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**A HYBRID
METHODOLOGICAL
APPROACH TO CHORAL
PRACTICE FOR OLDER
ADULTS IN CUENCA,
ECUADOR: INTEGRATING
ARTIFICIAL INTELLIGENCE
AND DIGITAL RESOURCES**

*ENFOQUE METODOLÓGICO HÍBRIDO PARA LA
PRÁCTICA CORAL EN ADULTOS MAYORES EN
CUENCA, ECUADOR: INTEGRACIÓN DE
INTELIGENCIA ARTIFICIAL Y RECURSOS
DIGITALES*

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A Hybrid Methodological Approach to Choral Practice for Older Adults in Cuenca, Ecuador: Integrating Artificial Intelligence and Digital Resources

Enfoque Metodológico Híbrido para la Práctica Coral en Adultos Mayores en Cuenca, Ecuador: Integración de Inteligencia Artificial y Recursos Digitales

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ABSTRACT

This study examines the integration of artificial intelligence (AI)-based digital tools into the choral practice of older adults in Cuenca, Ecuador. Using a qualitative descriptive approach, the research draws on a literature review, analysis of local choral experiences, and interviews with choral directors. The study proposes a hybrid pedagogical model that combines traditional choral methodologies with AI-supported digital resources to enhance vocal training, repertoire preparation, and learner autonomy. Findings suggest that AI tools can support individual musical learning and aural skills development; however, their implementation is constrained by factors such as digital literacy, access to technology, and teacher training. The study contributes to the field of music education by proposing an innovative framework for integrating AI into community-based choral practice for older adults.

Keywords: artificial intelligence, music education, older adults

RESUMEN

Este estudio examina la integración de herramientas digitales basadas en inteligencia artificial (IA) en la práctica coral de adultos mayores en Cuenca, Ecuador. Utilizando un enfoque descriptivo cualitativo, la investigación se sustenta en una revisión de literatura, el análisis de experiencias corales locales y entrevistas con directores corales. El estudio propone un modelo pedagógico híbrido que combina metodologías corales tradicionales con recursos digitales apoyados por IA para mejorar el entrenamiento vocal, la preparación del repertorio y la autonomía del aprendizaje. Los hallazgos sugieren que las herramientas de IA pueden favorecer el aprendizaje musical individual y el desarrollo de habilidades auditivas; sin embargo, su implementación está limitada por factores como la alfabetización digital, el acceso a la tecnología y la formación docente. El estudio contribuye al campo de la educación musical al proponer un marco innovador para la integración de la IA en la práctica coral comunitaria dirigida a adultos mayores.

Palabras clave: inteligencia artificial, educación musical, adultos mayores

INTRODUCTION

Choral practice is one of the most widely recognized forms of collective musical participation in both educational and community contexts. In the case of older adults, choral singing constitutes an activity that fosters socialization, cognitive stimulation, and emotional well-being (Clift & Hancox, 2010; Creech et al., 2013).

Various studies have demonstrated that participation in collective musical activities contributes to improving quality of life in later years, strengthening social networks, and reducing symptoms associated with social isolation (Hallam, 2015). In particular, choral singing has been linked to psychological, cognitive, and physiological benefits among older individuals (Welch et al., 2014).

In the city of Cuenca, Ecuador, several choral groups composed of older adults function as important artistic and community spaces, including the choir of the University for Older Adults (UPAM), the Santa Catalina Choir, and the Agua Capulí Choir, which function as artistic and community spaces for their members. However, recent research highlights the lack of systematized pedagogical methodologies specifically oriented toward choral work with older adults (Neira, 2024).

In recent years, digital technologies—particularly artificial intelligence—have significantly transformed music education practices. In particular, artificial intelligence has begun to be applied in processes such as audio analysis, automatic music generation, and vocal feedback supported by machine learning algorithms (Briot et al., 2020).

Nevertheless, the integration of these technologies into community choral practice—and specifically within ensembles of older adults—remains scarcely documented in the academic literature.

In this context, the present study aims to analyze the pedagogical potential of integrating artificial intelligence-based digital tools into the choral practice of older adults in the city of Cuenca, Ecuador.

More specifically, this research seeks to identify possible applications of these tools within the choral teaching and learning process, as well as to explore their pedagogical implications in community-based music education contexts. Accordingly, this study addresses the following research question: *How can the incorporation of artificial intelligence-based digital tools contribute to musical learning within choral ensembles of older adults?*

This study contributes to the field of music education by addressing a gap in the literature regarding the integration of artificial intelligence in community-based choral practice for older adults. It proposes a hybrid pedagogical model that combines traditional choral methodologies with AI-supported tools, offering a framework that may be adapted to similar socio-cultural contexts.

Theoretical Framework

Choral Conducting and Music Pedagogy

Choral conducting constitutes a discipline that integrates musical, pedagogical, and communicative knowledge aimed at leading vocal ensembles (Durrant, 2018). The choral conductor fulfills interpretative, pedagogical, and organizational functions within the vocal ensemble.

Some authors have pointed out that the construction of choral sound depends on factors such as vocal technique, collective listening, understanding of the repertoire, and the conductor's gestural communication (Jordan, 2012). In this sense, the choral rehearsal is conceived as a space for collaborative learning in which singers develop musical skills through interaction and active listening (Phillips, 2015).

Within the field of Latin American choral pedagogy, the contributions of Méndez (2003) and Sánchez and Guerra (1982) have supported the development of methodological models oriented toward choral practice. These approaches emphasize a progressive process that begins with unison singing and advances toward polyphonic structures, prioritizing aspects such as intonation, breathing, phrasing, and tonal homogeneity.

Likewise, music education methodologies have influenced contemporary choral practice, including the approaches of Dalcroze, Kodály, Orff, and Suzuki, which integrate the development of musical hearing, rhythmic perception, and bodily expression into the music learning process.

Characteristics of the Aging Voice

The aging process produces physiological transformations in the human voice known as presbyphonia. These modifications include changes in the structure of the phonatory system, alterations in the elasticity of laryngeal tissues, and variations in vocal fold vibration, which may result in a reduced vocal range and decreased vocal intensity (Retuert et al., 2017).

In the choral context, these characteristics require adaptations in vocal technique, repertoire selection, and rehearsal organization in order to prevent vocal fatigue and promote comfort within the singers' vocal range (Welch et al., 2014). In this regard, the choral conductor must consider the physiological characteristics of the singers when planning the ensemble's vocal and musical work.

Artificial Intelligence and the Evolution toward Modern Artificial Intelligence

Artificial intelligence (AI) is defined as the field of computer science dedicated to the design of systems capable of performing tasks that typically require human intelligence, such as pattern recognition, decision-making, and learning from data (Russell & Norvig, 2021). Since its origins in the mid-twentieth century, AI research initially focused on symbolic approaches based on rules and logical representations of knowledge. This paradigm, known as classical or symbolic AI, relied on explicit knowledge bases and inference engines to solve specific problems.

Although these approaches achieved advances in areas such as planning and expert systems, they encountered difficulties in addressing complex environments and processing large volumes of data. Beginning in the 2010s, significant progress emerged with the rise of machine learning and, in particular, deep learning—techniques that enable computational systems to identify patterns directly from large-scale datasets (Briot et al., 2020).

This new approach, commonly referred to as modern artificial intelligence, is based on statistical models and artificial neural networks capable of identifying regularities in complex data and improving their performance through automated training processes. These technologies have had a significant impact on fields such as speech recognition, computer vision, machine translation, and content generation.

In the musical domain, modern artificial intelligence has enabled advances in areas such as automatic audio analysis, source separation, computational music generation, and automated vocal feedback. For instance, Chandna et al. (2022) developed a deep learning–based model capable of separating individual voices within polyphonic choral recordings, facilitating the analysis of each vocal line and the independent study of repertoire.

Similarly, recent studies have shown that AI-assisted vocal feedback systems can improve intonation accuracy and support self-regulation processes in music learning (Li et al., 2025). In the field of music generation, deep learning models make it possible to create

accompaniments, harmonic progressions, and personalized practice materials for music students (Herremans et al., 2017).

Consequently, modern artificial intelligence offers new possibilities for music education by providing tools that support aural training, vocal analysis, and individual musical practice. However, some authors note that these systems present limitations related to creativity, musical control, and user interaction; therefore, their use should be understood as complementary rather than as a substitute for human interpretative processes (Briot et al., 2020).

In the context of choral practice with older adults, artificial intelligence can serve as a complementary resource to support individual repertoire study, strengthen aural training, and enhance preparation prior to choral rehearsals.

Applications of artificial intelligence in music education and choral practice

With the growth of research on the use of digital technologies and Artificial Intelligence (AI)-based tools in music and music education, these resources have become instrumental in analyzing sound data, identifying musical patterns, and generating musical material through computational models (Briot et al., 2020).

Recent literature has demonstrated that digital tools can enhance musical learning by facilitating processes of autonomous practice and auditory training. In the context of singing, AI-assisted vocal analysis systems allow for the assessment of parameters such as pitch, rhythm, and melodic accuracy, providing immediate feedback to the student (Li et al., 2025).

Another line of research is the development of algorithms for source separation, which enable the isolation of individual instruments or voices within complex musical recordings. These technologies are particularly useful in a choral context, as they facilitate the independent study of each vocal line within a polyphonic work (Chandna et al., 2022).

Furthermore, advancements in automatic music generation have led to the development of systems capable of creating melodies, accompaniments, and musical structures through computational models, which opens new possibilities for the creation of practice materials and educational tools in music (Herremans et al., 2017).

In educational practice, these technologies have materialized in digital applications such as Moises.ai, Vocal Remover, and auditory training platforms like EarMaster, which allow for

the separation of musical tracks, modification of tonalities, generation of accompaniments, and development of auditory skills.

Nevertheless, it is noted that the use of Artificial Intelligence in music education should be understood as a complement to the pedagogical work of the teacher and not as a substitute for the human interaction that characterizes collective musical practice (Briot et al., 2020).

The integration of these three perspectives—choral pedagogy, research on the aging voice, and emerging AI-based technologies—establishes a conceptual foundation for exploring new hybrid methodologies in community choral practice. While choral pedagogy provides methodological principles for rehearsal organization and the technical development of singers, research on the senile voice offers the necessary physiological foundations for adapting vocal training strategies. AI-based technologies provide new tools that can support autonomous learning and expand the pedagogical possibilities of the choral conductor in contemporary educational contexts.

Despite these technological advancements, there remains a lack of research addressing the integration of artificial intelligence within community-based choral settings, particularly among older adult populations. This gap highlights the need for pedagogical models that meaningfully incorporate digital tools into collective music-making processes.

METHODOLOGY

The present proposal was developed using a qualitative, descriptive approach, grounded in a literature review, the analysis of local choral experiences, and consultations with conductors associated with the musical context of the city of Cuenca. This approach enabled an interpretative examination of the teaching and learning dynamics within community choral ensembles, as well as an exploration of the potential contribution of artificial intelligence–based technological tools in these contexts.

As a part of the exploratory phase of the research, consultations were conducted with choral directors who have experience in choral conducting and music education across diverse educational and community contexts. The purpose of these consultations was to understand their perceptions regarding the use of artificial intelligence–based tools in choral practice, particularly in ensembles composed of older adults.

The consultations were carried out through direct messages via digital communication platforms, which allowed for efficient contact with the participants. At this stage, three choral

directors with established experience in the field of choral conducting and music education participated.

In order to preserve the confidentiality of the participants, their identities are presented using codes: Choral Director 1, Choral Director 2, and Choral Director 3.

The responses obtained revealed preliminary perceptions regarding the level of knowledge, familiarity, and use of artificial intelligence tools within the choral field, which contributed to complementing the theoretical analysis developed in this research.

In order to broaden and deepen the theoretical review, semi-structured interviews were also conducted with directors of collective singing groups composed of older adults. Participants were selected through purposive sampling, primarily considering their experience in directing such ensembles and their involvement in musical projects aimed at this population.

A total of five directors from different local choral groups were consulted, either in person or virtually, depending on their availability.

The interview questions addressed various aspects related to choral pedagogical practice, including:

- the musical working strategies employed with older adults;
- the main pedagogical challenges identified during teaching processes;
- and perceptions regarding the use of technological tools in music learning processes.

As a methodological foundation for the development of the proposal, the model proposed by Neira (2024), aimed at the formation of choral ensembles of older adults in the city of Cuenca, was taken as a reference. This model is structured into four main stages:

- a diagnostic assessment, intended to identify the participants' initial vocal and musical conditions;
- technical-vocal exercises, aimed at the progressive development of basic vocal skills;
- progressive repertoire selection, considering the group's technical level and the vocal characteristics of its members;
- and a choral approach and ensemble process, focused on voice integration and collective interpretative work.

Based on this structure, an exploratory analysis of digital tools based on artificial intelligence was subsequently incorporated, with the aim of identifying their potential to support music learning processes in community choral contexts.

It is important to note that the methodological proposal presented in this study is exploratory in nature and has not been validated through experimental or quasi-experimental studies. Consequently, its findings should be interpreted as an initial approach aimed at generating future lines of research in the field of music education and community choral practice.

The analysis of the data was conducted using thematic analysis, identifying categories related to choral teaching, music learning, and the potential use of digital tools in community choral contexts.

This procedure made it possible to organize and systematize the information into various interpretative categories, which were subsequently contrasted with specialized literature on music education, choral practice, and technologies applied to learning, in order to establish connections between the empirical findings and existing theoretical frameworks.

RESULTS

The analysis conducted allowed for the identification of three main findings.

The literature review revealed that most research on choral practice among older adults has focused on the social and psychological benefits of choral singing, while there is a limited body of academic work aimed at the development of specific pedagogical methodologies for this age group.

It was observed that most artificial intelligence-based applications currently used in music education have been designed for individual learning contexts or music production, rather than specifically for community choral practice.

The exploration of technological tools made it possible to identify various digital applications with potential to support choral learning, particularly in aspects related to ear training and individual repertoire preparation.

Choral Directors' Perceptions of the Use of Digital Tools

The interviews conducted with choral directors made it possible to identify a range of perceptions regarding the use of digital tools—including those based on artificial intelligence—within the process of music learning in choral contexts. The directors

interviewed indicated that audio separation applications can facilitate the individual study of vocal lines within choral repertoire, as they allow singers to hear their part more clearly, which may enhance interpretative confidence during rehearsals.

Additionally, some participants highlighted the potential of ear training platforms to strengthen musical skills such as intonation, interval recognition, and the identification of rhythmic patterns. However, the directors also pointed out certain limitations associated with the use of technology in groups of older adults, particularly those related to digital literacy, access to technological devices, and internet connectivity.

The consultations carried out also allowed for the identification of initial perceptions regarding the use of tools specifically based on artificial intelligence in choral contexts. The responses indicate that the use of such tools in choral ensembles of older adults remains limited.

Some of the directors consulted reported that they are not familiar with artificial intelligence applications oriented toward choral work with this age group. For instance, one of the directors (Choral Director 1) stated: “I am honestly not aware of any artificial intelligence applications used in choirs of older adults.” Similarly, another director (Choral Director 2) noted that such tools are not used in her ensemble: “In my choir we do not use artificial intelligence, and I am not aware of any choir that does.” Likewise, another participant (Choral Director 3) indicated that they do not have information regarding the use of artificial intelligence in choral contexts, suggesting that the incorporation of these technologies is not yet common in such ensembles.

Taken together, these responses suggest that, although artificial intelligence has begun to be incorporated into various areas of music education, its application in community choral practice—particularly in choirs composed of older adults—remains at an early stage.

Table 1. Artificial Intelligence Tools with Potential Applications in Choral Practice

DIGITAL TOOL	TYPE OF TECHNOLOGY	CHORAL POSSIBLE APPLICATION
Moises.ai	separación de audio mediante IA	estudio individual de líneas vocales
Vocal Remover	procesamiento digital de audio	aislamiento de voces
EarMaster	entrenamiento auditivo	desarrollo de afinación e intervalos
Singerhood	análisis vocal	práctica individual del canto
ChatGPT	IA generativa	generación de materiales pedagógicos

Source: Authors' own elaboration.

Based on the analysis of the identified digital tools, a methodological integration is proposed that articulates the traditional principles of choral conducting with the use of technology-based resources grounded in artificial intelligence. This proposal aims to support the individual musical learning of singers and to complement the work carried out during choral rehearsals.

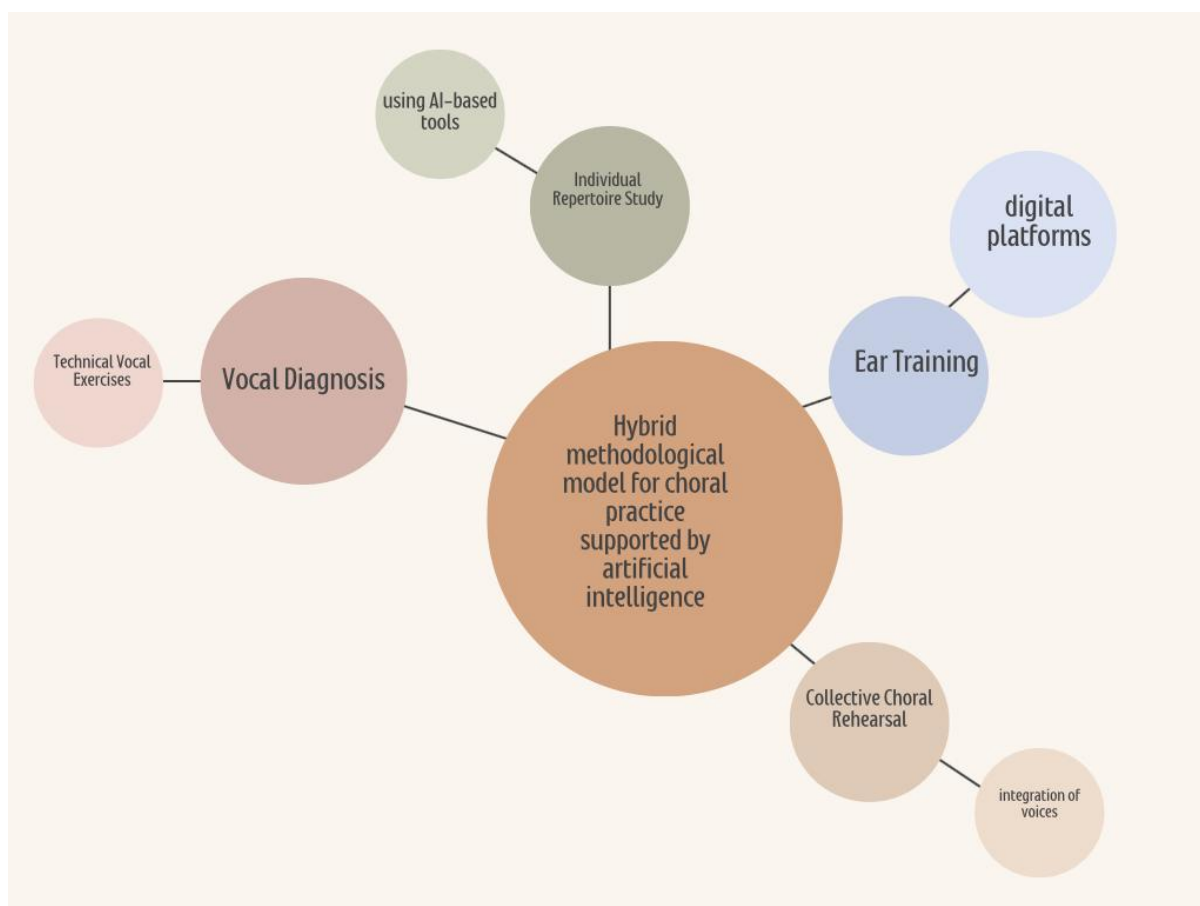
Table 2. Hybrid Methodological Proposal for Choral Practice Supported by Digital Tools

STAGE OF THE CHORAL PROCESS	PEDAGOGICAL OBJECTIVE	SUGGESTED DIGITAL TOOL
Vocal diagnosis	Identification of vocal characteristics and vocal range	Vocal analysis applications
Technical-vocal exercises	Development of breathing, vocalization, and intonation	Singerhood; Endel
Repertoire study	Individual understanding of the vocal line	Moises.ai; Vocal Remover
Ear training	Development of auditory skills	EarMaster
Choral ensemble	Integration of voices within the ensemble	In-person choral rehearsal

Source: Authors' own elaboration.

In order to synthesize the methodological proposal presented in this study, Figure 1 illustrates a model that integrates the traditional stages of choral work with the use of digital tools based on artificial intelligence. This model aims to complement the choral rehearsal process through resources that promote autonomous learning, ear training, and the individual preparation of repertoire.

Figure 1. Hybrid Methodological Model for Choral Practice Supported by Artificial Intelligence. Hybrid Methodological Model for Choral Practice with Older Adults Supported by Artificial Intelligence–Based Digital Tools



Source: Authors' own elaboration.

DISCUSSION

The results obtained are consistent with previous research, which indicates that digital technologies can support autonomous learning processes in music education (Hallam, 2015).

Likewise, recent studies have shown that audio separation tools can facilitate the individual study of vocal lines within polyphonic repertoire, contributing to the development of intonation and the musical understanding of choral works (Chandna et al., 2022).

However, within the context of this proposal, it is necessary to consider factors associated with digital literacy and access to technological resources, as these may influence the implementation of such tools in choral teaching processes.

For this reason, artificial intelligence should be conceived as a supportive tool within the pedagogical process, rather than as a replacement for the work of the choral director.

The present study presents several limitations.

First, the proposed methodological framework is theoretical and exploratory in nature, as it has not been implemented or evaluated through experimental or quasi-experimental studies. Second, the analysis of artificial intelligence tools focused on publicly available applications, many of which are offered in free versions with limited functionality.

Furthermore, it is important to note that the consultations conducted with choral directors were exploratory and involved a limited number of participants. For this reason, the findings should be interpreted as preliminary insights that help identify initial trends regarding the use of artificial intelligence in choral contexts.

CONCLUSIONS

This study examined the potential of integrating artificial intelligence-based digital tools into the choral practice of older adults in the city of Cuenca, Ecuador. Based on a literature review, the analysis of local choral experiences, and the systematization of a methodological proposal grounded in principles of choral conducting, several opportunities were identified for combining teaching and learning processes in community choral contexts.

The findings confirm that choral practice constitutes an activity of significant social, emotional, and cognitive value for older adults. Specialized literature demonstrates that choral singing promotes psychological well-being, strengthens social interaction networks, and contributes to the development of cognitive skills such as memory, attention, and auditory perception.

The analysis also highlighted the need to develop specific pedagogical methodologies tailored to choral work with older adults. Physiological changes associated with vocal aging require the adaptation of conducting strategies, repertoire selection, and rehearsal organization to the particular characteristics of this age group.

Furthermore, the study showed that recent developments in artificial intelligence-based technologies offer new possibilities for music education. Digital tools such as audio separation applications, ear training platforms, and vocal analysis systems may contribute to strengthening individual repertoire learning and improving singers' preparation prior to choral rehearsals.

However, the integration of these technologies into community choral contexts remains at an early stage. The literature reviewed indicates that most research on artificial intelligence in music has focused on music production or individual music education, rather than specifically on choral practice.

In this regard, the methodological proposal presented in this study should be understood as an exploratory approach that seeks to articulate traditional choral conducting practices with emerging technological tools. Artificial intelligence is not conceived as a substitute for the pedagogical work of the choral director, but rather as a complementary resource that can support the music learning process.

Finally, it is important to note that the proposed methodology has not been implemented or evaluated through experimental studies. Therefore, future research should empirically examine the impact of these technological tools on choral learning, particularly in aspects such as collective intonation, ear training, and participant motivation.

Overall, this study provides a theoretical foundation for future research on the integration of digital technologies in community choral practice, as well as for the design of innovative pedagogical methodologies aimed at musical work with older adults.

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