Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

https://doi.org/10.23913/ride.v14i27.1611

Artículos científicos

Estrategia de gamificación para la enseñanza de solfeo a niños

Gamification strategy for children's solfeggio teaching

Estratégia de gamificação para ensino de teoria musical para crianças

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Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Resumen

La enseñanza musical mediada por tecnologías es un campo emergente en el ámbito de las ciencias de la educación, particularmente en lo que respecta a la educación musical infantil. Si bien se han desarrollado diversas herramientas tecnológicas tanto para el aprendizaje como para la creación musical, las cuales han demostrado ser eficaces para abordar objetivos específicos de enseñanza, resulta imperativo que estas se integren en un plan de estudios que englobe todos los aspectos académicos necesarios para crear un entorno de aprendizaje estimulante para los estudiantes. Por eso, este trabajo describe el proceso de investigación, diseño e implementación de un curso de solfeo que se presenta como una propuesta de integración tecnológica en la enseñanza musical en entornos educativos virtuales en el Centro de Iniciación Musical Infantil Xalapa de la Universidad Veracruzana. Para ello, se incorporan técnicas de gamificación como un recurso para potenciar la motivación entre la población estudiantil. Los resultados resaltan la pertinencia de adoptar nuevos paradigmas en la iniciación musical que consideren la tecnología educativa como un componente fundamental. También enfatizan la relevancia de la gamificación para motivar a los estudiantes más jóvenes y subrayan la necesidad de construir propuestas educativas que sean apropiadas y adaptables a través de procesos participativos y horizontales.

Palabras clave: educación musical, innovación educativa, gamificación, educación infantil.

Abstract

Technology-mediated music teaching is an emerging field in educational sciences, especially when it comes to children's music education; there are various technological tools both for learning and for producing music that have proven to be efficient for specific learning objectives; however, to promote a child's formal musical training requires that the tools be integrated into a study program that addresses all relevant academic aspects, while fostering a motivating learning environment for the student. This work describes the process of research, design and implementation of a music theory course, as a proposal for the integration of technologies for music teaching in virtual educational systems at the Centro de Iniciación Musical Infantil Xalapa of the Universidad Veracruzana, incorporating gamification techniques as a resource that enhances student motivation. The results show the relevance of the opening towards new paradigms of musical initiation, which consider educational technology as a basic element, emphasize the importance of incorporating gamification to motivate the child student and highlight that the construction of

educational proposals to be appropriate and appropriable must continue in a participatory and horizontal construction process.

Keywords: music education, educational innovation, gamification, children education.

Resumo

O ensino de música mediado pela tecnologia é um campo emergente no campo das ciências da educação, particularmente no que diz respeito à educação musical na primeira infância. Embora tenham sido desenvolvidas diversas ferramentas tecnológicas, tanto para a aprendizagem como para a criação musical, que se revelaram eficazes na abordagem de objectivos específicos de ensino, é imperativo que sejam integradas num currículo que englobe todos os aspectos académicos necessários para criar um ambiente de aprendizagem estimulante. para estudantes. Portanto, este trabalho descreve o processo de pesquisa, desenho e implementação de um curso de teoria musical que se apresenta como uma proposta de integração tecnológica no ensino de música em ambientes educacionais virtuais no Centro de Iniciação Musical Infantil de Xalapa da Universidade Veracruzana. Para isso, técnicas de gamificação são incorporadas como recurso para aumentar a motivação da população estudantil. Os resultados destacam a relevância da adoção de novos paradigmas na iniciação musical que considerem a tecnologia educacional como componente fundamental. Enfatizam também a relevância da gamificação para motivar os alunos mais jovens e sublinham a necessidade de construir propostas educativas adequadas e adaptáveis através de processos participativos e horizontais.

Palavras-chave: educação musical, inovação educacional, gamificação, educação infantil.

Fecha Recepción: Enero 2023 **Fecha Aceptación:** Agosto 2023

Introduction

The hyperglobalization prevailing in today's society, characterized by a diverse cultural fusion, has generated a profound impact on our forms of communication, coexistence, learning and lifestyle. The ubiquitous presence of technologies in their various manifestations has taken root in our daily lives and has directly transformed our interaction with the environment. These intelligence technologies and mental tools, applied in techno-educational contexts, provide the opportunity to enrich teaching and learning experiences, as they provide them with a more playful, holistic, systemic and transformative dimension (Díaz-Barriga et al., 2015).

However, the dizzying pace at which they emerge far exceeds the speed with which educational centers, of various kinds, can adopt them. In the educational field of our country, for example, various reasons are identified that explain the reluctance to integrate technologies into traditional teaching methods. On the one hand, there is an evident demand for technological skills on the part of the teaching staff (Domínguez González and Serna Poot, 2021), although there is also a lack of willingness to acquire them. Problems such as obsolete curricula, lack of institutional resources, and limited access to electronic devices and technological services also hinder the integration of technologies. In this context, the quality and relevance of study plans in relation to the 21st century acquire crucial importance for the development and updating of educational programs, so that they are aligned with the social reality of students and the current world.

In an era characterized by a profusion of sensory, visual and auditory stimuli, education cannot afford to remain static and monotonous. Educational practices must evolve towards a deeper congruence with the authentic sociocultural needs of this century. Thus, in the field of children's musical education, the object of this study, it is evident that educational methodologies have remained unchanged for decades, which has generated a considerable distance and demotivation between students and the content.

In this scenario, it is considered that the integration of emerging technologies in education should be a priority both in Mexico and internationally, because as time progresses, the gap between music teaching institutions and students widens constantly, since the latter are immersed in a hyperstimulated world while using educational tools that are outdated. Therefore, a reformulation of paradigms is necessary in order to ensure the persistent relevance of music education and prevent this activity from becoming obsolete in the coming years of this century.

According to Cuervo et al. (2022), the incorporation of technology in the musical learning process is effective, particularly with regard to sound exploration, creation and musical performance. However, such applications tend to be geared primarily towards adult musicians in training, who already have the fundamentals of musical notation necessary to approach such approaches effectively. However, the question arises of how to efficiently implement technologies to teach the basics of musical notation to children, avoiding significant distractions and maintaining the level of motivation essential for effective learning. Based on this premise, the following main objective is proposed:

> Propose an educational strategy based on gamification and applied to the teaching of music theory on the Eminus 4 educational platform for second semester students of the Children's Musical Initiation Center (CIMI) Xalapa of the Universidad Veracruzana.

From this general objective, the following specific objectives emerged:

- Identify training needs through a survey of CIMI students and teachers.
- Define didactic sequences articulated with the curriculum of the Educational Experience (EE) Solfeggio.
- Articulate simple and interactive content for the music theory course.

Although the design, development and implementation of a course on a platform does not constitute an innovation in the strictest sense, it does represent a significant advance within the socio-educational context in which the project was carried out. This initiative presents a proposal on how to integrate technology in educational environments in which the notion persists that face-to-face teaching is the only way to instruct in such an intricate field and that demands both direct interaction between the teacher and the student.

Justification

This project finds justification in two fundamental pillars. The first is the closure of educational institutions due to the health contingency derived from the SARS-CoV-2 virus, following the pandemic declaration issued by the World Health Organization (WHO) in March 2020. This situation was driven by the prevailing need to move educational activities from face-to-face environments to virtual environments (United Nations Organization [UN], 2020). The second pillar addresses the urgency of transforming traditional educational practices in the field of music education. This is sought through the appropriate and consistent incorporation of new technologies in the teaching and learning processes.

In addition to addressing these two main issues, this work identifies additional areas of opportunity, such as closing the gap between conventional educational content and digital platforms to promote a fluid interaction between the content and the contemporary and future student. The migration from face-to-face classrooms to virtual spaces has marked a milestone in the global history of education. During this transition, both achievements and deficiencies were evident in the educational field, as most educational institutions were not prepared to address this unprecedented situation, as they lacked the necessary infrastructure for effective distance education. In addition, the lack of competencies and skills in the techno-educational field on the part of teachers and administrative staff was highlighted.

For this reason, it was considered that the integration of technologies and the creation of virtual educational environments could address the aforementioned problem and contribute to closing the educational gap. This approach seeks to establish a direct link between students and

education, given that the lack of this link has direct negative consequences on the training of students. The low motivation and commitment to the content of the classes, the lack of engagement with them and the presentation of the contents are factors that significantly impact the students' interest in the topics addressed. (Aparicio-Gómez y Ostos-Ortiz, 2021).

However, it should be noted that the mere incorporation of technologies does not guarantee an improvement in educational practices; In fact, if used inappropriately, they can cause real harm to students. Therefore, it is essential to examine successful examples of technological integration in the classroom, such as gamification, game-based learning, virtual reality and simulations, among others (Ortiz-Colón et al., 2018). In this project, the integration of gamification and game-based learning is achieved at the primary level, in the design of the music theory course, with the purpose of enriching and complementing conventional educational practices in the musical field.

Reference frame

Due to the emergence of the SARS-CoV-2 virus in 2020, there was a need to suspend educational activities, which affected more than 1,215 million students at all educational levels globally. In this situation, distance education, mediated by technology, emerged as the primary tool to continue educational activities at all stages (Díaz-Barriga et al., 2020).

This transition, however, was forced and unforeseen, forcing classrooms to close and educational practices to be relocated to homes and other available spaces. One of the first challenges was access to digital resources and services, since both teachers and students lacked them. In addition to moving outside the classrooms, the curricula also underwent a reconfiguration, which accentuated the deficiencies that had been noticeable for years. This covered gaps in teachers' techno-educational skills, institutional infrastructure, availability of digital tools, internet access, and competency in digital literacy and democratization.

In this context, an interrelation can be established between the digital divide, education and the economic disparities that prevail at the regional, state, national and global levels (Unesco, 2022). It should be noted that in Mexico, approximately 60% of the population lacks computers and does not have access to the internet. Even those with access are limited by bandwidth and connectivity, aspects that are insufficient for the intense work required (Institute for Research on University and Education [IISUE], 2020).

For all of the above, it is essential to define and understand the responsibilities of the teacher in the 21st century, so that they continue to play an essential role in the teaching-learning processes, beyond being limited to the selection of educational content. In other words, as the next decades

advance and educational technologies emerge at an accelerated rate, it will be imperative that the role of the teacher also undergoes transformation and adaptation to preserve its relevance (Domínguez González and Serna Poot, 2021). Likewise, deep reflection is required on how to take advantage of this situation to promote a different type of learning and a new modality of knowledge acquisition. (Jenny Lizette Ramírez Guillermo, comunicación personal, 13 de octubre de 2020).

Xalapa Children's Musical Initiation Center

This project was developed at the Children's Musical Initiation Center (CIMI) of the Xalapa region, belonging to the Universidad Veracruzana. The CIMI is located at the address Gutiérrez Zamora no. 40, in the center of the city of Xalapa, Veracruz.

> The CIMI is an entity of the Universidad Veracruzana that for more than 35 years has been teaching the Musical Initiation program to children from 7 to 12 years old, which has allowed those who wish to continue with professional music studies. For a long time it has been considered the breeding ground for future students of the Faculty of Music, who thanks to this training arrive with firm foundations to pursue a career as a professional musician or as a music educator. (Universidad Veracruzana [UV], 2018a, p. 2).

The educational model in force at the Children's Musical Initiation Center is structured in four areas: musical initiation, ensembles, musical appreciation and instrumental practice. The vision of CIMI towards the year 2021 is to be “a center that, due to its quality, commitment, professionalism and innovation, is a national and international reference in children's musical education and positively influences the transformation of the social environment” (UV, 2018a , p. 6).

In 2019, the Educational Model of the Children's Musical Initiation Center of the Universidad Veracruzana was formulated: systematized and collective experience of 35 years. This project arose with the purpose of formalizing the CIMI educational model (UV, 2019), and establishes three primary objectives:

- Systematize the accumulated experience of the Children's Musical Initiation Center throughout its 35 years of operation in order to recover its practices and explain the guiding principles of its educational model.
- Evaluate and analyze these practices in light of contemporary social needs, trends in children's musical education and other experiences in the field with the purpose of opening

new perspectives, consolidating the model and clarifying the meaning and significance of CIMI's work.

- Collectively build the educational work model based on the analysis carried out (UV, 2019).

Within the educational model document, the results of a survey applied to graduates of the Children's Musical Initiation Center are incorporated to investigate the benefits they obtained by studying music from an early age. Additionally, the perceived strengths of CIMI and areas in which respondents felt a deeper focus was lacking during their time at the center were explored. Likewise, the need to accentuate playful interaction with music, implement more creative classes that stimulate imagination and interest, and renew teaching methodologies, the curriculum and the integration of technologies, among others, was highlighted (UV, 2019). The objectives of the Children's Musical Initiation Center are the following:

> Promote collaborative learning environments where children acquire the ability to work as a team to participate within groups such as choirs, chamber groups, orchestras, etc.; provide the child with the theoretical and practical knowledge of musical language that allows them to identify them in practice and listening; develop the sensitivity, discipline, perseverance and commitment of children through the different educational experiences provided by the center; transmit theoretical and practical knowledge that allows you to have a solid foundation to continue your artistic activity; involve parents in the commitment to comprehensive training and musical awareness of their children to achieve a transformation in the social environment (UV, 2019, p. 40).

This project, therefore, responds in a pertinent and coherent manner to the objectives of CIMI, since it directly contributes to promoting collaborative learning environments through the incorporation of technology in the training process. In addition, it provides theoretical and practical knowledge of musical language, stimulates the discipline, perseverance and commitment of children to enrich their comprehensive training.

The Solfeo Educational Experience (EE) program establishes the following general objective: “The student will develop musical skills, attitudes and knowledge through methodologies that allow them to establish a pleasant, effective and permanent contact with the musical art” (UV, 2018b). For all semesters, the didactic technique of playful learning is adopted, which includes rounds, children's songs, improvisation activities and body language. The teaching resources used are the portable staff, plate instruments and small percussion. Throughout the

different semesters, the music theory educational experience program accurately presents the didactic technique of playful learning, applied through various activities.

The program is made up of the following areas: rhythmic and compass, musical reading, intonation and melody, listening, theory and musical culture (UV, 2019). In each semester, students have a specific printed music theory method for the period they are studying, which is prepared by the music theory academy. As justification, the study program states the following:

> Music theory is the discipline through which a musician accesses the reading and interpretation of a printed or digitized score. It includes aspects such as the name of the notes on the staff in different keys, intonation of intervals and scales, execution of measures and rhythms, theoretical explanation of concepts, and auditory discrimination of the melodic and harmonic elements of a musical work. It is taught in groups with approximately 16 students and lasts two hours a week. It is characterized by being a theoretical-practical educational experience. It is interdisciplinary, since its concepts and activities are related to other musical experiences such as instrument, choral singing and musical appreciation. The teacher's profile must be supported by a professional degree in music or musical education, with experience in musical teaching. (UV, 2018b, p. 2).

This work focused on the objectives corresponding to the second semester of the music theory program. Within the framework of the Solfeggio Educational Experience (EE), various activities are included, such as reading notes, rhythms, melodies and auditory development.

Regarding reading, exercises that involve agility and access on the board are addressed, the treble clef is worked on in the second line and the bass clef in the fourth line. In relation to rhythm, rhythmic syllables, games, rounds, body rhythms (claps, legs, feet), pulse and beat marking are used.

In the area of melodic activities, educational children's songs, phonomimics, rounds of games, piano and a cappella interpretation are incorporated, with pulse and compass marking. Regarding auditory development, both oral and written dictation exercises of notes, melodies, intervals and chords are included. During these exercises, the teacher performs some of these elements of music theory on the piano, and the student, in turn, sings, identifies and transcribes in his or her scheduled notebook (UV, 2018b). As a methodology, the EE Solfeo study program contemplates the following:

> All work will be supported by theoretical explanation of the concepts, questions about the topic studied, exercises on the blackboard, observation of individual

> progress, lessons of various methods provided by the teacher and group and individual work on lessons from the printed work material; The teacher poses the learning tasks in the form of problems, seeking the participation of the students through questions and activities that promote individual interest and group work. The student also participates with questions which are discussed, trying not to reproduce the knowledge, but to reconstruct it, reorder it. (UV, 2018b, p. 7).

e-learning

E-learning is currently used by numerous organizations globally due to its ability to be just as effective as traditional learning. In addition, it offers effective instructional methods, such as feedback, and allows you to combine collaborative activities with self-paced study. It also provides the possibility of customizing learning paths according to the needs of the students, as well as using simulations and games (Food and Agriculture Organization of the United Nations [FAO], 2011).

In this regard, Area and Adell (2009) list the following benefits that e-learning contributes to the improvement and innovation of teaching: extend and facilitate access to training for groups and individuals who cannot access the face-to-face modality, increase the autonomy and responsibility of the student in their own learning process, overcoming the limitations imposed by the separation in space and/or time between teachers and students, interactive potential between teacher and student, flexibility in educational times and spaces, access to multiple sources and diverse data at any time and place, promoting collaborative learning in virtual communities of teachers and students. To do this, in the context of e-learning, content must be designed in line with a set of learning objectives and presented through various media, such as text, graphics, audio and video.

Furthermore, to ensure and promote the quality of a course in e-learning format, certain characteristics must be considered. The FAO guide for the design and development of e-learning courses (2010) proposes the following:

- Student-centered content.
- Granularity.
- Interactivity.

For this project it was convenient and imperative to resort to e-learning as a solution strategy, and it was also an opportunity to explore it as an alternative resource to traditional education in classrooms as we know them. This allowed us to have a broader vision regarding the integration

of new information technologies in traditional education as a teaching resource, whether main or supportive.

Gamification

Gamification refers to the use of game techniques in contexts that are not inherently playful. Initially, gamification was applied mainly in business environments, but over time and with the intellectual collaboration of various disciplines, its influence has reached various fields of knowledge and daily life. As references in this field, Imma Marín Santiago (2018) and Yu-kai Chou (2020) stand out, both authors recognized as pioneers and innovators in gamification in various fields.

Now, it is important to make a brief clarification regarding the use of the term gamification instead of gamification:

> The term "gamification" comes from the Anglo-Saxon term gamification, which comes from the root games, that is, "games." Following this etymological root, it would seem that the easiest translation should be jueguización or even juguetización... in fact the words derived from game are formed from the Latin root ludus... following the linguistic advice of the Fundéu, for the term Gamification, from the word game, transcends the games themselves and refers us to the action of playing, which gives the concept greater openness and power... but the reality is that the word gamification is the one that prevails in conversations, articles and debates (Marín, 2018, p. 70).

This project was focused on a child population, but we must be clear that gamification is not only useful in this group, as it is functional with practically any age population. An essential part of gamification is understanding what it means to play and the playful attitude:

> In short, playing is a free and spontaneous action, one of the most important sources of progress and learning throughout our lives. An inexhaustible source of pleasure and satisfaction. An attitude towards life that promotes in the person the desire to know, to feel, to make an effort, to experience difficulties as challenges, to keep alive the capacity for wonder. An attitude of freedom, passion and enjoyment of life as it comes (Marín, 2018, p. 38).

From a deeper perspective, gamification aims to encourage the student to develop a proactive attitude and a genuine desire to acquire knowledge, learn and, above all, enjoy the

educational process. The objective is for the student to respond enthusiastically to learning stimuli and experience enriching emotions that allow them to achieve significant learning.

Gamification transcends the application of gaming techniques in non-gaming contexts. According to Yu-Kai Chou (2020), gamification is a synergy of game design, game dynamics, behavioral economics, motivational psychology, user experience, interface design, neurobiology, technology and business management. This definition is extremely enriching and challenges the basic and superficial understanding of gamification. Therefore, it is seen as a transformative tool and strategy in the educational field, with the power to revolutionize traditional teaching processes through the incorporation of games.

Using attractive techniques and elements, it seeks to create memorable, motivating and impactful educational experiences. Although gamification alone does not constitute a complete educational revolution, its integration as a disruptive and innovative tool in educational processes, especially in children's music education, represents a significant modification in traditional teaching-learning approaches.

Methodology

The present intervention project was based on a social research that used a mixed approach—as proposed by Guevara Alban et al. (2020)—as it addressed descriptive quantitative data and qualitative data on the opinions and perceptions of the actors involved in the process. Likewise, a participant research approach was followed, since an understanding of the problem and the definition of a strategy to address it was sought, according to the needs and interests of the target population and the institution; Therefore, it was proposed as a methodological strategy that resulted in a social intervention in a real environment.

The instruments for data collection were questionnaires applied to the target population, made up of teachers, students and parents, as well as interviews applied to teachers and directors of the CIMI. Both types of instruments were validated by experts in educational technology, music and music education.

For the analysis of quantitative data, descriptive statistics of frequencies obtained in the questionnaires were used, and for the qualitative data, discourse and word cloud analysis applied to data collected in semi-structured interviews (Lopezosa et al., 2022).

In this process, the co-creation of the proposal was essential to achieve an appropriate intervention appropriate to the context of the study, based on the method for action research proposed by Villasante (2014): a prior immersion in the environment, extensive documentation,

contextualization, diagnostic analysis, co-creation of the proposal, development, validation, piloting, implementation, evaluation of results and return to the social group involved. This in order to address, in a systemamic and orderly manner, the final offer of a solid proposal for the application of technologies in children's musical education of the Children's Musical Initiation Center of the Universidad Veracruzana. For the design of the contents, the already proven ADDIE instructional design model (analysis, design, development, implementation and evaluation) was used, as proposed. Molenda (2003).

Delimitation of the population of the intervention project

The CIMI receives around 120 new students every year—children between 7 and 12 years old—who begin the musical initiation program lasting eight semesters and at the end of which they receive a diploma and a certificate issued by the Universidad Veracruzana that accredits their studies (CIMI, 2022, p. 3).

Different educational actors participated in the project: management staff, administrative staff, eight teachers for the analysis survey, two teachers for the implementation of the intervention project and forty students from the Xalapa Children's Musical Initiation Center, as well as mothers, fathers and/or guardians. of the students. The target population of this project was composed as follows:

- Teachers of the Xalapa Children's Musical Initiation Center.
- Students of EE Solfeo I, EE Solfeo III, EE Solfeo V and EE Solfeo VII at the Children's Musical Initiation Center in the city of Xalapa, Veracruz. Those students who were enrolled in the CIMI, but who did not take the EE Solfeggio at its different levels, were excluded.

Previous immersion in the context

As a prior immersion process in the context or first phase, we had experience as a teacher at the CIMI in music theory and piano courses, which allowed us to adopt a role as a complete participant researcher (Guevara Alban et al., 2020, p. 167). . This allowed us to directly observe educational practices, advantages, disadvantages, as well as areas of opportunity in general.

Derived from the isolation caused by the pandemic, it was possible to appreciate the problems faced by both teachers and students to continue their studies through virtual means, as well as the shortcomings on the part of teachers in terms of techniques, resources, tools and even skills to drive. processes efficiently. As for the students, it was difficult for them to maintain the

interest, motivation and pace of learning required in the CIMI study program, while their parents found it difficult to support them to continue training without the direct presence of the teacher.

This opened the possibility of other ways of conducting educational processes mediated by technologies that could awaken and maintain the interest of the target population. The above was reinforced with contact with those who were identified as key informants: directors, teachers, students and parents of the children; Based on their opinions, the idea of collaboratively building a proposal that would address this problem was consolidated.

Diagnostic analysis

In the second phase of the research process, the target population of the project was characterized, for which a questionnaire was designed through the Google v forms platform. 2015, which in addition to the general data, focused on having the first elements of analysis on the problems of music theory classes in times of social isolation, specifically on suggested contents and their characteristics, students' difficulties in directing their studies without the direct presence of the teacher, means by which they could access the content, use of devices and means by which they connect to the Internet, as well as the subjects that required special support for the development of resources.

The data collection instrument was reviewed and evaluated by three experts from the field of music, music education, education and educational technologies. Each one made pertinent observations that were taken into account and applied to the design. Likewise, the instrument went through a piloting process, in which two teachers from the Solfeggio Academy of the Musical Initiation Center participated; For the pilot phase of the survey aimed at students, the participation of ten CIMI students was required, through an invitation extended through institutional emails. It was sought that the students had the same age and training characteristics of the target population. The language and approach of each questionnaire item was validated, correcting the details found. Given the construction of the instrument in open questions, no reliability analysis was carried out, since it was considered that closing the responses to a linear scale would mean the participants would lose their speech.

The questionnaire was applied to 50 active enrolled students in the period August 2020-January 2021 of the Xalapa Children's Musical Initiation Center, who were taking the EE Solfeggio, in any of the semesters offered in the same period. In the next phase of analysis, and in correspondence with the previous process, an instrument with similar characteristics and validated with the same process was applied to teachers.

On the other hand, it was decided to apply an online survey due to the health contingency derived from the SARS-CoV2 virus. To implement a survey of CIMI Xalapa students, the design of a comprehensive and simplified privacy notice was required; Both privacy notices were designed based on the guide for preparing privacy notices of the Veracruzano Institute for access to information and personal data; The basis for the processing of personal data was article 104 section XVI of the Law of Transparency and Access to Public Information of the State of Veracruz. (Ley de Transparencia y Acceso a la Información Pública del Estado de Veracruz, 2016).

Questionnaire design

In the questionnaire for teachers, mandatory basic personal data was required, such as full name, email and age (as non-mandatory personal data). The following questions were then asked:

- Based on your experience, what content do you suggest for teaching music theory at an initial level?
- Select the educational experiences taught at the Xalapa Children's Musical Initiation Center (CIMI)
- What is your main instrument?
- What characteristic suggests that it should be privileged when choosing content for teaching music theory at an initial level?
- Through what teaching tool would you like EE Solfeggio students to be able to learn?
- What existing teaching resources do you recommend to support learning music theory?
- Do you know how to use Eminus 4 as a facilitator?
- Do you have internet access from your home?
- Do you have internet access from your workplace?
- Do you have access to a computer?
- What operating system does your cell phone have? For each question, more than one answer is allowed. In addition to the written options, the “other” option was added.

To obtain information from the students of the Xalapa Children's Musical Initiation Center (CIMI), a non-probabilistic directed survey was designed due to the way the target population was chosen and the context. Special attention was paid to the questionnaire design phase, since it is essential in the planning of a survey, since the quality of the data collected depends on the success of its design (D'Ancona, 2005 cited by Rodríguez-Polo, 2006). In the questionnaire, personal

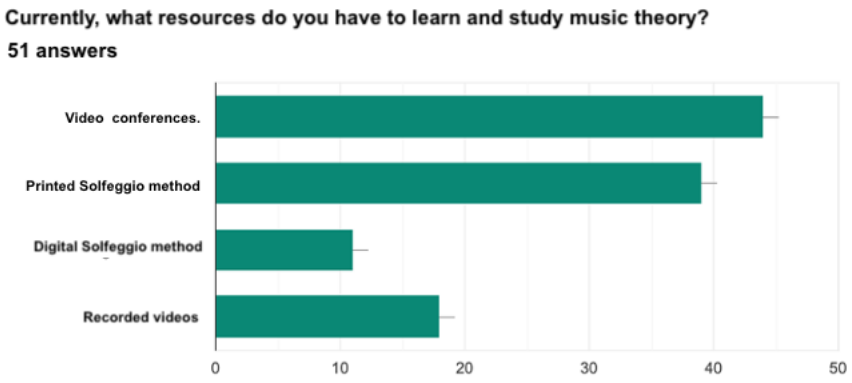
information was requested, such as full name, age, email address of parents and/or guardians, and gender. Likewise, the following questions were proposed:

- What semester are you studying at CIMI?
- What instrument do you play?
- How much do you like music?
- How much does studying music motivate you?
- How much does studying music theory motivate you?
- How much do you like choral ensemble class?
- How much do you like to study your instrument?
- Currently, what resources do you have to learn and study music theory?
- What are the resources you have to learn music theory?
- How would you like to learn music theory?
- What is your favorite subject at CIMI?

In addition to the personal and content questions, questions were proposed to know the level of internet connectivity and digital media available to students; In this sense, the following was asked: do you have access to the internet? Do you have access to a computer? Do you have access to a cell phone or tablet? What operating system does your cell phone have?

Some of the results of these student surveys are seen in figure 1. Regarding what resources do you have to learn and study music theory?, the children responded that video conferences were very important during the pandemic.

Figure 1. Resources to learn solfeggio

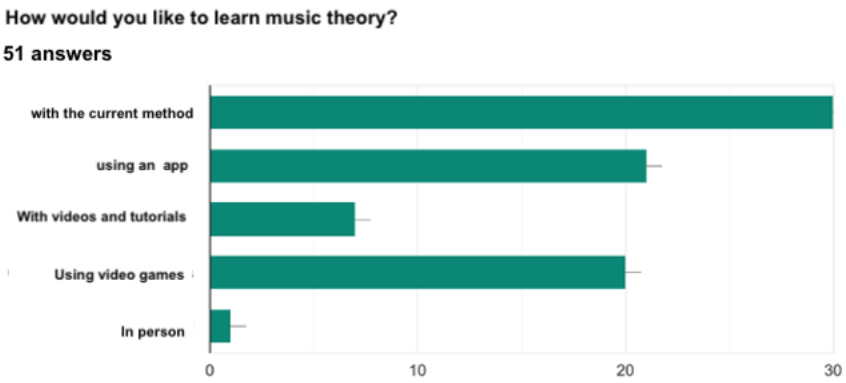


Source: Self made

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

In relation to the question: How would you like to learn music theory?, the majority responded that with the current method and with the use of an application (figure 2).

Figure 2. Preferences for resources to learn solfeggio



Source: Self made

In the case of the teachers' interviews, some interesting responses can be seen in Table 1:

Table 1. Responses from teacher interviews

Questions	Teacher 1	Teacher 2
What were your first thoughts about a solfeggio course at Eminus 4 for CIMI second semester music theory students?	I loved the idea from the beginning, talking about Eminus is talking about ICT platforms, I needed to work on this because I didn't know about it, it seemed like an excellent idea.	I thought it was an excellent idea, I think we were taking too long. The truth is that the world is changing, we are evolving, right now due to pandemic issues, but, to tell the truth, the children of today are not the children of five or ten years ago, the CIMI is celebrating 40 years, I was the second generation of this center and I have a special affection for it, it is not just any job, it is the school that trained me, where I grew up, where I have my best memories and experience of music...
How do you think traditional music education needs to adapt to the new educational challenges of the twenty first century?	You have to adapt, there is no other option. We, as teachers in charge of children, must understand that the situation we are experiencing is totally different from what we had to experience. One of the ways to give students the best in terms of their training is to prepare ourselves, in this specific case with ICT, knowing how to use the platforms that the Universidad Veracruzana offers us and the others that exist for their benefit. Musical education has to be updated and apply the feedback with everything that happens to have a better offer.	I think that not only we as teachers of our practice are constantly renewing ourselves, but also the methods of education. The CIMI took a big step, it worked with an anthology and at the time it served to cover the needs of that student population, but the truth is that times change and I believe that we should not stop there. A couple of years ago, the academic body worked on elements that were important to address and that for various reasons we had not stopped to think that things were being done well but that needed to be renewed. With so many years and prestige, CIMI deserves to do well-founded work, rich in content for future generations...

Source: Self made

Derived from this analysis, it was possible to define that the target population for the implementation of the Solfeggio course in Eminus 4 was constituted as follows:

- Students enrolled in the Xalapa Children's Musical Initiation Center who were taking the second semester of the EE Solfeggio 2 in the February-July 2021 semester in any of the groups 201, 202, 203, 204 or 205.
- Two full-time teachers who will teach the EE Solfeggio 2 in the February-July 2021 semester at the Xalapa Children's Musical Initiation Center in groups 201, 202, 203, 204 and 205.

EE Solfeggio program analysis

The review and analysis of the EE Solfeggio program in all its semesters was essential to understand the structure and form of the contents, as well as the knowledge of the general and specific objectives of each semester to better serve the target semester of this project.

As a result, it was considered that the program is properly structured, since it articulates in progression the theoretical contents of the eight semesters of music theory. It is observed that the methodology proposed in the program is relevant for the physical space where classes are regularly taught, but areas of opportunity are identified to improve the congruence of the contents, the method and the target population. The evaluation suggested in the music theory program involves three training stages: initial, middle and final, in order to assign a final grade. In this section, an area of opportunity was also identified in the final grade assignment method, so the design of a rubric and the use of badges as a student motivation tool were proposed.

Finally, the in-depth interviews with the directors completed the perspective of how CIMI teaching operated in pre-pandemic and post-pandemic, as well as the conditions that music theory education must consider to meet the objectives of the subject's study program and the institution.

Design and development of the proposal

For the design and development of the proposal, the program and structure of the EE de Solfeggio was taken into account, and the participation of two teachers from the solfeggio academy was consolidated. Plans and didactic sequences structured according to the EE Solfeggio 2 program were co-created, as well as rubrics. The didactic plans were projected in the same way for the entire target population in any of the five groups and teachers. A base proposal was proposed, but with openness and flexibility to the specific requirements of each group and teachers throughout the implementation. The two teachers participated actively and collaboratively in the development of the proposal, which served to achieve a consistent and viable result of the objectives of EE Solfeggio 2.

For the development of the course, didactic planning and sequences were used to consistently organize the contents on the educational platform. Eminus 4[1*]; Eight plans and sixteen didactic sequences were generated to organize the course and its contents. A review was carried

[1*] Eminus es el sistema de educación distribuida propio de la Universidad Veracruzana; actualmente está en su versión 4 (Colunga y Márquez, 2007).

out of the existing digital educational content for the EE Solfeggio and educational content available on the web; Based on this review, relevant content was selected for the course, but it was necessary to design and produce new content to achieve the objectives of each module.

Various programs were used to develop content such as Finale 2014®, Powtoon, Google Forms, Adobe Photoshop®, Microsoft PowerPoint 365®, Garage Band 10®, Logic Pro X®, among others. It was decided to develop special content to meet objectives that existing digital content could not meet.

For the selection of the content available on the website, the following selection criteria were determined:

- That the content of the digital resource was relevant, consistent and directly related to the course program, planning and didactic sequences.
- That they were in Spanish.
- Interactive content was privileged.
- That the content of the resources presented an attractive visual design for children.
- That the contents were freely accessible for educational purposes, so as to avoid infringing any copyright.

To add game elements to the course, digital badges were designed corresponding to the rubric criteria, where one star was designated for the developing performance level, two stars for the good performance level, and three stars for the excellent performance level. As an additional resource to digital badges and to add details to the course, the development of digital certificates was proposed as an alternative option to a traditional report card with the objective of motivating the student population and as an element of gamification.

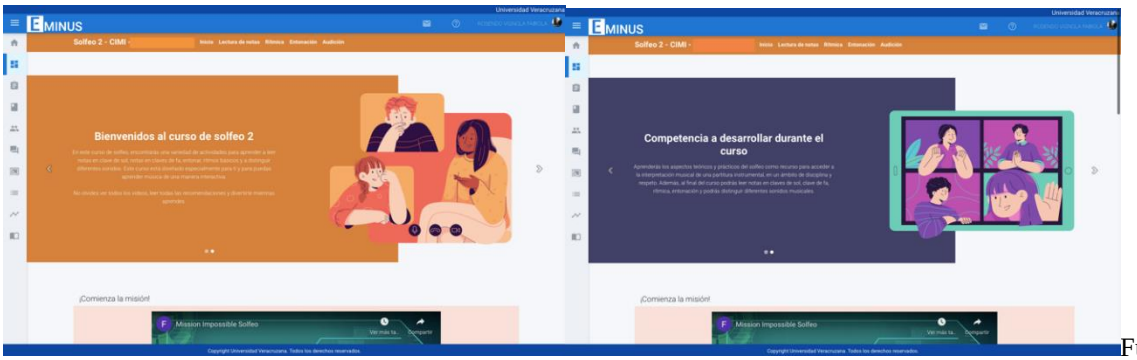
Implementation

The design and development process resulted in five Solfeggio 2 courses on the Eminus 4 platform, three groups in collaboration with teacher one and two groups in collaboration with teacher two. The five courses were structured as follows:

- Home page: Welcome to the course, introduction video, description of competence to be developed, buttons to page for reading notes, rhythm, intonation, auditory training, reference on badges, content experts and facilitators, bibliography (figure 3) .
- Reading notes: Five audiovisual resources; rhythmic: seven audiovisual resources; intonation: eleven audiovisual resources and auditory training: four audiovisual and informative resources.

- The activities section included 30 activities developed specifically for the course objectives, including reference videos and images.

Figure3. Course cover and competencies in Eminus v. 4



Fuente:

Source: Self made

To access the Eminus 4 platform, students were provided with a generic login account and a password through institutional email to mothers, fathers and/or guardians with the collaboration of the administrative staff of the Xalapa Children's Musical Initiation Center. Support was offered to those who made up the target group and to the participating teachers to answer technical questions about the platform, resources, learning activities and communication on the platform.

Evaluation of the proposal

To evaluate the resulting courses, an evaluation survey was designed aimed at the students participating in the course and an interview with the regular teachers of the music theory groups; The first data collection instrument was carried out on the Google Forms platform, which was validated by expert judgment and was implemented in the month of June 2021, at the time of the pilot completion of the course in Eminus 4; The second data collection instrument was designed to be implemented through two videoconferences on the Zoom platform, and was applied in the same period.

Results

As the initial survey of the diagnostic phase applied to six teachers, the following results were obtained:

- 100% of the teachers considered that the contents that should be addressed in teaching music theory at an initial level are rhythmic, intonation and auditory training.

- 87.5% of teachers stated that interactivity between content and students should be prioritized, followed by visual design and theoretical content.
- 100% of teachers agreed that they would like students to be able to learn through recreational activities and 50% expressed their opinion in favor of the current music theory method, leaving aside the use of video games, video conferences and YouTube video tutorials.
- 100% of teachers recommended specialized music theory applications as a teaching resource as an alternative to the CIMI music theory method.
- 62% of the teachers consulted did not know how to use the Eminus 4 educational platform as a facilitator.
- 100% of teachers had internet access from their home.
- 100% of teachers did not have internet access from the workplace.
- 100% of teachers had access to a computer.
- 50% of teachers used iOS and 50% Android as their mobile operating system.

The qualitative analysis of the information from the teacher interviews can be observed through the following word cloud (figure 4). This, according to Lopezosa et al. (2022), provides interesting information about the most relevant concepts, both because they present a greater challenge for teachers and because they are topics of interest that they were interested in addressing. As can be seen, the center of interest is the students and the institution itself, ideas of training needs are highlighted, the need for video technologies is mentioned, and the presence of the pandemic is highlighted as a disruptive element of the training processes.

Figure 4. Relevant concepts for teachers

Source: Self made

In this same diagnostic phase, the survey was implemented in November 2020 to a total of 51 students from CIMI Xalapa, which was open and available to participate 24 hours a day for two weeks, which facilitated the participation of the child population. The following results derive from it:

- 86% of the students surveyed counted on video conferences as a resource to learn and study music theory, 76% the printed method of music theory, 35% recorded videos and 21% the digital method of music theory.
- The questions related to motivation and taste for the educational experiences of music theory, choral ensembles and instruments yielded similar percentages, that is, the majority of students had a satisfactory perception of them.
- 58% of students considered that the resources they have to learn are interesting, 29% interactive, 23% fun and 13% difficult.
- 58% of the students considered that they would like to learn music theory with the current method, 41% with the use of an application and 39% with the use of video games.
- 54.9% of the students considered the instrument subject as their favorite, 29.4% of music theory and 15.7% of choral ensembles.
- 100% of the students had access to the internet.
- 84% of students reported having access to a computer.

- 92% of students reported having access to a cell phone or tablet.
- 76% of students reported having Android as the operating system on their mobile device.

Based on the data obtained in the surveys provided to students and teachers, it was determined to design the contents and implement a pilot Solfeggio 2 course on the Eminus 4 educational platform in the period February-July 2021.

Initially, we worked collaboratively with a base course proposal and during the implementation period each teacher participated and required content in a different way; We worked directly with five CIMI Solfeggio 2 groups and a total of 41 students participated.

The implementation of the pilot course for CIMI teachers, coordination and administration occurred on February 19, 2021, through a videoconference on the Zoom platform. In addition to the presentation of the course proposal, teachers were advised on the basic functions of using Eminus 4 (UV, 2022).

The beginning of the piloting of the course was on March 5 of the same year, the day on which the students' income accounts were administered to parents and/or guardians, through an institutional email. The teachers involved showed interest and openness with the implementation of the pilot.

The ADDIE model (Morales-González et al. 2014) of instructional design used in this project suggests continuous evaluation, so it was carried out that way throughout the process. From analysis to implementation, a parallel process of continuous evaluation was carried out, which made it possible to recognize areas of opportunity and intervene in a timely manner throughout the implementation. Furthermore, to evaluate the implementation of the course at a first level, at the end of the piloting, a second student reaction questionnaire was administered and an in-depth interview was carried out with the participating teachers, taking into account the four-level evaluation model. proposed by Donald Kirkpatrick (Kirkpatrick 2007 cited by Kirkpatrick and Kirkpatrick, 2016), who proposes that the responses to the reaction questionnaires and the results should be analyzed and the comments received from the participants should be considered to modify future training actions.

From the data obtained in the evaluation stage of the course, it was determined that it was necessary to implement a comprehensive training course for teachers in the use of Eminus 4 and Lienzos 4. In addition, the need for teachers to participate in the entire course design and development process to achieve more favorable results. The need to hold a technical introductory session for the use and navigation of Eminus 4 for mothers, fathers, guardians and students was

also identified. The results obtained in the evaluation phase will be taken into account as initial analysis input for future redesigns and implementations of courses of this type.

The reaction questionnaire was applied to the students of the participating groups through an instant messaging application, during the last week of the pilot. In total, 28 student entries were obtained, with the following results: 82% of the students agreed that the instructions for the activities of the music theory course in Eminus 4 were clear, 93% of the students agreed that the activities proposals were interactive, the same percentage believes that the activities corresponded to the topics of the music theory classes on the Zoom video conferencing platform; 89% of students believe that the activities helped them understand the topics covered in classes. 53.6% of students entered the course from a computer, 25% from a cell phone, and 14.3% from another device. Among the suggestions, the interest was expressed in making the sequence of the activities simpler to avoid confusion and an introductory video tutorial to explain the general operation of the platform.

The implementation of the Solfeggio 2 course on the Eminus 4 educational platform concluded satisfactorily on June 7, 2021, corresponding to the calendar of the February-July school period of the same year.

Discussion

The initial results of the research process with teachers showed an interest in incorporating technologies into their teaching processes, especially due to the situation they were going through due to the isolation derived from the pandemic. However, despite this acceptance, when taking actions to define and develop the strategy, there was active participation from only two teachers, which could mean resistance to the use of technology. This agrees with other research, such as that of Calderón et al (2019), who—based on the review of the binomial music education and technology—consider that there is a strong tendency in music education to resort to traditional practices; In fact, in cases where educational technology is used, these classic dynamics are reinforced. In other words, there is no willingness to use novel methods, as in this case that included gamification.

On the other hand, it should be noted that the application of educational technologies in teaching is influenced by factors such as teachers' beliefs and their previous experiences with learning mediated by it. Therefore, a crucial point in these processes of incorporating educational technology is the willingness and active participation of teachers for effective integration into educational practice, since a teacher's level of comfort with the use of technologies can be reflected

directly in the implementation process (Domínguez and Serna, 2021), since the teacher is the student's first link with the materials and resources. Likewise, the teacher is required to reflect on his/her role in teaching and open new possibilities for the music student's learning (Serrano Pastor, 2017), such as composition or the creation of multimedia materials in general.

Regarding the students, due to the stage in their learning and their age, in the implementation of the piloting of the course it was observed that regardless of their motivation, the implementation of the proposed activities depended directly on the collaboration with parents and /or tutors. That is, their disposition and understanding of the objectives directly impacted the students' achievement, which coincides with what was reported by Cuervo et al. (2022), who affirm that families are an important educational agent in distance models, especially at preschool and primary levels, where ignorance of technology management and the limited availability of technological resources or time have a strong impact.

On the other hand, and in contrast to the idea of some teachers that games are distracting, the students who participated in the implementation of the course remained focused on their learning; That is to say, this playful component kept them in a relaxed state, which facilitated learning music theory. This coincides with Sáez-López and Sevillano-García (2017), who developed research to incorporate computational thinking in arts education through devices such as sensors and minicomputers. In their work, the authors concluded that students remained motivated, interested, and fun, especially in music classes.

Finally, after the implementation of the Solfeggio 2 course, an atmosphere of curiosity, greater willingness and openness on the part of teachers was observed to continue carrying out projects that integrate new technologies and educational platforms into traditional educational practice. This reinforces the ideas expressed by Serrano (2017), who indicates that although the incorporation of educational technology in music teaching continues to play an instrumental role, it is necessary to migrate to models where collaboration in networks and among peers allows creative learning. and collaborative composition.

Conclusions

Before, during and after the process of implementing a music theory course in Eminus 4 for CIMI Xalapa, reflections and questions arose about traditional musical educational practices, the integration of new technologies for education, training, digital skills for teachers, parents and students and the direct and indirect factors in the practice of educational innovation.

Indeed, as could be seen in the results, the idea of incorporating educational technology tools for teaching music theory in children between 7 and 12 years old was very well accepted in general, although in particular, at the time of implementation, there was a smaller participation. Even so, it is considered that the objective of submitting a proposal based on technologies applied to the teaching of music theory was effectively achieved, starting from participatory techniques in the analysis of needs and promoting the co-creation of those who were involved in this process. Therefore, this type of approach to innovation in the classroom is considered viable.

On the other hand, it can be stated that the proposal was well received by the students, who had better results than those who only had class by videoconference. In fact, the students who participated in the Eminus 4 course had greater achievement, better music theory skills, higher academic performance, less frustration due to isolation and less school dropout. In other words, it helped them cope more easily with the pandemic and they felt motivated to continue their studies and socialize with their peers.

It is important to highlight that the systemic vision of all the members and elements of teaching that was maintained throughout the research process was basic for the identification of training needs through surveys of students and teachers, the establishment of didactic sequences articulated with the curriculum of the music theory course, the selection of simple and interactive content for the course and for the design of the missing resources.

The most important thing is that, following the research method chosen for the study, the proposal did not arise unilaterally and vertically, but rather worked collaboratively with teachers, directors, students and parents to achieve a horizontal proposal that responded to the needs and interests detected in the target group. Likewise, and although the implementation of technologies in education processes does not directly represent an educational transformation, it is expected that true transformation will come only with a joint effort of educational actors, economic resources, changes in the curriculum, willingness to change and a sense of evolution.

In this context, gamification can offer educational experiences that promote meaningful learning in students due to its playful, motivational and enjoyment characteristics. In this sense, the game can be considered one of the most powerful educational tools in the child student population,

so it is important to encourage the use of tools like this to enhance meaningful learning and experiences. The use of new technologies and other recreational educational tools, such as gamification, requires a great effort on the part of teachers and the institution.

In short, technologies can offer possibilities if they are articulated with the socio-educational reality and with the interests and needs of the student community, combined with the gradual and gradual improvement of the technological infrastructure of the institutions. With this, it is possible to project a significant educational transformation.

Future Future lines of research

It is convenient to continue this project in the following school periods of the Xalapa Children's Musical Initiation Center, since areas of opportunity and educational possibilities offered by new technologies have been detected. For example, teachers consider that the use of new technologies can represent the beginning of change and the transition towards new educational paradigms regarding children's musical education.

Likewise, it should be considered that the implementation of courses on digital educational platforms, specialized applications or the integration of cutting-edge technology may not be enough. This means that educational institutions must promote investigative processes on effective integration in terms of digital equity, access to services, disposition and digital skills of teachers, administrators, parents, tutors and students.

Likewise, a curricular transformation must be promoted to reduce the impact of generational gaps in the development of digital skills. This will allow an effective coupling to the social reality that students experience, especially children, who already live with complex information technologies.

Another interesting line of research will be the use of technologies such as augmented reality, virtual worlds and artificial intelligence in music teaching, as they open the possibility for children to explore their creativity in music composition in greater depth.

In summary, more research is required on gamification in music teaching to define scenarios where the game is a motivation for learning and for the development of children's creativity and natural talent.

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Metodología	Principal: Nancy Domínguez Que apoya: Daniel Serna Poot
Software	Principal: Fabiola Rosendo Vignola Que apoya: Daniel Serna Poot
Validación	Principal: Daniel Serna Poot Que apoya: Nancy Domínguez González
Análisis Formal	Principal: Fabiola Rosendo Vignola Que apoya: Daniel Serna Poot
Investigación	Fabiola Rosendo Vignola
Recursos	Fabiola Rosendo Vignola
Curación de datos	Principal: Daniel Serna Poot Que apoya: Ernesto Vilches
Escritura - Preparación del borrador original	Nancy Domínguez González
Escritura - Revisión y edición	Nancy Domínguez González Daniel Serna Poot Ernesto Vilches Lleó
Visualización	Daniel Serna Poot
Supervisión	Nancy Domínguez González
Administración de Proyectos	Daniel Serna Poot
Adquisición de fondos	No aplica