Comparative Analysis of Moodle and Google Classroom in Music Theory Instruction

(es) ***Análisis comparativo de Moodle y Google Classroom en la enseñanza de la teoría musical***

(port) **Análise comparativa do Moodle e do Google Classroom no ensino de teoria musical**

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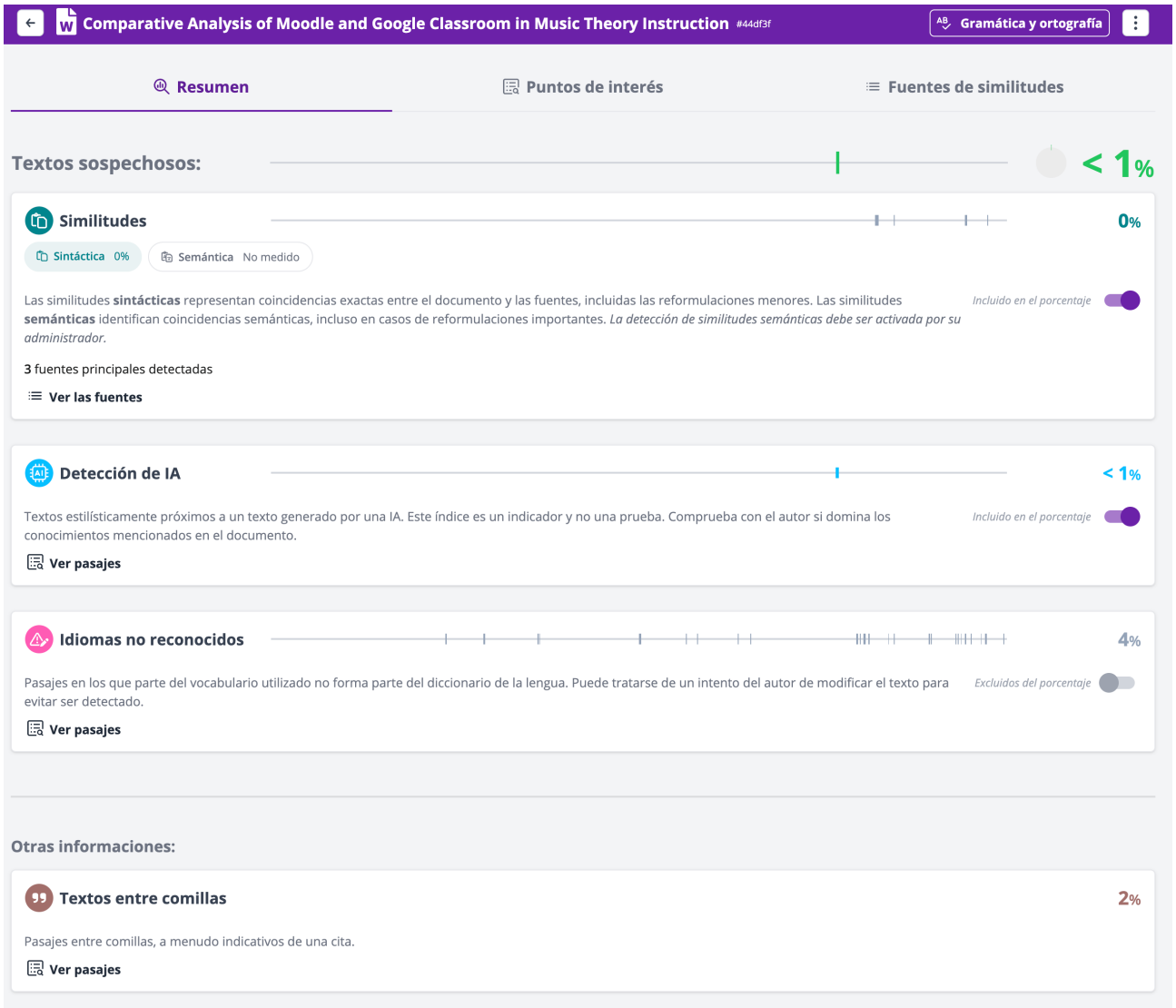

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Abstract

The global health crisis of 2020 accelerated the incorporation of digital technologies into teaching and learning processes across all educational levels. Educational Technology has consequently become a consolidated component within contemporary educational institutions. However, in the field of music education, particularly in professional music training, the systematic exploration of technological tools remains relatively recent. This study aims to compare two Learning Management Systems, Google Classroom and Moodle, in their application to the teaching of Solfeggio within the Academic Unit of Arts of the Autonomous University of Zacatecas, specifically in the Bachelor of Music program with an instrumental emphasis. A mixed methodological approach was employed, incorporating documentary analysis, pedagogical observation, interviews, and surveys. The findings indicate that the effectiveness of each Learning Management System is closely related to students' profiles and the academic level at which Solfeggio is taught. The results highlight the importance of aligning digital platforms with pedagogical objectives and learner characteristics in music education contexts.

Keywords: Music theory teaching; educational technology in music learning; learning management systems

Resumen

La crisis sanitaria global de 2020 aceleró la incorporación de tecnologías digitales en los procesos de enseñanza y aprendizaje en todos los niveles educativos. En este contexto, la Tecnología Educativa se ha consolidado como un componente fundamental en las instituciones educativas contemporáneas. No obstante, en el ámbito de la educación musical, especialmente en la formación profesional, la exploración sistemática de herramientas tecnológicas es aún incipiente. El presente estudio tiene como objetivo comparar dos Sistemas de Gestión del Aprendizaje, Google Classroom y Moodle, en su aplicación a la enseñanza del Solfeo dentro de la Unidad Académica de Artes de la Universidad Autónoma de Zacatecas, en el programa de Licenciatura en Música con énfasis instrumental. Se empleó un enfoque metodológico mixto que incluyó análisis documental, observación pedagógica, entrevistas y encuestas. Los resultados evidencian que la efectividad de cada sistema depende en gran medida del perfil del estudiantado y del nivel académico en el que se imparte la asignatura, subrayando la necesidad de una adecuada articulación entre plataforma digital, objetivos pedagógicos y características del aprendizaje musical.

Palabras clave: Enseñanza de la teoría musical; tecnología educativa en el aprendizaje musical; sistemas de gestión del aprendizaje

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Resumo

A crise sanitária global de 2020 acelerou a incorporação de tecnologias digitais nos processos de ensino e aprendizagem em todos os níveis educacionais. Nesse cenário, a Tecnologia Educacional consolidou-se como um componente estruturante das instituições de ensino contemporâneas. No entanto, no campo da educação musical, especialmente na formação profissional, a exploração sistemática de ferramentas tecnológicas ainda é relativamente recente. Este estudo tem como objetivo comparar dois Sistemas de Gestão da Aprendizagem, Google Classroom e Moodle, aplicados ao ensino de Solfejo na Unidade Acadêmica de Artes da Universidade Autônoma de Zacatecas, no curso de Bacharelado em Música com ênfase instrumental. Adotou-se uma abordagem metodológica mista, baseada em análise documental, observação pedagógica, entrevistas e questionários. Os resultados indicam que a eficácia de cada sistema está diretamente relacionada ao perfil dos estudantes e ao nível acadêmico em que a disciplina é ministrada, ressaltando a importância do alinhamento entre plataformas digitais, objetivos pedagógicos e características do aprendizado musical.

Palavras-chave: Ensino de teoria musical; tecnologia educacional na aprendizagem musical; sistemas de gestão da aprendizagem

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Introduction

The New Mexican School (NEM), as an educational project in the six-year period 2018-2024, proposed the revaluation of the teaching profession as one of the measures to vindicate the figure of the teacher in the face of the smear campaign that reached its highest point with the educational reform of 2013. With the arrival of Andrés Manuel López Obrador to the presidency of the republic, the educational reform of 2019 was carried out (Congress of the Union, 2019a). The secondary laws that emanated from this new provision emphatically recognize the contribution of teachers to social transformation.

Technological advances are now part of almost every aspect of human life, which also includes education, especially after the COVID-19 health pandemic. Due to the Sars Cov 2 health situation, declared an "international public health emergency by the World Health Organization (WHO)" since 2020 and due to preventive isolation measures, school institutions were forced to adapt to new teaching models, and thus be able to continue with the teaching-learning process; the Academic Unit of Arts of the Autonomous University of Zacatecas "Francisco García Salinas" (UAAUAZ), was not the exception in adopting the measures, designed in a transitory way, to deal with the situation that arose. Some teachers understood the new educational modalities so well that they have continued to implement them in their classes, even after the so-called return to normality; such is the case of teachers of Music Theory subjects such as Music Appreciation, History of Universal Music y Solfeggio (Zelicovich et al., 2020).

The latter is an essential discipline for the integral training of the musician, so much so that it can be considered a guiding discipline among the so-called complementary or theory subjects within formal music education (Osa-Ricardo et al., 2023). The use of ICT as a support in the UAAUAZ Solfeggio class has been a support that has allowed us to take even more advantage of the face-to-face class schedule, however, it has unleashed a quite interesting debate on what is the educational platform that should be used in the implementation of a b-learning model in the discipline?

Theoretical framework

As Juan-Carvajal and Juan-Carvajal have argued, the education of the future professional musician must be conceived as an integral process in which multiple dimensions converge. This formation should articulate theoretical and technical mastery, interpretative skills, methodological knowledge, and artistic and aesthetic appreciation, understood as complementary and interdependent elements (Juan-Carvajal y Juan-Carvajal, 2015). From this perspective, the teaching of music theory—and particularly solfeggio—plays a central role in achieving comprehensive academic and professional development. As Besa (1990) emphasizes, understanding how a musical work is constructed from its microstructural elements is as essential for a musician as grammatical knowledge is for a writer.

A review of specialized literature indicates that solfeggio is widely recognized as a method of auditory–musical training aimed at developing reading skills, intonation, and the performance of melodies, rhythmic patterns, and tuning through vocal practice, whether individual or collective (González-Mayorga y Pacheco Sanz, 2012; Hernández Vidales, 2015; Borne, 2019). This body of research supports the conception of solfeggio as a

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discipline grounded in the intonation of melodies, scales, intervals, and chords, in which musical notes are named, rhythmic values respected, metronomic indications followed, and, in some pedagogical contexts, certain musical alterations are intentionally omitted in order to preserve rhythmic continuity, while time signatures are marked manually.

Within this academic framework, the Academic Unit of Arts of the Autonomous University of Zacatecas offers two educational programs in the School of Music: a Bachelor's Degree in Singing and a Bachelor's Degree in Music with an instrumental emphasis. In the latter, musical instruction is structured across four educational levels: Infant, Basic, Upper Middle, and Bachelor's or Higher Level. The discipline of solfeggio is present throughout all levels, with the exception of the Higher Level, where it is replaced by the subject of Ear Training, which pursues learning objectives closely aligned with those of solfeggio.

Admission to the Infant Level begins at approximately eight years of age and continues until twelve, after which students advance to the Basic Level. Entry into the Basic Level does not require prior formal musical training, nor is strict adherence to the age guideline mandatory, although such alignment is considered pedagogically optimal, as it allows students to progress through musical training concurrently with secondary education.

Upon completion of the Basic Level, students advance to the Upper Middle Level, which consists of six academic semesters. After completing the first two semesters, students may request admission to the Bachelor's Degree program, subject to their age and demonstrated level of musical knowledge.

Across all levels, solfeggio instruction is allocated two hours per week and has traditionally been delivered through face-to-face instruction. However, pedagogical experience has demonstrated that this limited instructional time is insufficient to address the breadth of learning required to develop the competencies established in the academic program. Furthermore, students frequently devote minimal or no independent study time to the subject, which negatively affects academic performance and skill acquisition.

In response to these limitations, the implementation of an educational platform within a blended learning modality has emerged as a viable pedagogical strategy. This approach allows in-person sessions to focus on practical activities essential to the discipline, while theoretical content can be delivered through diverse digital resources hosted on the educational platform. Additionally, such platforms facilitate both synchronous and asynchronous communication between teachers and students, as well as peer-to-peer interaction, beyond the constraints of physical classroom time.

The instructional proposal was developed using an Instructional Design framework, specifically the ASSURE model, which begins with an analysis of learners and group characteristics, followed by the definition of learning objectives and the alignment of instructional strategies and resources. During the development of digital materials for the different course levels, a critical pedagogical question emerged: which Learning Management System is most appropriate for implementing the virtual classroom for solfeggio instruction?

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Learning Management Systems are defined by Contreras (2018), as cited in González Ríos and Flores Aguilera (2021), as a specific type of Content Management System whose functionalities are explicitly oriented toward learning processes, and which can be categorized as either proprietary or open-source systems. Complementarily, Bendezú Paytán (2018) defines an LMS as an internet-based application, hosted on a server or in the cloud, designed to manage, distribute, and monitor learning activities in an organized and systematic manner.

Taken together, these definitions allow LMS to be conceptualized as Educational Technology tools intended to support the implementation of virtual learning environments within distance or blended educational modalities (Bendezú Paytán, 2018; Contreras, 2018, citado en González Ríos y Flores Aguilera, 2021).

Authors such as Bendezú Paytán (2018), Herrera-Cubides, Gelvez-García and López-Sarmiento (2019), and Cabero-Almenara, Arancibia and Del Prete (2019) agree that, among the multiple functionalities offered by Learning Management Systems, core features include course administration, content distribution through digital publication, student management, communication supported by diverse technological tools, and the organization of assessment systems. These elements constitute the structural basis of LMS use in formal educational contexts.

Complementing this perspective, Praxedis Daniel, Gómez Zermeño and Zambrano Izquierdo (2015), drawing on the work of Cole and Foster (2007), identify a set of essential LMS components, including hierarchical organization of content by levels and courses, the integration of educational videos and multimedia materials, frequently asked questions sections, tools for content creation and assessment design, and systems for the submission and storage of academic documentation (p. 130). Together, these components reinforce the pedagogical and administrative versatility of LMS platforms.

From a broader technological standpoint, Vidal Ledo, Gómez Martínez and Ruiz Piedra (2010) explain that educational software is characterized by its pedagogical purpose, specifically its orientation toward supporting the teaching–learning process in its various modalities. Additional defining features include the use of technological devices such as computers and mobile technologies, ease of use based on intuitive interfaces and accessible navigation, the possibility of returning to relevant information from any point within the virtual environment, and interactivity, understood as the effective exchange of information between the system and the learner.

Despite these advantages, empirical evidence suggests that a significant number of teachers do not fully exploit the pedagogical potential of Learning Management Systems. Cabero-Almenara, Arancibia and Del Prete (2019) note that many educators limit their use of LMS platforms to basic functions, such as publishing course syllabi, uploading materials, collecting assignments, and providing brief annotations or comments, thereby underutilizing more advanced instructional possibilities.

The existence of a wide variety of Learning Management Systems is internationally recognized. According to Bendezú Paytán (2018), Zurita Cruz et al. (2020), and Díaz Quilla, Carbonel Alta and Picho Durand (2021), the continuous expansion of digital technologies has contributed to the sustained development and

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diversification of LMS platforms. Among the most widely known systems are Chamilo, Claroline, Blackboard, Dokeos, Docebo, Edu 2.0, Edmodo, ATutor, Microsoft Teams, Moodle, and Google Classroom. Of these, Moodle and Google Classroom have been officially adopted at the institutional level by the Autonomous University of Zacatecas and are therefore implemented within the Academic Unit of Arts.

Within this context, the question of which of these two Learning Management Systems is more suitable for implementing a blended learning course in the discipline of Solfeggio at the Academic Unit of Arts gains particular relevance. Addressing this question requires a systematic evaluation of both educational software platforms. This, in turn, raises a fundamental issue: what constitutes the evaluation of educational software, and on what criteria is such evaluation based?

According to Cataldi (2000) and Zurita Cruz et al. (2020), educational software evaluation is a process aimed at determining the degree of adequacy of a digital product to specific educational contexts. This process typically involves two complementary forms of assessment: internal evaluation, conducted during the development phase, and external evaluation, carried out once the software is implemented in real educational settings. Both forms of evaluation contribute to identifying limitations, detecting areas for improvement, and generating modifications to enhance product effectiveness. These assessments incorporate feedback from development teams as well as from the primary actors in the educational process, namely teachers and students.

Cataldi (2000) further argues that when a commercial educational software product reaches teaching staff, it is generally assumed to have already undergone internal and external evaluations. However, this does not eliminate the need for contextualized evaluation, as effectiveness and efficiency can only be fully determined through use in specific pedagogical environments (p. 58).

In this regard, Cova, Arrieta and Aular de Durán (2008) highlight that software evaluation introduces an additional responsibility for educators, one for which they are not always adequately prepared. As these authors emphasize, it is insufficient for teachers to possess only disciplinary knowledge; they must also acquire foundational competencies in educational computing in order to critically assess and effectively integrate digital tools into the teaching–learning process (p. 96).

Pedro Marquès Graells (2002) emphasizes that an objective evaluation of educational software must be grounded in the consideration of a set of clearly defined quality criteria and indicators. These criteria are typically organized into structured questionnaires designed to facilitate the evaluators' work and to ensure systematic and comparable assessments. The author further argues that a close relationship exists between the nature of the materials being evaluated, the objectives pursued through the evaluation process, and the intended recipients of the results. Depending on how these elements are articulated, different evaluative approaches and methodological proposals may be applied to the assessment of educational programs.

In a similar vein, Cova, Arrieta and Aular de Durán (2008) review several evaluation models, including the proposal developed by Barroso et al. (1997), known as the Software Evaluation Scale. This model is conceived as a systematic assessment tool aimed at supporting informed decision-making regarding the use and pedagogical appropriation of educational software. The proposal is structured into three main components:

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> (a) identification of the software, which includes commercial and technical information, potential users, and a description of its main characteristics;
> (b) evaluation of elements, consisting of a closed-response questionnaire using categories such as very adequate, adequate, inadequate, and not at all adequate, applied to aspects such as installation procedures, user manuals, and tutorial features; and
> (c) evaluation of relationships, which examines the interaction between context variables (price, technical requirements, distribution, and documentation), input factors (learning objectives, curricular alignment, sequencing, and exemplification), and process dimensions (ease of use, error tolerance, interactivity, and graphic environment). These dimensions are assessed using a numerical scale ranging from 1 to 10 and are aggregated separately to obtain differentiated evaluative results (Cova et al., 2008, p. 97).

Another relevant proposal highlighted in the literature is that of Dorrego (1998), who presents a model for the production and formative evaluation of instructional media, with a particular focus on audiovisual resources and educational software. This model is grounded in Gagné's theory of instruction and information processing, and it assigns two primary functions to instructional media: the transmission of messages and the development of cognitive skills required for processing the information conveyed by those messages.

Although the body of pedagogical literature offers a wide range of evaluation models and methodological approaches, the present study adopts the proposal developed by Marquès Graells (2002). This decision is based on the suitability of his framework for the objectives of the research, as it organizes evaluation criteria into two broad categories of quality characteristics and indicators: technical elements, and pedagogical and functional aspects. This structure allows for a balanced assessment that integrates both the technological performance of the software and its educational effectiveness within specific teaching–learning contexts.

Among the pedagogical and functional characteristics, the pedagogue lists the following:

1. Ease of installation and use: referring to the fact that SEs need to be pleasant and easy to use.
2. Didactic versatility: these must provide an optimal response to the diverse educational needs of the recipients and adapt to the circumstances that arise.
3. Motivational capacity, attractiveness: as expressed in the characteristic, the teaching materials must be attractive to users.
4. Suitability for the recipients: The material to be used must take into account the characteristics of the students to whom it is addressed.[1]
5. Potentiality of the didactic resources: this depends on the activities they offer, the greater the diversity of resources, functionalities and activities available to the teacher to plan the course and guarantee the teaching-learning process, the greater the potential of the didactic resources.

[1] For this, it is highly recommended to carry out the design instruction

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6. Tutoring and treatment of diversity, evaluation: this should be focused on the assessment of learning and appropriation of knowledge of the students, as well as providing good reinforcement and guidance and help in the learning process.
7. Applicational and creative approach: it must take into account constructivist theories and meaningful learning principles.
8. Promotion of initiative and self-learning: The materials should provide cognitive tools in the search for learners to exploit their learning potential to the fullest (p. 116-118).

Regarding the technical characteristics of educational software, Marquès Graells (2002) argues that evaluation should consider multiple dimensions related to the quality of the digital environment. Among these dimensions are the quality of the audiovisual interface, the quantity and adequacy of multimedia elements, the coherence and structure of content, the organization and navigability of activities, the use of hypertextual resources, the degree of user interaction, and the reliability of system execution (pp. 118–119).

These aspects, characteristics, and indicators are synthesized by the author into a cataloguing and evaluation sheet that systematizes the assessment process. This instrument includes basic identification data of the material, an objective evaluation of its technical and pedagogical qualities, product identification information, and an overall appraisal of the educational program (Marquès Graells, 2002; Samaniego Erazo, Marqués Molías y Esteve-González, 2014).

According to Marquès Graells (2002), the effectiveness of an educational resource is largely determined by its capacity to adapt to the specific training contexts in which it is applied, as well as by the teacher's ability to integrate it meaningfully into instructional practice. As the author states, when selecting educational resources, it is necessary not only to consider their intrinsic quality, but also to assess the extent to which their particular characteristics—such as content, activities, and tutoring mechanisms—are aligned with the curricular conditions of the educational context (p. 123).

In this regard, Marquès Graells (2002) proposes a series of guiding questions that orient the evaluative process: to what extent does the material contribute to achieving the intended educational objectives; whether the content is consistent with the objectives of the subject; whether the material is appropriate for the characteristics of the students; whether the context in which the program will be implemented allows for its effective use; which didactic strategies will be employed; and what level of effort will be required to organize and develop learning activities using the resource (p. 123).

Based on the analysis of existing proposals for educational software evaluation, and drawing on the evaluation framework proposed by Marquès Graells (2002), as well as complementary contributions by Vargas Castillo (2003) and Camacho Quintero (2023), the present study conducts an evaluation of the Learning Management Systems Google Classroom and Moodle.

Google Classroom is part of the Google for Education ecosystem, which integrates a set of digital applications designed to support educational processes, commonly referred to as Google Apps for Education. According to information provided by Conpas.net (2021), Google Classroom is a web-based application that is

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freely available to educational institutions and facilitates collaborative work between teachers and students, thereby promoting interaction, communication, and shared responsibility within the teaching–learning process. This characteristic has contributed to its widespread adoption among educators (Prado-Prado, García-Herrera, Erazo-Álvarez y Narváez-Zurita, 2020).

In practical terms, the platform enables teachers to create, distribute, and collect assignments digitally, identify students' participation and task completion, provide direct feedback, and organize materials automatically within Google Drive folders by task or by student (Prado-Prado et al., 2020, p. 11). These features contribute to administrative efficiency and pedagogical monitoring.

Among the main advantages of Google Classroom are its ease of configuration, time and paper savings, and an organizational structure that allows students to access activities either through the class stream or via an integrated calendar. Additionally, all submitted work is automatically stored and organized in Google Drive, which simplifies document management for both teachers and learners.

A review of the literature indicates that Gómez (2020) identifies educational orientation, speed, simplicity, security, organization, communication, and free access as the platform's defining characteristics (p. 49). Similarly, Tarango, Machin-Mastromatteo and Romo-González (2019), as cited in Prado-Prado et al. (2020), emphasize these same attributes while also highlighting Google Classroom's capacity to facilitate collaborative document creation, distribution, and sharing. These authors further underscore the platform's usefulness for promoting the use of editable documents, such as word processors and spreadsheets, within collaborative learning environments.

The Google Classroom interface is widely regarded as intuitive and user-friendly, allowing for rapid familiarization without the need for extensive training or prolonged adaptation periods. Its seamless integration with other Google Workspace tools—such as Google Forms and YouTube—enhances its instructional versatility. However, a notable limitation is the absence of a built-in, comprehensive evaluation module. In the context of this research, this limitation was addressed through the use of assignments, questions, and forms as alternative mechanisms for systematic assessment (Prado-Prado et al., 2020).

> Google's environment and its applications and educational resources are very useful to strengthen learning since they allow activities such as: the creation of virtual classrooms within the same educational institution, this facilitates connectivity and academic link between all members of the educational community, streamlining communication between directors, teachers, students and parents or representatives, facilitating time and space to develop their classes, distribute tasks, evaluate content, which promotes active learning.(Prado-Prado et al., 2020, p. 12)

The literature review makes it possible to identify several pedagogical features associated with Google Classroom, including the creation of personalized learning playlists, support for Project-Based Learning, clear and accessible scheduling of activities, and both synchronous and asynchronous interaction and communication

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between teachers and students. Additionally, the platform facilitates the distribution and creation of educational content within an integrated digital environment.

Regarding Moodle, authors such as Rizo Rodríguez (2019), González Ríos and Flores Aguilera (2021), and Peña Matos and Dibut Toledo (2021) define it as a Learning Management System that enables teachers to design and manage multiple courses across different subject areas, adapting instructional structures to diverse educational needs.

The acronym Moodle, which stands for *Modular Object-Oriented Dynamic Learning Environment*, refers to a platform that, according to Rizo Rodríguez (2019) and Maliza Muñoz (2023), is among the most widely used systems in secondary and higher education contexts. Its widespread adoption is closely related to its pedagogical orientation and technological versatility.

Murillo (2012), as cited in Rizo Rodríguez (2019), identifies a set of defining characteristics of Moodle, including its design for learning purposes, extensive global use, support for both teaching and learning processes, ease of use, open-source nature with no licensing costs, continuous updates, high flexibility and customizability, scalability to institutions of different sizes, robustness, security, privacy, and accessibility across devices and locations (pp. 20–21).

Documentary analysis reveals a high degree of consensus among scholars regarding these characteristics. Rizo Rodríguez (2019) emphasizes that Moodle is primarily distinguished by its focus on the teaching–learning process, its user-friendly interface, free access, continuous updating, flexibility, security, scalability, and web-based operation (p. 20).

Similarly, Maliza Muñoz (2023) highlights Moodle's capacity to strengthen collaborative and interactive learning, support synchronous and asynchronous remote activities, and facilitate communication across multiple dimensions, including teacher–group, teacher–student, and student–student interactions.

Among the platform's instructional resources are forums, chats, lessons, URLs, assignment submission tools, the creation of pages, folders, databases, self-assessment activities, and the integration of external tools. It should be noted that, in the context of the present study, only those tools that directly support the teaching and learning of music theory within the Academic Unit of Arts of the Autonomous University of Zacatecas are considered.

Furthermore, Moodle allows for the installation of plugins that enhance the teaching–learning process. In this case, reference is made to the *Music Theory* plugin, which enables the integration of self-assessment activities specifically designed for music theory instruction (Bedregal-Alpaca, Cornejo-Aparicio, Tupacyupanqui-Jaén y Flores-Silva, 2019).

Among the platform's main advantages, Peña Matos and Dibut Toledo (2021) highlight its scalability in relation to student numbers, the possibility of creating virtual courses and learning environments, its function as a digital complement to face-to-face instruction, the availability of diverse assessment and grading methods, and

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its accessibility and compatibility across different web browsers and operating systems (p. 67). As a limitation, these authors point out that Moodle's interface could be simplified, as some users report difficulties in usability and longer-than-expected adaptation periods, which may affect initial engagement with the platform.

Methodology

This study follows a descriptive research design with a mixed-methods approach, integrating qualitative and quantitative perspectives. From the quantitative standpoint, data were collected, recorded, and selected for subsequent analysis, focusing on the characterization of the initial and final states of the pre-experiment. This process enabled the identification of variations in the measured variables before and after the pedagogical intervention. In parallel, the qualitative component supported the exploration of specialized literature related to teaching models, educational levels in professional music training, and the use of educational platforms for music instruction.

The methodological procedures employed facilitated the identification of antecedents concerning the use of different Learning Management Systems in diverse educational modalities, as well as their characteristics, advantages, and limitations. Special attention was given to the analysis of Google Classroom and Moodle as educational management systems, along with the examination of theoretical and methodological references and the evolution of blended learning models applied to professional music education across initial, basic, upper secondary, and higher education levels. To this end, a combination of methods was applied, including analytical–synthetic analysis, documentary analysis, historical–logical analysis, interviews with key informants, unstructured group interviews, pedagogical observation, surveys, and the analysis of learning activities based on Talizina's theoretical contributions (Juan-Carvajal y Juan-Carvajal, 2019; Talizina, 2009).

To verify the use and management of Google Classroom and Moodle in solfeggio instruction across the different educational levels of the Bachelor of Music with an instrumental emphasis at the Academic Unit of Arts of the Autonomous University of Zacatecas, the study employed methodological triangulation. This strategy combined a pedagogical experiment in its pre-experimental variant with the application of measures of central tendency and a concordance criterion, allowing for the validation of findings from multiple analytical perspectives (Figueredo, 2023; Gutiérrez, 2018; Juan-Carvajal y Juan-Carvajal, 2019).

The pedagogical experiment was implemented following a pre-experimental design, taking into account methodological considerations commonly applied in Educational Sciences. The literature reviewed reveals a diversity of terminological approaches to experimental research and highlights the methodological challenges associated with its application in the Social Sciences. These challenges have led to the adoption of alternative designs, such as pre-experimental and quasi-experimental approaches. As noted by Salas (2013), pre-experimental designs do not involve strict control of extraneous variables; however, they meet the fundamental condition of experimental research by manipulating the independent variable, thereby allowing for the observation of its effects under real educational conditions (Figueredo, 2023; Salas, 2013).

As an initial phase of the research process, the Instructional Design was developed based on the ASSURE model—Analyze learners, State objectives, Select media and materials, Use media and materials,

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Require learner participation, and Evaluate and revise. This design was applied to the solfeggio discipline within a blended learning modality at three educational levels: Infant Level (from approximately eight years of age), Basic Level (comparable to lower secondary education, approximately from 12 to 15 years of age), and Upper Middle Level (the stage immediately preceding higher education).

The Instructional Design framework made it possible to identify the specific characteristics of student groups at each educational level, define learning objectives, select appropriate teaching methods, media, and materials, and determine instructional resources aligned with both the teaching–learning process and learner profiles. Additionally, the model emphasized active student participation and continuous evaluation and revision of both student performance and instructional strategies, allowing for adaptive modifications based on group characteristics and learning outcomes (Ponce et al., 2021).

For the implementation of the pre-experiment, a structured design process was followed, consisting of five stages: conception of the experiment, initial diagnosis, manipulation of the independent variable, final diagnosis, and evaluation of results.

Regarding platform selection, the Instructional Design for the Infant Level was implemented exclusively through Google Classroom, based on evidence highlighting the platform's ease of use and accessibility for younger learners. At the Basic Level, both Google Classroom and Moodle were combined within the experimental groups in order to compare their pedagogical functionality. Finally, at the Upper Middle Level, Moodle was used exclusively, given its greater flexibility and capacity to support more complex instructional and evaluative processes.

Discussion

The initial results of the application of the methods during the research constituted the mainstays for the elaboration of the Instructional Design, in its ASSURE model, of the Solfeggio class in a mixed educational modality, the recognition of foundations, antecedents and evaluation criteria of the SEs, in this case Google Classroom and Moodle, for the teaching of the discipline in the professionalizing teaching of music. The initial exploration of the research was carried out in six groups of the Bachelor of Music of the UAAUAZ covering the levels of Infant, Basic and Upper Secondary training.

From the methodological triangulation it was possible to verify that both Learning Management Systems favor the development of the teaching-learning process in the discipline of Solfeggio at the UAAUAZ at its different levels of teaching.

The interviews, questionnaires and pedagogical observation made it possible to verify that in the case of the students who study the Infant level, the LMS Google Classroom was easy to use and that the tools used for the course contributed to the development of the knowledge and skills outlined in the semester, in addition, to express that they had fun with the various resources used.

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Regarding the students who are studying the Upper Secondary level and in whom Moodle was applied as the only teaching management system, they expressed that at the beginning of the course it was somewhat complicated for them to use the platform, however, during the development of the classes and practice, their mastery was facilitated and allowed them to reinforce the necessary skills for the practice of the subject. The above was also mentioned by the students of the Basic Level who used Moodle.

At the aforementioned level, it was possible to observe the advantages and opportunities for improvement and work with the use of each LMS and allowed a more in-depth comparison in terms of the practice and development of a course in b-learning mode with the use of Classroom or Moodle.

The first one made it possible to easily adapt to the new modality and the work in terms of the theoretical part of the discipline of Solfeggio, however, for the level that is worked on and the subsequent ones, it is very important to be able to develop both theory and practice in a similar way, which was evidenced in the results of the evaluations carried out by the students who worked in Moodle.

Conclusions

Both software are free and allow add-ons and interaction with tools external to their programming, which favors self-taught and collaborative learning.

The assessment of the ES allowed us to realize that Moodle presents greater resources and activities for learning, as well as greater interaction with tools external to its programming than Classroom, however, the instruments applied showed that the students adapted much more easily to the Classroom interface than to the Moodle interface.

After carrying out the instructional design of the Solfeggio courses in the b-learning modality at the UAAUAZ and together with the results exposed by the research instruments and the evaluation of Educational Software, the use of both LMS for the development of the courses in the discipline was determined.

Google Classroom is recommended to be implemented for the courses of the discipline in the Children's Level of the Bachelor's Degree in Music with an emphasis on instrument, between the ages of 8 and 12 years, and that Moodle is the platform in which the Solfeggio courses are anchored for the Basic, Upper Middle and Higher levels of the aforementioned Educational Program.

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Principio del formulario

Final del formulario

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