, (h) become the protagonists of their own learning, and enjoy a playful component that increases motivation (Fuentes, 2019; Kwong et al., 2022).

In this digital gamified Breakout (see Figure 5), participants faced the narrative of overcoming a series of challenges and missions to unlock locks while learning and reviewing various musical topics. As they successfully completed the assigned challenges in this engaging and meaningful gamified resource, they contributed to planet protection while enhancing the students' understanding of the seventeen Sustainable Development Goals (SDGs). The activity was designed as a group dynamic to be carried out during a practical session of the course, with a 40-minute time limit for resolving the challenges. The instructor managed the time and supervised the entire process, with students taking on the active role of protagonists in the learning experience.

Figure 5. Breakhout. Protecting the planet: Learning with music. (https://view.genially. com/66ac01462ed9f7df92501ab8)

To conclude this fourth workshop, students participated in a digital game using the Quizizz application (see Figure 6). Quizizz is a multiplayer quiz game similar to Kahoot, characterized by active pedagogy under the motto: *Teach with fun, have fun teaching*. This tool allows teachers to create a question-and-answer contest for playful education. The instructor generates the questions, and students access a webpage where they enter a code or PIN that gives them access to the quiz. They input this code using their mobile devices or tablets and register under their chosen alias, which then appears on the screen. Once inside, students answer the questions using their mobile devices as if they were game controllers. Their screens display three colors, each corresponding to a possible answer. The idea is to learn musical content through playing. This social and gamified educational web service rewards progress by granting higher scores to those who answer correctly and more quickly, placing them at the top of the leaderboard (Carrion, 2022; Jones et al., 2018).

This game offers students an interactive way to engage with and review course material, making learning both enjoyable and competitive, thus promoting deeper engagement with musical education.
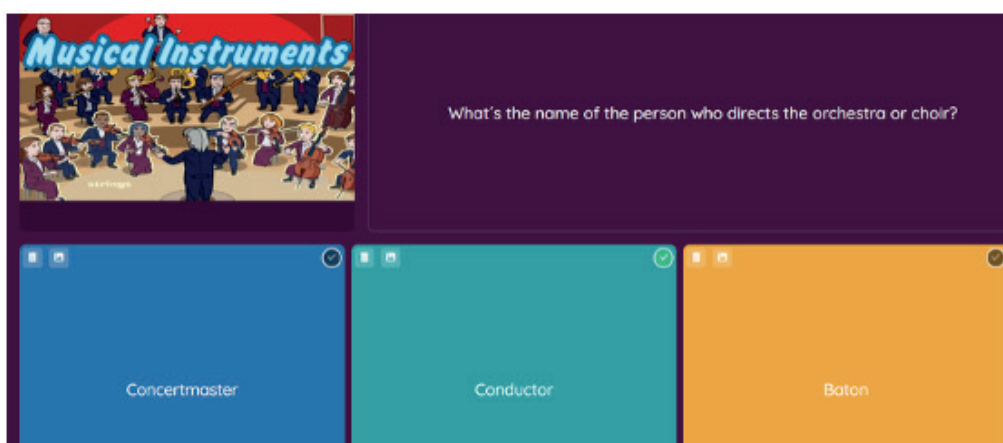
Figure 6. Quizz. The Concert: The instruments of the orchestra. (https://quizizz.com/admin/ quiz/6094f49927e67b001f0e58f3?source=quiz_share)

During the implementation of all these digital games in the classroom, it was observed how these applications motivate students from the outset, leading to more dynamic participation in class, such as asking more questions on the subject and offering more opinions during the discussions. In real-time classroom settings, the teacher gathers relevant information to tailor the progress of each student, fostering a positive disposition toward learning. Furthermore, through the various direct instruction sessions, continuous feedback on the students' development is provided, enabling the teacher to offer optimal educational support. At the conclusion of the intervention, a post-intervention questionnaire was administered to gather students' evaluations of the digital resources used.

Data Collection Instrument

Data was collected using both a pre-intervention and post-intervention questionnaire, designed to be identical.

Questionnaire

For this research, a questionnaire was designed and administered before (PRE) and after (POST) the instructional intervention. This questionnaire evaluates students' perceptions of their learning and motivation through the use of digital resources such as Breakout, Genially, Educaplay, Quizizz, and Nearpod during the lessons. The design of this questionnaire is based on scientific literature (Carrion et al., 2024), which employs similar questionnaires and justifies the improvement in learning perception and motivation using digital resources in higher education. The questionnaire developed by Carrion et al. (2024) was used as a foundation, with five additional items included.

The questionnaire consists of a 15-item Likert scale with responses ranging from 1 to 5, where 1 is strongly disagree, 2 is disagree, 3 is neither agree nor disagree, 4 is agree, and 5 is strongly agree. Students completed the questionnaire via Google Forms, accessible through a computer, tablet, or mobile device. The 15 questions are organized into two related categories:

- *Learning:* Items 2 (competence), 3 (non-memorized learning), 4 (different learning), 5 (unattainable objectives), 7 (realistic learning), 8 (improvement of learning), 9 (student-centered learning), 12 (autonomous learning), 13 (meaningful learning), 14 (knowledge), 15 (quality of learning).
- *Motivation:* Items 6 (motivation), 10 (participation), 11 (group work), and 16 (recommendation).

The reliability of the questionnaire, calculated using Cronbach's alpha and McDonald's omega, was found to be strong for both the PRE (α = .925, Ω = .938) and POST (α = .895, Ω = .916) questionnaires. Content validity was assessed by three education experts specialized in educational technology, with a good degree of agreement evaluated using the Kappa coefficient, yielding a value of .86.

Procedure and Data Analysis

Procedure

The procedure followed in this study was as follows: During the first class, students were informed about the research, the necessity of obtaining informed consent, the anonymity of the data, and their right to withdraw at any point. During this initial class, the PRE questionnaire was administered through a Google Forms link provided to the students. Subsequently, the instructional intervention took place over four practical workshops or sessions, each lasting one hour, using the following resources: In the first and second workshops, the Nearpod application was used. In the third workshop, various games created with Genially and Educaplay were implemented. Finally, in the fourth workshop, a Breakout activity and a review game using the Quizizz application were conducted.

All workshops were held across four practical sessions from February to June 2024. Upon completing the instructional intervention in June, the POST questionnaire was administered during the final online class through a Google Forms link provided to the students.

Data Analysis

To estimate the questionnaire results, it is essential to first evaluate the content validity and reliability of the questionnaire. Given that it is a Likert scale (ordinal data), the corresponding coefficients, in this case, Kappa and Alpha, were employed. The normality of each questionnaire item was then assessed using the Kolmogorov-Smirnov test, which indicated a significance (p= 0.000) below .05 for all items, confirming the assumption of non-normality. Consequently, non-parametric tests were applied to the data.

For the descriptive analysis, frequencies were used for each response option, and for the inferential PRE-POST analysis, the Wilcoxon Signed Rank Test (W) was employed. Effect size was measured using the biserial rank (95% Confidence Interval) and interpreted according to Coolican's (2009) classification of low, moderate, and high. To control for the effects of confounding variables that could bias the results, the effects of gender, age, and degree program on learning and motivation were examined. For gender, the Mann-Whitney U test was used, while for age and degree program, the Kruskal-Wallis H test was applied.

All analyses were conducted using SPSS version 27 (IBM, 2016) and R version 4.2 for effect size calculations (R Core Team, 2021). The significance level was set at p = .05.

FINDINGS

The results are presented in accordance with the research objectives and hypotheses.

O1. To Analyze The Perception of Learning Before and After The Instructional Experience

Figure 7 displays a comparison of the PRE and POST frequencies for each individual learning item. It is evident that the frequencies for responses 4 (agree) and 5 (strongly agree) increase across all POST items. Conversely, the frequencies for responses 1 (strongly disagree), 2 (disagree), and 3 (neither agree nor disagree) present in the PRE items decrease almost to the point of disappearing (remaining in only three items) in the POST items. This suggests that students are more inclined to agree with the perception of enhanced learning (significant, active, realistic, autonomous learning, with the acquisition of objectives, competencies, and knowledge) following the instructional intervention using digital resources (Nearpod, Genially, Educaplay, Breakout, and Quizizz) in the classroom.

Figure 7. Comparison of PRE-POST learning frequencies

As it can be observed in Table 1, the inferential analysis using the Wilcoxon Signed Rank Test (W) indicates that students perceive a significant improvement in all learning items after the use of Breakout, Genially, Educaplay, Quizizz, and Nearpod in the online classroom. Table 2 presents the number of positive, negative, and tie ranks, average ranks, sum of the ranks, W, significance level, and effect size. A statistically significant increase is observed in the POST questionnaire for all learning items, with a medium to low effect size. With this educational intervention approach, students feel more knowledgeable about the subject matter and more competent in using digital resources, perceiving their learning as more active, realistic, autonomous, and significant, allowing them to achieve objectives and become protagonists of a different, higher-quality learning experience. These results reject the null hypothesis (HO) and support the alternative hypothesis

(H1): The use of gamified digital resources enhances students' perception of learning in an online university classroom. Therefore, students perceive a positive improvement in their learning when digital resources such as Breakout, Genially, Educaplay, Quizizz, and Nearpod are used to explain course content.

Table 2. PRE-POST learning results

Variables		N	Average Rank	Rank Sum	W	p	Effect size
Competence	Negative ranks	19	35.18	668.50	3883	.000*	-.491
	Postivie ranks	53	36.97	1959.50			
Active learning	Ties	75					
	Negative ranks	39	45.09	1758.50	3956	.000*	-.424
	Postivie ranks	71	61.22	4346.50			
	Ties	37					
Different learning	Negative ranks	32	50.63	1620.00	2630	.009*	-.289
	Postivie ranks	63	46.67	2940.00			
	Ties						
Objetives	Negative ranks	39	47.00	1833.00	2611	.009*	-.288
	Postivie ranks	52	53.52	3318.00			
Realistic learning	Ties	46					
	Negative ranks	35	40.14	1405.00	2988	.003*	-.343
Learning improvement	Postivie ranks	57	50.40	2873.00			
	Ties	55					
Student-centered learning	Negative ranks	39	44.26	1726.00	2174	.030*	-.243
Autonomous learning	Postivie ranks	56	50.61	2834.00			
	Ties	52					
Meaningful learning	Negative ranks	35	44.40	1554.00	3235	.001*	-.359
	Postivie ranks	66	52.23	3297.00			
Knowledge	Ties	49					
	Negative ranks	26	41.61	1083.50	3726	.000*	-.434
	Postivie ranks	61	44.99	2744.50			
Learning quality	Ties	60					
	Negative ranks	19	40.95	778.00	5580	.000*	-.636
	Postivie ranks	73	47.95	3500.00			
	Ties	55					
	Negative ranks	28	46.11	1291.00	4174	.000*	-.457
	Postivie ranks	69	50.17	3462.00			
	Ties	50					
	Negative ranks	23	43.22	994.00	4675	.000*	-.535
	Postivie ranks	69	47.59	3284.00			
	Ties	54					

*p<.05

The analysis conducted to control for confounding variables in the learning items shows that there are no differences based on gender in either the PRE questionnaire (n = 147, U = 1632.500, p = .431) or the POST questionnaire (n = 147, U = 1794.000, p = .985). Similarly, there are no differences based on age in the PRE questionnaire (n = 147, H = 751, p = .861) or the POST questionnaire (n = 147, H = 5236, p = .155). No differences are observed based on academic degree in the PRE questionnaire (n = 147, H = 5264, p = .153) or the POST questionnaire (n = 147, H = 2769, p = .429). Therefore, gender, age, and academic degree do not generate significant differences that could influence the results regarding university students' perception of learning.

O2. To Examine The Perception of Motivation Before and After The Instructional Experience

Figure 8 shows a comparison of the PRE and POST frequencies for each motivation item. The frequencies for responses 4 (agree) and 5 (strongly agree) increase across all POST items. Response 1 (strongly disagree) is virtually non-existent in both the PRE and POST questionnaires, while response 2 (disagree) appears in three PRE items and two POST items. Response 3 (neither agree nor disagree) is also low in all PRE and POST items. Meanwhile, responses 4 (agree) and 5 (strongly agree) increase in frequency from the PRE to the POST questionnaire. This indicates that students are more inclined to agree with the perception of improved motivation (motivation, participation, teamwork, and recommendation) following the instructional intervention with digital resources (Breakout, Genially, Educaplay, Quizizz, and Nearpod) in the classroom.
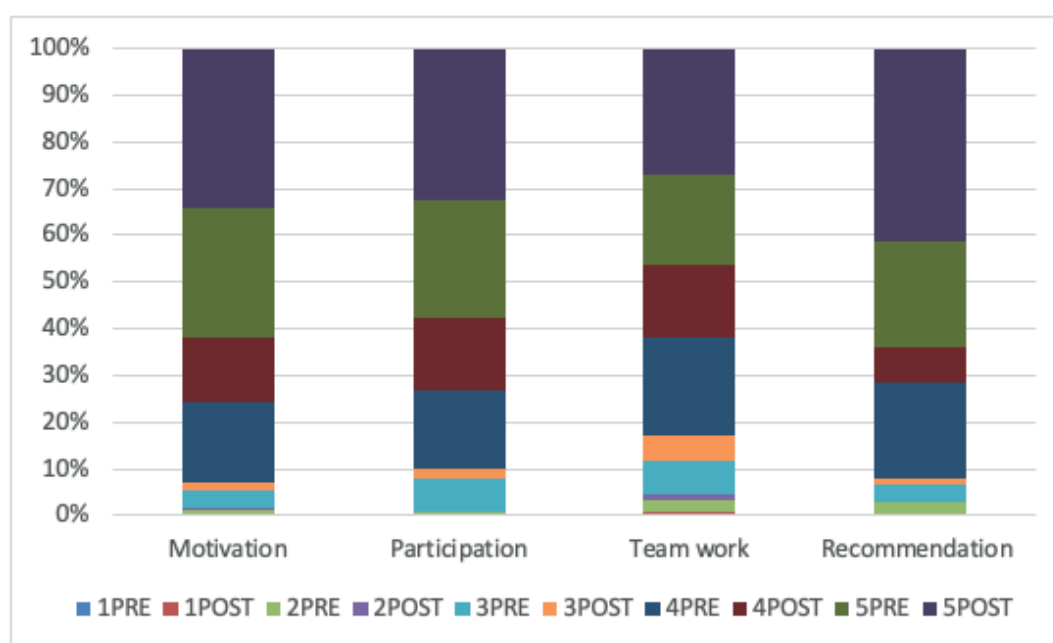
Figure 8. Comparison of PRE-POST motivation frequencies

The inferential analysis using the Wilcoxon Signed Rank Test (W) indicates that students perceive a significant improvement in all motivation items after the use of Nearpod, Genially, Educaplay, Breakout, and Quizizz in the online classroom. Table 3 presents the number of positive, negative, and tie ranks, average ranks, sum of the ranks, W, significance level, and effect size. A statistically significant increase is observed in the POST questionnaire for all motivation items, with a medium effect size. With this educational intervention approach, students feel more engaged and motivated in class, showing greater enthusiasm for participating in activities and group work. Moreover, they recommend this approach for other subjects in higher education. These results reject the null hypothesis (HO) and support the alternative hypothesis (H2): The use of gamified digital resources enhances students' perception of motivation in an online university classroom. Therefore, students perceive a positive improvement in their motivation when digital resources such as Nearpod, Genially, Educaplay, Breakout, and Quizizz are used to explain different content in music courses.

Table 3. Resultados PRE-POST en Motivacion

Variables		N	Average Rank	Rank Sum	W	p	Effect size
Motivation	Negative ranks	28	37.29	1044.00	2498	.013*	-.305
	Postivie ranks	49	39.98	1959.00			
Participation	Ties	70					
	Negative ranks	32	40.88	1309.00	3144	.002*	-.361
	Postivie ranks	58	48.05	2787.00			
	Ties	57					
Team work	Negative ranks	35	45.91	1607.00	2141	.032*	-.249
	Postivie ranks	57	45.86	2671.00			
	Ties	55					
Recommendation	Negative ranks	14	38.36	537.00	5799	.000*	-.692
	Postivie ranks	69	42.74	2949.00			
	Ties	64					

*p<.05

The analysis conducted to control for confounding variables in the motivation items shows that there are no differences based on gender in either the PRE questionnaire (n = 147, U = 1648.000, p = .469) or the POST questionnaire (n = 147, U = 1539.000, p = .195). Similarly, no differences are observed based on age in the PRE questionnaire (n = 147, H = 1571, p = .666) or the POST questionnaire (n = 147, H = 3797, p = .284). No differences are observed based on academic degree in the PRE questionnaire (n = 147, H = 7602, p = .055) or the POST questionnaire (n = 147, H = 7589, p = .055). Therefore, gender, age, and academic degree do not generate significant differences that could influence the results regarding university students' perception of motivation.

DISCUSSIONS AND CONCLUSION

This study analyzes university students' perceptions of learning and motivation following a didactic intervention in an online classroom using digital resources such as Breakout, Genially, Educaplay, Quizizz, and Nearpod. The results show significantly positive perceptions of moderate magnitude after the didactic intervention, as reflected by the W test and the effect size. This rejects the null hypothesis (H0) and confirms hypotheses 1 and 2 proposed in the study, validating that a didactic intervention using the aforementioned gamified digital resources positively enhances students' perceptions of their learning and motivation.

O1. To Analyze Perceptions of Learning Before and After The Didactic Experience

The results reflect a more positive perception of the quality of learning after the didactic intervention. Specifically, significant differences are found in the students' perceptions of all items related to learning in an online class. Students perceive that digital resources such as Nearpod, Genially, Educaplay, Breakout, and Quizizz positively enhance their level of competence and knowledge in music subjects, fostering a more active, realistic, autonomous, and meaningful learning process. These tools help to achieve previously unattainable goals with improved quality. This leads to the acceptance of hypothesis 1: "The use of gamified digital resources improves students' perceptions of their learning in an online university classroom." This finding aligns with other studies (Boom-Carcamo et al., 2024; Gironella, 2023; Lee et al., 2023; Mese & Dursun, 2019; Ozdamli & Yazdeen, 2021), which also support that the use of digital resources enhances students' perceptions of learning in an online university environment. These researchers agree that digital game-based learning (DGBL) has become an effective medium for developing cognitive skills or adopting simulations that allow students to practice their skills in a virtual environment, recognizing the benefits of motivation and engagement in learning performance compared to conventional and traditional classroom teaching.

Inuguidan (2024) found that students show a positive perception and efficacy towards digital tools like Kahoot, Padlet, and Quizizz, agreeing that the use of these digital tools enhances their overall learning experience, engagement, and confidence in acquiring knowledge. Similarly, research involving the digital tool Genially (Cabrera-Solano, 2022; Castillo-Cuesta, 2022) revealed that Genially has the potential to improve the academic performance of students learning English as a foreign language in online instruction, particularly in grammar and vocabulary acquisition. Studies involving Nearpod (Al Redhaei et al., 2022; Armas-Arias et al., 2023; Hernandez-Mena et al., 2024) demonstrate that it promotes active learning in the classroom. Students expressed high satisfaction with the integrated learning environment and recommended Nearpod for all courses, particularly those conducted through videoconferencing systems.

The study confirms that university students' perceptions of learning can be enhanced through didactic experiences. The results indicate a moderate positive change in perceptions of learning as being more active, realistic, autonomous, and significant. These changes enable students to take a more active role in their learning, achieving higher-quality outcomes with greater competence and knowledge. A slight positive change was also observed in the perception of achieving objectives and engaging in diverse learning activities. The didactic intervention thus fosters an environment conducive to in-class learning development, likely contributing significantly to improved academic performance. Mustafa and Karimi (2021) demonstrated that gamified resources optimize and motivate learning, enhancing educational performance. Similarly, Hamari et al. (2014) found improvements in students' learning across various educational stages.

O2. To Examine Perceptions of Motivation Before and After The Didactic Experience

The data indicate a more positive perception of motivation in classes following the didactic intervention. Significant differences are found in all items related to students' motivation in an online class. This leads to the acceptance of hypothesis 2: "Students perceive that digital resources such as Nearpod, Genially, Educaplay, Breakout, and Quizizz positively impact their interest and motivation in class, participation, group work, and consider using these resources in other Higher Education subjects. These findings are consistent with other studies (Adams & Du Preez, 2022; Bouchrika et al., 2021; Kyewski & Kramer, 2018), which have shown that DGBL can be considered a valuable and innovative tool in educational contexts to engage students and address motivational challenges, increasing their interactivity and participation. These studies also support the idea that digital resources enrich learning by fostering autonomy and personalized teaching in a university setting.

Fahada & Asrul (2024) emphasize the potential of digital games to improve students' participation, enjoyment, and learning efficacy. Specifically, their study demonstrated that Quizizz significantly increased students' motivation and interest in learning English. Dhamayanti (2021) found that most English as a Foreign Language (EFL) students had a positive perception and motivation toward Quizizz, supporting the idea that Quizizz is an appropriate e-learning tool to enhance motivation in the English classroom. Other studies on Genially (Cabrera-Solano, 2022; Castillo-Cuesta, 2022) reveal that, according to students' perceptions, the implementation of this tool increases their motivation, especially when effective feedback is provided. Al Redhaei et al. (2022) found that Nearpod promotes inclusion, active participation, and collaborative work, allowing the teacher to act as a guide or mediator in the learning process while students feel motivated and, most importantly, generate knowledge.

The use of digital resources such as Nearpod, Genially, Educaplay, Breakout, and Quizizz emphasizes the role of the student as an active participant in their learning, which, according to Strelan et al. (2020), is the learning style that education should promote. Therefore, in this case, technology is a useful complement to pedagogical instruction in Higher Education (Alomari et al., 2019; Zainuddin et al., 2020; Padilla et al., 2024), as these tools help enhance the quality and efficacy of Music Education by improving students' experiences, making learning more engaging, enriching, and autonomous. These approaches are also supported by experts in the field of educational technology in Music Education, such as Liu & Shao (2022), Sun (2023), Wang (2022), and Yao & Li (2023), who have highlighted that the implementation and use of technology in Music Education, through blended and online teaching modalities, yield significant results in developing students' musical skills and abilities through the use of these technological resources.

The results also indicate that university students' motivation perceptions can be improved through didactic interventions. The findings reveal a moderate positive change in motivation, participation, and willingness to recommend the course to others, along with a slight positive change in perceptions of teamwork. Consequently, the intervention cultivates an environment that supports motivational development, significantly contributing to students' engagement and classroom well-being. This aligns with prior studies, such as those by Colomo-Magana et al. (2024) and Erkinovna (2024), which highlight the impact of gamified resources on university students' motivation. Furthermore, Albdullah et al. (2022) and Mokhtari et al. (2021) stated that students who feel motivated and interested in the tasks proposed, have a better academic performance, and Haji Vosoogh et al. (2021) found a significant and positive correlation between motivation and psychosocial climate in the classroom since students who are motivated to do their work, advance their educational interests, improve their performance, self-confidence, self-esteem and classroom interactions.

Additional research (Adie et al., 2024; Gutierrez & Tomas, 2018) emphasizes the relationship between student motivation, classroom climate, and academic performance. For instance, Adie et al. (2024) examined how peer-created learning environments influence academic motivation and engagement, finding that positive climates foster higher motivation and participation. Similarly, Gutierrez and Tomas (2018) and Sanchez de Miguel et al. (2023) concluded that positive classroom climates mediate the relationship between motivation and academic success. Therefore, research indicates that increased motivation in the university environment enhances student well-being, fosters a positive classroom climate, and improves academic performance. This context promotes active participation and skill development, underscoring the importance of implementing strategies that cultivate a motivating and collaborative learning environment.

This study provides scientific evidence supporting the significant and perceptible improvement (ranging from slight to moderate) in learning and motivation perceptions through a didactic intervention employing gamified digital resources. These findings align with and expand upon existing literature, contributing to the development of more dynamic learning environments. In summary, interaction with technology has allowed students to explore musical concepts more interactively, enhancing their music teaching and learning process. For these reasons, the importance of integrating educational technology into the field of Music Education is emphasized, and further exploration and expansion of these approaches using digital resources in the curriculum are suggested to align with the demands of an increasingly technological society.

The educational implications for university educators highlight the necessity of implementing pedagogical practices that foster student motivation and engagement, thereby enhancing their well-being and academic performance (Darling-Hammond et al., 2020). Active learning methodologies, such as Project-Based Learning and gamification, can increase student interest by connecting academic content with meaningful and collaborative experiences (Jaaska & Aaltonen, 2022). The constant students' interaction and the development of interpersonal skoills and autonomy helps students increase their knowledge in a distended atmosphere (Chaves-Yuste, 2023). The integration of gamified digital resources fosters student-centered learning environments. By actively engage with content, students undergo an interactive and experiential learning process aligned with 21st-century educational goals. The improvement in students' perceptions of their learning suggests that these gamified digital resources not only enhance understanding of the the music content but also build other soft skills which are essential for professional and academic success, such as collaboration, critical thinking or problem-solving. Additionally, fostering a positive classroom climate

characterized by respect, active participation, and constructive interaction promotes a safer and more stimulating learning environment. Educators should also strive to personalize teaching by adapting activities to the interests and abilities of their students. This tailored approach reinforces self-confidence and perceived competence. To do so, educators should receive targeted training to integrate these tools effectively into their teaching practices. The observed increase in motivation and participation highlights the need for educators to adopt active learning methodologies, such as gamification, to encourage students' engagement. Continuous and detailed feedback further supports students' self-regulation and sense of achievement, strengthening their capacity for autonomous learning. Finally, encouraging student autonomy through decision-making in their educational processes enhances their sense of belonging and responsibility. These strategies underscore the importance of educators serving not only as knowledge transmitters but also as facilitators of motivating environments that promote students' holistic development. This study is focused on music courses but gamified digital resources have the potential to improve learning and motivation in other disciplines and academic fields. Finally, the analysis of the variables of gender, age, and academic degree shows that they do not significantly influence the results, which underscore the inclusivity of gamified digital resources, being a suitable option for diverse student populations.

This research presents certain limitations inherent to its methodological characteristics, such as the sample size or the type of methodological design. On the one hand, future research could benefit from increasing the sample size to enhance data generalizability, incorporating university students from other subjects, degree programs, and institutions, including public universities and monolingual and bilingual students. This approach would enable researchers to determine whether the didactic intervention yields benefits across disciplines and cultural contexts, particularly in settings with greater demand for technological training resources to optimize learning and academic performance. On the other hand, employing a pure experimental design with control and experimental groups, rather than a pre-experimental single-group design, could address concerns about scientific rigor. Furthermore, regarding the data collection, the use of a single questionnaire may contribute to some limitations; however, a questionnaire already used in other studies with very good reliability was selected for this research in both measurements (pre- and post-intervention). Future studies might also incorporate mixed-method approaches, such as brief interviews during the intervention, or the use of a focus group, to provide a more comprehensive understanding of students' perceptions. Combining qualitative and quantitative data would enrich the findings and offer deeper insights into the effectiveness of didactic interventions.

Nevertheless, despite the benefits obtained in this study, it is crucial to recognize that the field of educational technology continues evolving. For this reason, several emerging lines of research may contribute to a deeper understanding of learning through these resources. These include studies on the adaptation of these technologies to different educational levels, their implementation in various Higher Education subjects, and the ongoing evaluation of learning outcomes. Additionally, the integration of Artificial Intelligence could be explored to offer new perspectives that may further enrich the learning experience through educational technology. In conclusion, this study provides a solid foundation for future research to maximize the potential of educational technology for learning in Music Education.

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