

Improving the quality of music education through applications based on Artificial Intelligence (AI)

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Abstract. Improving the quality of music education through the use of artificial intelligence (AI) technology is a promising opportunity to encourage students' interest in learning music. This article explores the integration of AI-based applications to enhance practical, personalized, and interactive music learning experiences. The research methodology used in this study is a literature review of relevant sources. The results demonstrate the capacity of AI to help teachers improve music teaching by examining student performance data. As for students, they can start self-study by using strategies tailored to their individual needs that aim to deepen their understanding of musical knowledge and ideas such as pitch, speed, rhythm, and harmony.

1 Introduction

Along with the rapid development of the times, it has ushered in an era where artificial intelligence (AI) technology is increasingly integrated into various aspects of life. This technological transformation has a significant impact on the way we work and interact, and AI itself has the potential to change the paradigm of human work, even potentially replacing some jobs in the future [1].

This phenomenon creates new opportunities, especially in the field of music education. The benefits of AI technology in music education can be applied as a medium to spark student interest and enthusiasm in developing inspiration and creativity during the music learning process. Through various applications, musical instruments have a constructive role in online music learning communities to effectively stimulate student creativity in all other music education contexts [2].

Music has aesthetic and expressive values that are useful in the creative process [3]. In the context of music education, the process of creative thinking becomes a fundamental requirement [4]. This is relevant to all the potential offered by AI technology in helping to facilitate the creative process. One example of an AI-based music

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application is one learning model that is currently developing is the use of internet networks or website-based learning platforms [5].

The application of artificial intelligence in music education has changed the traditional music education model, where the understanding of artificial intelligence technology is still limited. As a result, most music teachers are not familiar with AI-based music applications and have not realized their potential in the development of music teaching [6]. So in facing future challenges that are increasingly complex, education needs to adapt to advanced technology, considering the potential for artificial intelligence-based products and services to help students, educators, and administrators throughout the student life cycle is very high [7].

Educational innovation with the integration of AI in music learning is not only a response to the times but also a step forward to improve the effectiveness and overall quality of learning. Although there are potential negative impacts, AI also makes a significant positive contribution to supporting student engagement in music learning and developing rich creativity in the art learning process [8].

The use of AI in music learning inevitably has some challenges and limitations. For example, there is the potential for negative impacts that could harm both teachers and students, as well as the risk of losing the humanistic aspect of teaching music. Therefore, vigilance is needed when integrating AI technology into music learning to minimize potential negative impacts that can harm both teachers and students [9]. The use of AI in music learning must also be balanced with the teacher's role in guiding and motivating students.

This article aims to explore the potential of artificial intelligence (AI) technology in supporting independent music learning, according to students' needs and interests, in order to improve the quality of music learning. The potential of AI in the context of music education has been explored with the hope of making a valuable contribution to the development of education in the arts and technology era.

2 Methods

In this study, more than 10 references, including scientific journals and articles, that are relevant to the use of artificial intelligence technology in music learning were analyzed in depth. These references were selected based on factors such as relevance, credibility, and contribution to understanding the role of AI in increasing interest in learning music.

Data obtained from various references were then analyzed thematically. The data is grouped based on the main themes that emerge in the literature, such as the benefits of AI technology in music learning. A similar approach is applied to information on challenges, teaching methods, human-AI interaction, and other relevant aspects.

Through these data grouping steps, deeper insights can be obtained about various aspects of using artificial intelligence technology in music learning. In addition, this study was also able to identify trends, strengths and weaknesses as well as potential uses revealed from various literature sources that have been reviewed. In this study, the method used is a qualitative approach and a literature review to explore the use of artificial intelligence (AI) technology-based applications identified as a medium to foster

interest in learning music. In qualitative research, which adopts study techniques to reveal phenomena holistically and contextually, the researcher acts as the main tool [10].

The main steps are carried out in a data search. First, identify the main sources that are relevant to research topics, such as scientific journals, books, and articles that discuss the use of artificial intelligence technology in the context of learning music. Furthermore, data searches were carried out systematically using appropriate keywords, such as artificial intelligence (AI), music education, learning, and interactive. After that, sources of information are selected based on predetermined criteria.

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3 Results and discussion

AI technology can support the learning process to achieve music knowledge and skills goals in innovative and interesting ways through various AI-based applications. By using AI applications, students can learn music in a way that is more flexible and according to their interests. Students can also access online learning resources anytime and anywhere via an Android-based cellphone [11].

Online learning systems require educators and students to understand various online learning tools in depth, including media such as laptops, cell phones, internet access, learning software, and other elements [12]. The initial step in this software-based approach involves selecting applications, media, and learning materials to be used and then adapting the topics and learning objectives to the materials that have been selected [13]. The relationship between online learning and information technology is something that cannot be separated.

The application of artificial intelligence technology in music education not only changes the educational model but also stimulates changes in learning approaches and student experiences. In a learning environment that is increasingly connected with sophisticated AI technology, the utilization of this technology becomes a significant component in the evolution of education towards a more adaptive, interactive, and contemporarily aligned learning experience.

Educators' roles, however, are not being supplanted by machines. Their capacity to delve into matters of taste, language, and character development positions their presence as eagerly anticipated by students. This remains true regardless of the pervasive influence

of technology, which is undeniably designed to facilitate human tasks, including within the realm of learning [14]. Consequently, it's crucial to recognize that the integration of artificial intelligence technology must be tailored to the specific requirements and distinct characteristics of music education. Moreover, the incorporation of AI technology in music learning bears the potential to erode the humanistic facets of music instruction.

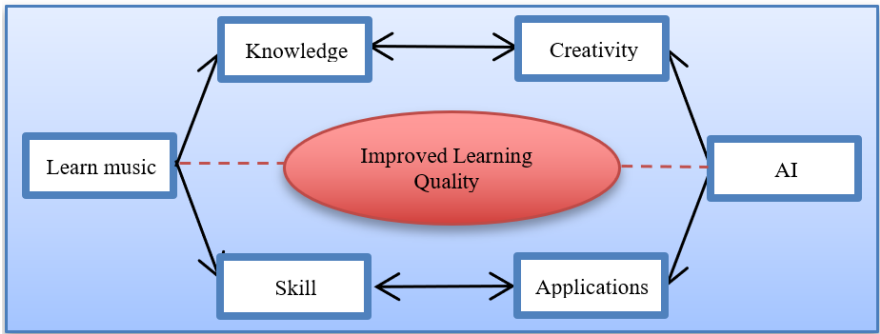


Fig. 1. Paradigm.

3.1 AI applications in music education

A new opportunity to revolutionize the landscape of music education has emerged through innovative collaboration with AI. By seamlessly integrating artificial intelligence into the realm of music teaching, educators can now tailor curricula and instructional approaches to precisely match the unique requirements of individual students. This remarkable advancement is made possible by harnessing the power of machine learning algorithms, which analyze vast sets of data to provide invaluable insights.

The inclusion of AI technology introduces a paradigm shift in the way students engage with music education. Through sophisticated algorithms, AI can provide feedback that is not only accurate but also incredibly detailed. This feedback becomes a guiding light for students, illuminating their areas of weakness and directing their focus towards skill enhancement. This transformative aspect of AI instills a sense of purpose and direction, motivating students to diligently refine their skills.

By embracing this technological synergy, students can access an array of platforms and music applications effortlessly, all through the convenience of their smartphones. This accessibility breaks down traditional barriers, democratizing music education and making it available to a wider audience. Whether practicing scales on a virtual keyboard or receiving personalized composition suggestions, the AI-powered tools empower students to explore, create, and excel. Here are a few inspiring examples of how AI technology is reshaping the landscape of music pedagogy:

3.1.1 Song detection application

The Shazam application stands as a testament to the power of AI technology in swiftly and accurately identifying songs [15]. Leveraging the advancements in mobile technology and audio signal processing, Shazam possesses the remarkable ability to instantaneously recognize a song from a mere 20-second snippet. This feat is achieved by cross-

referencing its extensive database and employing a sophisticated music recognition algorithm [16].

The integration of musical compositions into educational materials holds the promise of igniting students' enthusiasm and cultivating their interest in the realm of musical artistry [17]. This scenario presented Shazam with a groundbreaking opportunity, as such technological marvels had not been conventionally harnessed for musical education. Shazam introduces an expeditious avenue for comprehending and delving into the musical creations of artists. This platform empowers students to glean invaluable insights into the intricate processes underlying music production, dissecting and comprehending the elements that constitute renowned melodies.

This amalgamation of technology and media underscores the versatility and multifaceted essence of AI-driven solutions like Shazam, as they relentlessly reshape our interaction with diverse forms of entertainment and information.

However, while Shazam's innovation is undeniable, it is not without its limitations. It struggles with identifying less mainstream songs and relies heavily on a stable internet connection, thereby posing challenges in regions with inconsistent connectivity. To bolster its capability in recognizing more obscure music selections, concerted efforts towards further refinement are imperative.



Fig. 2. Shazam application [18].

3.1.2 Sound processing application

Adobe Enhance represents a remarkable innovation in the realm of sound enhancement, harnessing the capabilities of AI technology to render voice recordings crisper and of higher quality [19]. This application adeptly elevates the caliber of voice recordings by adeptly eliminating intrusive background noise, while also enhancing the precision and clarity of pronunciation.

Navigating this application is refreshingly straightforward. Users are only required to upload pre-existing sound files, and Adobe Enhance will seamlessly process these files, resulting in recordings that exhibit heightened clarity and more distinct enunciations [20].

In an era dominated by the burgeoning popularity of online learning, the potential applications of Adobe Enhance are truly promising, particularly for students seeking to optimize their voice recordings for online lectures or presentations. Moreover, the accessibility of Adobe Enhance services on a complimentary basis further sweetens the deal, sparing students from the additional financial burdens often associated with such high-quality services.

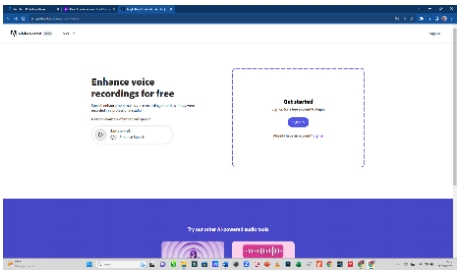


Fig. 3. Adobe podcast application [21].

3.1.3 Music composition application

Amped Studio is an AI-based application that works like a digital audio workstation (DAW). This application opens up new opportunities for making music online for both beginners and professionals [22]. The use of Amped Studio is also similar to conventional DAWs used by composers, producers and sound engineers. But what sets Amped Studio apart is its ability to work through an internet browser without requiring additional program installation. This application can even be used practically without having to make recordings as usual by taking advantage of the available features and adjusting the desired music genre, making the process of making songs or instruments easier and faster.

Although previously not widely used in the learning process, this application has good potential and can provide convenience in using it. The use of this AI-based DAW provides a variety of innovative, interactive, and flexible tools to enrich music learning. Its attractive features stimulate the creative power and enthusiasm of students in the process of learning music.

However, drawbacks exist when using this application. Apart from the limitations concerning the features within this application, the ease of generating musical works in the form of songs or musical instruments does not cultivate the user's proficiency and precision in crafting a piece and cannot completely articulate ideas. The Shazam application, on the other hand, relies on AI technology to swiftly and accurately identify songs [15]. Leveraging mobile technology and advancements in audio signal processing, Shazam can automatically recognize songs from a 20-second sample by cross-referencing its database and utilizing a music recognition algorithm [16].

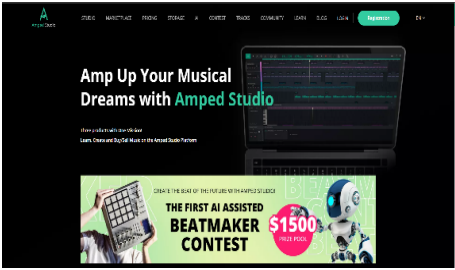


Fig. 4. Amped studio application [23].

3.1.4 Music analysis application

Mix Check Studio is an application that uses AI technology to provide analytical results in mixing and mastering musical works [24]. Using Mix Check Studio is very simple: upload a piece of music to the app, define a music style, and let the AI algorithm process and provide suggestions or analysis of the uploaded piece [25].

Students can utilize this application to analyze recordings from music producers, sound engineers, and podcasters, encompassing volume levels, frequencies, stereo imaging, dynamics, and various other facets of music production. Subsequently, the application generates a comprehensive report detailing identified issues and offering suggestions for enhancement. This data is instrumental in elevating music quality, thereby refining the final outcome.

Optimal outcomes in music recordings hinge on the meticulous mixing and mastering processes, as these stages ultimately shape the definitive auditory experience for music enthusiasts. With this application at their disposal, students can leverage it as a feedback mechanism for refining their self-recorded materials. This iterative process not only fosters a deeper comprehension of music's significance in their lives but also bolsters their capacity to conceive, produce, and ameliorate their musical creations.

However, akin to numerous other AI applications, Mix Check Studio may also exhibit limitations in recognizing intricate and unpredictable musical contexts or characteristics. The ever-evolving realm of music incorporates elements that are exceedingly complex or distinctive, rendering them arduous for an AI algorithm to perfectly identify or analyze. Consequently, analysis outcomes aligned precisely with the desires of a music piece's user or listener might not always be attainable.

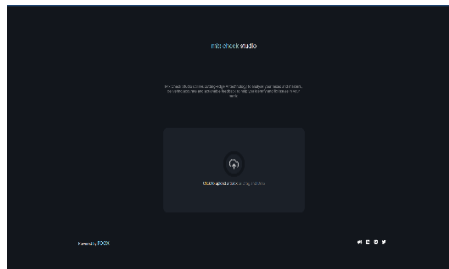


Fig. 5. Mix Check Studio application [26].

3.1.5 Music learning application

AI technologies such as Yousician, an interactive music app from Finland, enable music learning without constraints of distance or time. Yousician helps learn how to play various musical instruments, such as the ukulele, piano, and bass, and improves the quality of singing [27].

Using this app starts with downloading from the app store, creating an account, selecting an instrument, and choosing a learning style. Lessons provide introductory videos, practice songs, and aptitude tests with scores and stars. Other features include tuning, challenges, songs and workshops [28].

This app offers a variety of exercises and challenges to develop musical skills. Its interactive features allow users to practice with friends or music instructors online and get feedback. With a variety of music genres and levels of difficulty, students can choose according to their interests and abilities, making learning music effective and fun.

However, keep in mind that, like any other app, Yousician may have limitations in the process of practicing music; it requires the ability to understand without direct help from the teacher, so that sometimes the training process becomes stiff and ineffective. If you want to access unlimited features, this application is paid, so it can be burdensome for students.

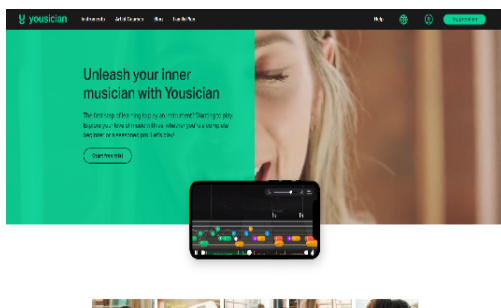


Fig. 6. Yousician application [29].

4 Conclusion

The paradigm of music learning has shifted from the traditional model to the digital era due to the introduction of artificial intelligence (AI) technology. The availability of AI technology has created new potential for music teachers and students to learn and teach music in a more effective and efficient way.

Personalized learning of the musical arts becomes possible thanks to AI technology. With its ability to analyze pitch, tempo, rhythm, and harmony in songs, this technology enables a learning experience that is tailored to the unique characteristics of each student. Various AI-based online applications such as Shazam, Adobe Podcast, Am-phed Studio, Mix Check Studio, and Yousician have opened the door for broader access to learning the art of music. Students can now learn and practice music flexibly without being limited by space or time through internet-based mobile or tablet devices. Students using AI technology also have the advantage of adjusting pace, difficulty level, and student preferences, making the learning experience more adaptive and effective.

While AI technologies have played an important role in shaping the way we learn music, the role of the teacher remains irreplaceable. Teachers still have a crucial role in guiding students in the expressive, emotional, and interpretive aspects of music. The right balance between AI technology and the human side is key to ensuring music learning maintains its human dimension.

The significant positive impact of using applications based on artificial intelligence technology provides potential benefits for students to learn music both in terms of theory and skills, so that the interest of teachers and students increases with various media that offer an interesting perspective on music that is more interactive.

The learning process is personal and adaptive but still receives valuable guidance from a teacher or music instructor as a role that will never be replaced even by anything. Ultimately, artificial intelligence technology will only be a tool controlled by humans to simplify and provide different nuances and experiences for the non-human music learning process controlled by artificial intelligence technology.

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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