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From Oral Heritage to Digital Code: Philosophical Reflections on the Reconstruction of Traditional Choral Teaching through Artificial Intelligence

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ABSTRACT
The intersection of artificial intelligence and choral traditions is transforming how we learn and preserve music. This critical study explores the deep connection between emerging technology and cultural transmission, revealing how AI can document, learn, and even reimagine musical heritage. By analyzing the interplay among machine learning, bodily knowledge, and traditional pedagogies, the research reveals the intricate processes of using emerging technologies in music pedagogy. The study proves that AI has tremendous potential to understand complex performance properties, maintain distinctive musical heritage, and create adaptive learning experiences. However, it also explores the ethical issues involved in using technology closely, outlining the need for maintaining cultural values and human capabilities. The research proposes a model of collaboration that views AI as a tool to enhance, not replace, traditional musical transmission, ultimately invoking an integrationist position in terms of both technological potential and cultural authenticity.

Keywords: Artificial Intelligence in Music Education, Choral Traditions, Cultural Preservation, Digital Musicology, Embodied Cognition, Musical Pedagogy, Technological Innovation, AI Ethics in Music

INTRODUCTION

The intersection between oral traditions and digital technologies gives a multifaceted way of reconstructing and preserving musical heritage. According to Casas-Mas (2022), such learning cultures are shaped by beliefs and practices on structuring and promoting learning, which provide other ways of approach instead of rigid systems. The influence of embodied cognition has gained the interest of multiple fields in music, specifically influencing psychological research with 4E (embodied, embedded, enactive, and extended) cognition frameworks (Delius & Müller, 2023). The turn recognizes the reality that musical actions evoke bodily behavior that helps individuals interpret their world and consequently establishes a close link between thought and biological processes.
Watching how people coordinate during choral singing shows that the timing of their body systems makes group musical performance possible. Delius and Müller (2023) state that choral singing is a dynamic process that demands tight coordination among individuals, with an interconnected body system and some patterns of connection (see Figure 1A). Their results show that respiratory and cardiac responses at six frequencies were more coordinated during singing than during rest in quietness, especially when singing together and not alone. The connectivity structure represented in Figure 2A reveals how members of the choir and conductors are highly interconnected in different groups with the conductor's main hand showing one-way connection, that is, having a leading function (Müller et al., 2018).

The application of artificial intelligence in recreating traditional choral pedagogy raises philosophical questions about authenticity and cultural preservation. In Umbrello's (2023) view, applying Bernard Lonergan's critical realism as the theoretical framework, AI-mediated realities will both affirm and challenge traditional religious doctrines, probably reshaping symbols, rituals, and creating new spiritual meanings. The intersection point can be witnessed in music pedagogy where intelligent technologies have transformed pedagogical practices. Li and Sun

(2023) found the application of smart technologies to have a positive impact on the performance of students, with piano students showing the most skill (48.55% above average) in final academic concerts compared to violin (39.13%) and percussion (35.71%) students.

The development of online music teaching tools illustrates the evolution of technology. Yan (2022) illustrates how data mining techniques can organize students' access data, identify popular websites, and demonstrate where students struggle to learn. The technique provides personalized online teaching by identifying students' learning difficulties and improving teaching materials on pedagogy platforms. The use of internet music educational resources has revolutionized traditional music education by structuring the curriculum more effectively and supplementing classroom instruction in schools.

Historical Context: The Evolution of Choral Pedagogy

Origins of Oral Transmission in Choral Traditions Across Cultures

The historical context of choral pedagogy reveals a rich tapestry of oral transmission practices that predate written notation by millennia. Archaeological evidence suggests that human musicality dates back at least 45,000 years with the discovery of bone and ivory flutes from the Aurignacian period in southwestern Germany, though some researchers hypothesize that humanity has been making music for much longer (Himonides, 2012). As noted by Benítez-Burraco and Nikolsky (2023), musical practices have been critical in human evolution, with collective singing and performance playing pivotal roles in social bonding and cultural development.

The oral transmission of musical knowledge has been fundamental across diverse cultures. Olusola (2023) observes that in West African societies, information was passed from one generation to the next by mouth within the context of an oral culture. Traditional values, morals, and musical practices were primarily transmitted orally, even as Western educational methods were introduced to the region. Among the Yorubas of West Africa, talking drummers not only provide accompaniment but also communicate messages through rhythmic patterns that incorporate proverbs, demonstrating the complex integration of musical performance and cultural communication.

Patterson (2015) emphasizes that oral transmission is not merely a primitive precursor to written notation but a sophisticated and enduring practice. This understanding challenges the false dichotomy between oral and written transmission that has often characterized music historical scholarship.

Development of Notation Systems and Their Limitations

The development of notation systems represents a significant evolution in choral pedagogy, though these systems emerged alongside—rather than replacing—oral transmission practices. As illustrated in Figure 1, the timeline of music technologies shows how different tools for music representation and performance have emerged relatively recently in humanity's musical history (Himonides, 2012).

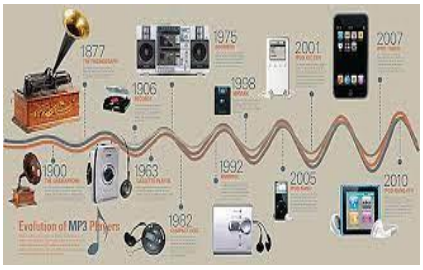


Figure 1: Technology's Influence on Music timeline

The earliest notation systems were primarily mnemonic in nature, designed to help experienced singers recall information already stored in their memories (Patterson, 2015). These systems evolved from basic neumatic notation, which indicated the general melodic contour above text, to more detailed staff notation that specified pitch and rhythm with greater precision. However, even as notation developed, it remained limited in its ability

to capture the full nuance of musical performance, particularly aspects like timbre, articulation, and cultural interpretation.

Blackwell et al. (2000) approach music notation as part of a broader class of notational systems, analyzing its usability through cognitive dimensions. They note that notation systems include both a notation and an environment for manipulating that notation, with each having specific usability characteristics. Their analysis reveals how different notation systems, from traditional staff notation to tablature and sequencer charts, each have advantages and limitations in terms of cognitive dimensions such as viscosity, hidden dependencies, and diffuseness.

The Master-Apprentice Model in Traditional Choral Instruction

The master-apprentice model has been a cornerstone of choral instruction across cultures. This model relies heavily on face-to-face transmission, with learners acquiring knowledge through direct observation, imitation, and personalized guidance. Åkesson (2012) describes how this horizontal transmission process—tradition as personal relationship—has been fundamental throughout the twentieth century, particularly in musical families and tradition-conscious areas.

The effectiveness of this model lies in its ability to transmit not just musical content, but also performance style, cultural context, and tacit knowledge that may be difficult to notate. Lumaca et al. (2018) explain how musical traditions are maintained over time through intergenerational transmission, which must survive what they call the memory bottleneck. The properties of cultural systems that are easiest to process, encode, and recall have the greatest likelihood of being passed to the next generation.

Research by Shanahan and Albrecht (2019) has shown how this traditional oral transmission affects the evolution of folk songs. Their study of the effects of transmission on melodic patterns revealed that in Western folk traditions, scale degree seven is often lost through oral transmission, with cadence points becoming more pentatonic. As shown in Table 1, folk songs primarily transmitted orally demonstrate different characteristics than those transmitted through notation.

Measure	**Western European classical**	**Folk traditions**	**Jazz and improvised**
Transmission mode	Primarily notation	Primarily oral	Mixed oral/notated
Melodic stability	High (fixed by notation)	Variable (shaped by transmission)	Moderate (framework with improvisation)
Scale usage	Full diatonic/chromatic	Often pentatonic or modal	Extended harmonies
Cadential patterns	Consistent V-I	Tendency toward stepwise motion	Extended or altered cadences

Table 1: Characteristics of different musical traditions by transmission mode (Shanahan & Albrecht, 2019).

Technological Disruptions Throughout Music Education History

Throughout history, technological innovations have repeatedly disrupted and transformed choral pedagogy. Himonides (2012) presents a comprehensive timeline of technologies that have influenced music education, from paper (c. 1101 AD) and the pipe organ (c. 1400 AD) to modern digital tools like digital audio workstations and mobile applications.

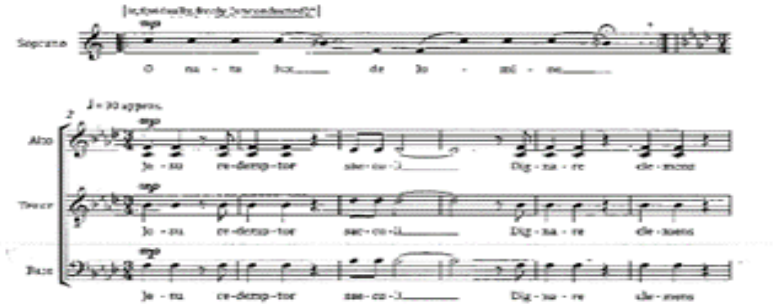
Each technological innovation has introduced new possibilities and challenges for choral instruction. For example, the invention of the phonograph in 1877 made it possible to record and reproduce performances, fundamentally changing how musical traditions could be preserved and shared. This technology accounts for just 0.16% of humanity's evidenced musical timeline but has had a profound impact on how we experience and study music (Himonides, 2012).

The advent of digital technologies in the late 20th century accelerated these changes dramatically. Blackwell et al. (2000) describe how digital sequencers offer multiple views of the same musical data, allowing changes to be made easily in the most appropriate view, thereby reducing the "viscosity" of the notation system compared to traditional paper-based methods. However, they also note that these systems introduce new hidden dependencies and complexities.

Åkesson (2012) discusses the emergence of what she refers to as "mediated aurality" in contemporary folk music pedagogy. This is where traditional methods of passing on music are assisted by recordings and other media. This concept illustrates how traditional methods of sharing music evolve and encompass new technology. It indicates that rather than detracting from oral tradition, technology can be a part of an evolving method to share music. Himonides (2012) agrees with this view. For him, we should see music technology as a tool for the improvement of our musical skills and knowledge and not an end in itself.

PHILOSOPHICAL FOUNDATIONS: KNOWLEDGE TRANSFER IN ART FORMS

Epistemology of Artistic Knowledge Transmission



The overall ideas about how knowledge is transmitted in choral traditions are sophisticated concepts about how we come to know music from generation to generation. Szelogowski (2024) theorizes that artificial intelligence can aid in music education by acting as a bridge between various ways of knowing. This help is important when conventional teaching fails to show and tell the many aspects of musical knowledge. Using AI for teaching choir brings up important questions regarding what is artistic knowledge and how it can be conveyed best.

Tacit Knowledge in Musical Traditions

Musical traditions rely heavily on tacit knowledge—knowledge that cannot be fully articulated through verbal instruction or notation. Miton and DeDeo (2022) demonstrate that tacit teaching often requires intervention in only a small fraction of the total knowledge domain to achieve high-accuracy transmission, as shown in their research on cultural transmission patterns (Figure 4).

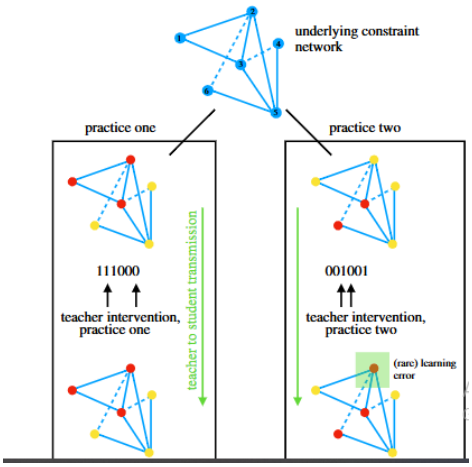


Figure 1:Musical tradition

This model helps explain how complex musical traditions can persist with high fidelity despite limited explicit instruction. In choral contexts, teachers may only explicitly address certain aspects of vocal production while the student intuitively acquires the remaining components through the constraint network of musical practice.

Embodied Cognition in Choral Practice

Choral singing represents a quintessential example of embodied cognition in musical practice. Mitchell et al. (2024) explore how singers experience music as a multisensory activity where "we hear with our eyes," highlighting the integration of visual, aural, and kinesthetic dimensions in musical understanding. Similarly, Galbreath (2020) documents how choral aleatorism workshops reveal the embodied complexity inherent in ensemble singing, showing that decision-making in choral contexts is fundamentally a bodily experience (Figure 1).

Figure 2: Kerry Andrew, O Nata Lux (2005)

Other research by Ridder et al. (2024) also operates to support the embodied nature of choral singing, finding choir singing to be positively related with self-reported embodied cognition in patients with dementia and that bodily engagement with music persists even where other cognitive functions suffer.

Considering How to Approach Music Traditions

Understanding musical traditions incorporates processes that synthesize cultural, historical, and personal backgrounds. Ovcharenko et al. (2020) suggest that the formation of a technology culture in vocal training is a matter of skill and a more profound understanding based on values and culture. In the same way, Grba (2022) reflects on how AI systems present new layers to artistic interpretation, and this brings about questions regarding how we come to understand meaning from music conveyed by digital media.

According to Merchán Sánchez-Jara et al. (2024), in the general sense of the term, AI can also produce new forms of approaching music that conform to conventional methodologies. These new methods may help preserve the culture and enable people from two different cultures share music with due consideration for the culture of every type of music.

Utilization of AI Technologies in Music Learning and Preservation

Music learning through artificial intelligence is a new way of sharing and receiving information in the musical field. In the field of education, artificial intelligence has been incorporated in various pedagogy techniques to enhance the ability to evaluate and enhance various mental competencies in the field of music. AI has been discovered to have a number of application in learning including intelligent instrument and advanced performance evaluation. Some of the new tools for analyzing and recording the musical tradition include the integration of machine learning, natural language processing, and other complex computer methods that have come up.

AI is outstanding in recognizing the usage of human voice through pattern recognition because of machine learning algorithms. These advanced computer methods are able to examine closely each of the small aspects that make up sounds with a high degree of precision. Boratto et al. (2025) have provided the proof that through machine learning, one could be able to distinguish between the two related but distinct phenomena of the vocal fold vibrations and vocal tract sounds in detail that may not be discernible to the human ear. It is used in the monitoring of body movement while playing music in a manner that was previously impossible.

It is also important in converting spoken instructions and the data associated with traditional notations to written forms. Modern AI software is competent to transform the teaching information into easy understandable digital formats making a link between conventional teaching methodologies and technology. This sort of systems are capable of capturing the knowledge passed from the master to the apprentice with a lot of precision. By so doing, natural language processing enable the researchers to capture musical practices in the right and most accurate manner.

To show how technology is used, the table and figures below demonstrate how AI is used to aid music education:

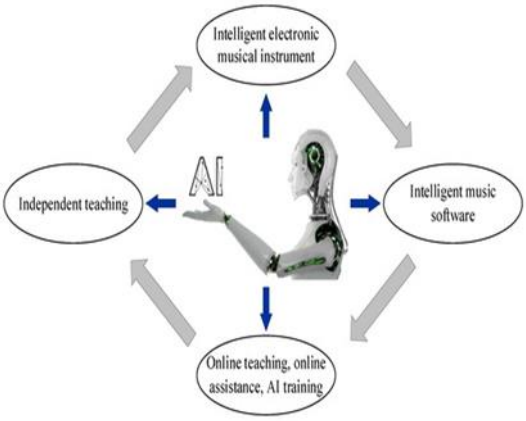


Figure 3: The Relationship between AI and Music Education (Yu et al., 2023)

This complex diagram shows how human voices are created. It supports the description of applying machine learning to decode vocal techniques. The picture divides voice production into major parts: the source (vibrations of the vocal folds), the filter (the vocal tract), and the emitted speech signal. It illustrates the intricate interactions between body systems that machine learning algorithms are eager to examine. It provides a visual representation of the intricate biomechanical processes involved in musical and vocal performance, which were discussed in the text on pattern recognition and vocal technique analysis.

Traditional Instruments	**Intelligent Electronic Instrument with AI**
Need relatively solid basic skills	Assist the performer to complete the music performance and reduce the difficulty of performance
One person only can play the instrument	One person can play multiple instruments
No advanced technological integration	Realizes the cooperation between electronic music online education and wireless network
Limited performance capabilities	Provides intelligent teaching, intelligent scoring

Table 2: Comparison between Traditional and AI-Enhanced Instruments (Yu et al., 2023)

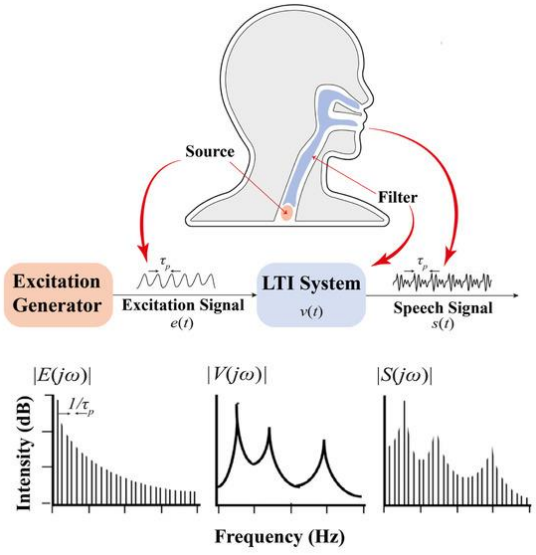


Figure 4: Source-Filter Model of Speech Production (Boratto et al., 2025)

The use of AI to analyze performance by recognizing patterns provides new data on how music is being played. Intelligent systems are now able to give precise feedback on technical ability, stylistic bias, and how well musicians work together, to a level never before possible.

Researchers recently found that these technologies are able to monitor intricate patterns within musical performances with more precise analysis compared to former assessment methods. This method helps individuals learn more effectively and also provides insightful information for understanding music skills and performance qualities. Researchers state that AI is not able to fully substitute human creativity. The most promising way forward appears to be collaboration, utilizing AI's strength in analysis while retaining the unique human aspects of music sharing. Experts discuss cautious planning and raise questions regarding cultural bias, creativity, and ethical use of generative AI in music education.

As they grow, they create new methods of recording, learning, and teaching music through time and across cultures.

Ethical Implications: Authenticity and Authority in AI-Supported Musical Traditions

Depending on artificial intelligence to help preserve music raises important questions about what is authentic, who has cultural authority, and how art is transmitted. As technology plays a larger role in the transmission of knowledge, finding the right balance between new technology and cultural values is very important for researchers. The advent of AI challenges conventional wisdom about learning music, leading to serious contemplation of the ethics of digitizing music preservation.

The question of authenticity in relation to tradition is the major problem of music specialists and everyone concerned with the topic. In his article Cheng (2025) addresses some of the key issues of cultural diversity in AI, mainly noting that most training sets are derived from Western music. This technological issue may result in a Westernization of the music business and reduction of the variety of materials. This is not mere technical reproduction, which is perhaps the reason it is an inexhaustible topic of discussion. It also raises major questions of representation and the specificities of cultural difference that define musical genres.

The transition from human leaders to computer systems is symbolical and has implications on the complexity of how knowledge is viewed. In the traditional music learning system, a student learns directly from an expert, thus acting as a way of conserving culture for several years now, this is changing with the new technological advancements in AI. Such technologies can watch, imitate and generate music. In their study, Yu et al. (2023) explained that AI electronic instruments help musicians, and this can reduce the role of human intervention in teaching. It is such technology that makes one think of what skillfulness is in music and what of the human is involved in the communication of art.

Cultural appropriation issues are highly pronounced in trying to archive cultures online. Boratto et al. (2025) speak to the embodied and more profound cultural aspects of musical performance. They theorize that AI technologies may boil rich cultural practice down to data points. The challenge is how to design AI systems that will archive and honor the unique cultural subtleties of musical traditions, as opposed to homogenizing them in a single digital form.

The dilution argument presents a worthwhile ethical inquiry. On one hand, AI music technologies enable more people to attain musicality, possibly eliminating traditional obstacles to musical learning. On the other hand, there is an enormous potential to lose the depth and cultural significance of musical heritage. Cheng (2025) says that although generative AI can make it easier to produce music, it can take away the deep technical and cultural skill that is acquired through traditional means.

There needs to be access and equity in using technology to conserve music. There is a gap in technology where not everyone can obtain the resources that they need due to different money and culture situations. Yu et al. (2023) state that intelligent music technologies can open up new possibilities for learning, yet they also note that such technologies can create new forms of exclusion.

To illustrate these complex concepts, we can refer to Figure 4 of Yu et al. (2023), which describes the numerous ways AI and music learning are interconnected. The linked segments of the diagram indicate the complex ethical concerns at play, illustrating how AI technologies influence various aspects of musical learning.

The best and fairest solution seems to be a collaboration model that exploits the strengths of AI without compromising human judgment and cultural sensitivity. This demands constant communication, thoughtful technology design, and determination to preserve the complex, subjective dimensions of musical activities that simply cannot be redesigned as computer algorithms.

The future of music preservation relies on striking a cautious balance between emerging technology and genuine cultural values. That is, AI must be employed to enhance music, but not to replace the rich, human-oriented means of transferring musical traditions.

CASE STUDIES: AI IMPLEMENTATION IN CHORAL TRADITIONS

Using artificial intelligence for the conservation of choral traditions offers a new way to document cultural heritage (Mary, 2025). Generative AI systems have amazing potential to notate subtle musical details that can be lost over time and across cultures. These advanced systems can virtually recreate as well as analyze complex music performances with high accuracy. The possibility of AI being used as a whole archive tool is a big step forward in music preservation methods.

The effective utilization of AI in maintaining endangered singing traditions illustrates how technology is able to record significant cultural specifics (Cheng, 2025). Sophisticated algorithms have the capacity to scrutinize singing traditions, performance approaches, as well as cultural backgrounds with high accuracy. Technology has the ability to record more subtle aspects of performances that conventional means may not capture. Scientists have found that AI can provide insight into musical traditions that were unknown to human researchers before.

Comparative studies of human and AI teaching show many varied and complex interactions (Netland et al., 2024). Content created by humans is marginally superior for learning, but AI-generated content can consistently communicate musical information. These technology-mediated methods are new ways of understanding and preserving musical tradition. The research shows that AI can be a supportive tool that augments, but does not replace, human music capacity.

Hybrid models that blend technology and old methods are deemed to be the ideal method of preserving culture (Bergadaà & Lorey, 2015). Community music practices should be treated sensitively to preserve cultural values as well as adopting new technology. In using AI, it is essential to prioritize the human element of passing on music, so that the technology enhances and does not replace ancient methods of learning. The ideal models utilize AI as an effective tool that enhances human cultural learning.

Responses of individuals towards technology indicate that it is highly complicated and has various facets (Herwanis et al., 2024). Cultural communities are curious and worried regarding the potential of AI to safeguard musical heritage. Some communities consider AI as an appropriate way of safeguarding their culture, while others are afraid of cultural appropriation and technological bias. The most favorable uses of technology occur when tech experts collaborate with cultural practitioners.

The use of AI on choral cultures presents serious concerns about reality and the transmission of culture (Mulenga & Shilongo, 2024). These technologies offer new avenues of documenting and examining music practices in accurate ways. Scholars have to balance carefully between using technology and honoring traditional knowledge. The core objective is still to maintain the lively and dynamic nature of musical traditions.

FUTURE DIRECTIONS: A COMBINATION OF HUMANS AND MACHINES

The future teaching of choirs needs to have an intelligent system that will augment human capabilities along with AI technology (Mary, 2025). Human and AI teaching methods need to take into account cooperation in order to support human music teaching instead of substituting it. These systems will have to harness the analytical power of AI to offer novel insights into musical performance, yet preserve the personal emotional and cultural aspects that are supplied by human teachers in music education. The optimal models will engage AI as an intelligent assistant that supports and augments human pedagogical expertise.

Using AI to store music securely in an equitable way needs to take into account culture and technological limits (Cheng, 2025). To use AI appropriately, we need to create diverse training sets with music from all over the globe, use explainable algorithms that people can validate, and make collaboration plans that value human effort. Researchers need to do their best to minimize biases so AI won't unintentionally transform different kinds of music into one.

Technologies are very important in teaching music and safety of music (Mulenga & Shilongo, 2024). Machine learning, virtual reality and adaptive learning systems are some of the new possibilities in personalized music education. It is possible to create intelligent learning environments that can address individual differences, support practice exercises and performances, and provide cultural contexts that cannot be provided by traditional teaching. It indicates that the creation of collections of global music and the educational experiences that come with such a process are becoming more feasible with such technologies.

Another challenge, or rather a difficulty that is worth being mentioned is the ability to keep the human-oriented approach while using technology (Netland et al., 2024). To be effective, we have to consider AI as an assistant and not as a competitor or a replacement of talents. Such an attitude means training models that would develop creativity, emotion, and cultural awareness in man. It is important that teachers should be educated on how to use the available AI technologies. They have to know what is possible and what is impossible in the context of AI and its capability to grasp the essence of music and dance as well as physical and cultural transmission.

CONCLUSION

Technology and musical heritage combine to create a precious element of culture, in which new ideas and traditional artistic practice come together. Musical heritages are not to be conserved static as old artifacts, but as living cultural practices that develop over time. The digital era offers us a special moment to transform the manner in which we share musical knowledge, encouraging more diverse, accessible, and lively ways of learning. In a manner consistent with respecting people's creativity and diverse cultures, using emerging technology, we are able to keep musical traditions active, alive, and relevant. The choral education of tomorrow is not an either/or affair of deciding whether people's aptitudes or new technology are the way to go, but an issue of seeing how to achieve a balance of both the oldest potential of humanity to create art and the innovative possibilities of new technologies.

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