

# UTILIZING KNOWLEDGE AND AI COOPERATION APPROACHES IN PROFESSIONAL MUSIC TRAINING — THE TUT EXPERIENCE

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## Abstract

The Ministry of Education in Taiwan is motivating educational institutions to incorporate artificial intelligence (AI) into elementary and middle-school education and expects Taiwan to become a leader in AI education in Asia within two years. In addition, the government plans to launch an alliance between universities. The plan will offer three cross-university credit programs and 14 courses, allowing students to learn from the best teachers. The idea is that technology applications require interdisciplinary collaboration for comprehensive research and development in the educational sector, and the collaboration presents an opportunity for music educators to reconfigure and strengthen their pedagogical approaches. What follows are some observations and reflections from the Tainan University of Technology (TUT), Taiwan, and educators' application of AI in teaching music, such as thesis writing. Notable benefits of integrating AI in the curriculum are research support and improvement in teaching outcomes. Additional benefits include recognizing the accessibility of AI to facilitate personalized learning experiences, create adaptive learning environments, provide real-time insights into student performance, enhance engagement and participation, influence teaching methods, and support the development of music students' critical thinking and problem-solving skills.

**Keywords:** *Artificial intelligence (AI), music, learning approaches.*

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## 1. Introduction

All types of artificial intelligence (AI), such as machine learning, generative AI, and computer vision, are fast becoming prevalent in all areas of higher education today. They are being used to help improve teaching and learning, create enhanced educational experiences, streamline processes, and accelerate academic research (Intel Technologies, 2025). Aguayo-Hernández et al. (2024) suggest that faculty members use different strategies to ensure effective assessments, including continuous evaluation of student progress, familiarity with evaluation models and tools, and constant adaptation and innovation of evaluation practices. Education, including music courses, has seen consistent growth in the use of digital technologies, but integrating artificial intelligence also feels like the beginning of a revolution. Artificial intelligence's emergence has disrupted music education and transformed this new technological development, implying the adaptation of educational ecosystems for its use and integration is a didactic and pedagogical resource (Merchán Sánchez-Jara et al., 2024).

A key challenge exposed in the shift to artificial intelligence in the music education environment is the traditionally focused face-to-face teacher-apprenticeship teaching models. From a critical perspective, the position of AI in the music education environment highlights challenges and opportunities, as well as paradigmatic areas of application, which project the development of AI in the organization and development of teaching-learning processes in music (Merchán Sánchez-Jara et al., 2024). The background to adopting new instructional practices in the classroom provides fascinating insights into the higher education scene where technology and the AI-based portfolio design learning for understanding engagement in practical hands-on activities such as learning how to play a musical instrument, singing, performing solo or in groups, and improvising and composing music.

This research explores the relationship between using knowledge and AI cooperation approaches and shows how teaching students to write and understand program notes can be facilitated by artificial intelligence that can author essays when provided with a prompt by an end user. The case of the Tainan University of Technology (TUT) Music Department was examined to achieve this aim. The main reason for focusing on the TUT is that the study of the TUT's Music Department and its curriculum and integration of innovations has been ongoing since 2020. The TUT offers a seven-year program from high school directly to a bachelor's degree in vocational education, and qualifying as a music artist first requires mastery of the general concert audience. This assumption has ensured that the TUT is a leader in professional music training as music artists shift from amateur to professional status.

## 2. Background

Like other educational programs, professional music training programs are challenged by significant changes in the socio-cultural and educational landscape and addressing pedagogical changes to ensure continued excellence in music teaching is both complex and stratified (Johnson, 2020). In response to Taiwan's societal challenges, such as current issues regarding music education policy, the Ministry of Education in Taiwan amended the Arts Education Act (AEA) of 1997, which outlined the curriculum for study in the performing arts. The AEA of 1997 was related directly to Taiwan's art education reform (Lau & Li, 2013). This new milestone provided a solid foundation for all students in music education in Taiwan (Ministry of Education, Taiwan, 1997). The TUT Music Department's seven-year program from high school directly to a bachelor's degree in vocational education has served as an example of incorporating educational innovations and interventions based on Teachout's (1997) three categories of skills/knowledge components, namely, teaching skills, personal skills, and music skills and behaviors as core competencies. Handbooks published for 2023 present the benefits and limitations of AI in TUT classrooms, for example, time-saving solutions and ethical issues, and provide concrete examples of how AI can be used to improve student outcomes. In particular, incorporating AI is noted as helpful if experimentation with technological innovation is not only a task for the teacher but also involves the active participation of the learning community, including school organizations and parents.

How can AI help teams improve teaching and learning? "The AI models are a series of large amounts of performance data to provide information on student progress, helping educators to identify areas that need more attention and adapt their teaching strategies accordingly" (Merchán Sánchez-Jara et al., 2024, p. 1172). The first version of AI was released in 1951. Several updated versions, including the first mobile intelligent robot in the 1960s, followed. An AI winter was then followed by an AI renaissance in the 1970s and 1980s, Speech and video processing in the 1990s, and IBM Watson, personal assistants, facial recognition, deepfakes, autonomous vehicles, GPT content and image creation, and lifelike GenAI clones followed in the 2000s (Karjian, 2024).

In 2024, Delphi launched GenAI clones, allowing users to create lifelike digital versions of themselves, ranging from likenesses of company CEOs sitting in on Zoom meetings to celebrities answering questions on YouTube (Karjian, 2024). AI is the latest innovation to be integrated into teaching music at the TUT. This paper focuses on how AI can help solve problems such as students' lack of engagement, offering them tailor-made learning experiences. In the context of AI and the associated variety of industries and applications, further adaptations proved necessary to achieve the formal educational goals for the Music Department at TUT.

## 3. Literature review

Research examining the impact of AI on higher education has witnessed substantial growth in recent years, as highlighted in notable studies (Al-Zahrani, 2023; Al-Zahrani, 2024; Bozkurt et al. 2021; Chu et al. 2022; Dai & Ke, 2022; Laupichler et al., 2022; Merchán Sánchez-Jara et al., 2024; Zawacki-Richter et al., 2019). Scholars from diverse fields, including education, computer science, psychology, and ethics, have explored various facets of AI implementation in higher education settings. Merchán Sánchez-Jara et al.'s (2024) research results confirm that incorporating AI in music education paves the way for a more personalized, interactive and efficient learning experience. However, there is a noticeable lack of emphasis on higher-order thinking skills, collaboration, communication, self-efficacy, and AI skills in higher education studies (Chu et al., 2022). Laupichler et al. (2022) emphasize that research on AI in higher education is still in its early stages, necessitating refinement in defining AI literacy and determining appropriate content for non-experts to enhance educators' and students' understanding of AI. However, Zhang (2023) emphasizes the advantages of working on teaching strategies according to the unique learning profiles of each student. In this sense, in line with González-Gutiérrez and Merchán Sánchez-Jara (2022), reflection on how, why and for what purpose new technologies are used in educational ecosystems becomes even more relevant in the era of artificial intelligence. This literature review overviews key research areas and offers insights into existing knowledge.

At the TUT, students can receive individualized tutoring and feedback from AI based on their learning requirements and development. Students can receive individualized research support tutoring from a conversational agent built on generative AI tools, which enhance learning outcomes. The conversational agent can adjust explanations to students' comprehension levels and misconceptions.

In the following section, Schumann's Piano Piece *Papillons*, Op. 2 is used as an example to evaluate the merits of using AI as a research assistant, like accessing relevant information and data, with students writing academic papers using AI for writing assistance and suggestions for phrasing, tone, and style.

#### 4. Schumann's Piano Piece *Papillons*, Op. 2 program notes for a classical western concert

As an aspect of the Research Methods and Thesis Writing class at the graduate student level, student performers are expected to write program notes about their performances for a general concert audience, an audience of non-musicians who are interested in music and reasonably knowledgeable. The goal of teaching students to write program notes is to increase the audience's understanding and enjoyment of the music performed (Blom et al., 2020).

It is assumed that program notes are naturally associated with knowing how to listen and think about the music performed at the strategic level and initiate a relationship between performers and their audiences. Therefore, students presenting recitals are encouraged to write notes for themselves and their audiences, and graduate students are often asked to relate interesting facts about the composer they are studying. Knowing the historical context of a piece makes for better interpretations and a better listening experience.

Before COVID-19, the teacher might have taken time in class to explain Schumann's Piano piece *Papillons*, Op. 2, as students rehearsed the piece. For example, the teacher might have alerted students to what was going on in inventive and descriptive titles from Schumann's piano music when he composed the piece and discussed how it is similar or different to anything audiences had heard. Much like college music lecture recitals, the teacher might have discussed with the students and raised awareness about how Schumann uses titles to reflect the tempo or speed at which he wants the music to be played. The teacher might also have focused on literature and reflected on including program notes to notify the audience about what was written before the piece. For example, the scene of the masked ball at the end of Richter's novel *Flegeljahre* (1804, as cited in Perahia, 2014) provides the dramatic "setting" for the cycle. It is a scene in which two brothers in love with the same woman vie to win her heart amid the gaiety and varied musical offerings of a social evening with a dance orchestra. Program notes inform the audience of this, facilitating a better listening experience by including what is interesting and relevant about the composer.

Therefore, the purpose of learning about this musical piece goes beyond just playing good music well. It incorporates an intentional introduction to new musical discourses and tools for students to add to their cognitive understanding of how music works by helping the student (and audience) understand that music is located within time and culture. With the growth of artificial intelligence (AI) and natural language processing (NLP) technologies, chatbots have evolved significantly, becoming more capable of handling complex tasks and undertaking more human-like interactions.

So, how did my teaching of writing program notes change with the introduction of AI in the online educational context? AI was trained on a massive dataset of text from the internet, allowing it to generate human-like responses to various questions and prompts (Kooli, 2023). Assessing students through case studies is an example of an effective student assessment strategy. Using case studies that require students to analyze real-world scenarios and apply their knowledge to solve complex problems could help mitigate the effects of the excessive use of AI (Kooli, 2023).

While AI can provide students with immediate answers to questions, using AI in the educational field also raises ethical challenges that must be addressed: AI can also lead to academic dishonesty and a lack of learning. In addition, using chatbots can create an uneven playing field because some wealthy students may have access to better or more advanced chatbots than poor students. These are two different issues—one is directed at ensuring all students, regardless of their economic status, have access to the same quality of assistance, and the other supports institutional efficiency.

#### 5. Conclusion

The most disruptive potential of generative AI in music education lies in its ability to create immersive and adaptive learning environments that simulate real-world intervention contexts (Merchán Sánchez-Jara et al., 2024). Various AI tools and techniques can be used in education to help researchers, educators, students and even the institution. This paper has reviewed the utility of AI technologies and the ethical challenges that might emerge from using AI. It acknowledges that the potential benefits of AI systems in the academic field include personalized learning, increased accessibility, and improved efficiency and teaching outcomes; consequently, the use of AI is likely to increase in the coming years.

However, AI tools are limited in providing the same quality of critique for performances as would be the case in face-to-face instruction, in the same way as watching a televised concert performance, which is an inferior experience compared to watching a live performance. Moreover, online distance learning courses in music mean that teaching music online requires knowledge and skills in online design, assessment, and communication. At the same time, regardless of what research reveals about AI tools and their place in education, music teachers will be asked to use remote teaching methods to ensure the sustainability and scalability of music education and attract and retain students. The integration of AI in music teaching is revolutionary and disruptive, but arguments for adopting and adapting online learning approaches for teaching music and musical appreciation should not be ignored.

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