



Applying artificial intelligence in teaching music for primary education students at Tan Trao University

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Abstract

Artificial Intelligence (AI) is driving broader and deeper changes in higher education. The application of AI in university teaching includes learner data collection, building learner models, constructing domain knowledge models, and developing teaching models. However, there are still some challenges in applying AI in teaching higher education, primarily concerning the understanding of the relationship between AI and humans, establishing educational goals in AI applications, and ensuring data safety and risks. The article is based on the theory of music teaching and the results of applying AI in teaching to highlight the current situation of music education for primary education students at Tan Trao University. Through an analysis of the current situation, we propose five solutions to apply AI in music education and organize pedagogical experiments to verify feasibility, with the aim of innovating teaching methods and enhancing teaching quality.

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1. Introduction

Today, the application of artificial intelligence (AI) in teaching has become a new development trend in the field of education. With its ability to self-learn, analyze data, and make accurate predictions, AI can support both lecturers and students in various aspects, from teaching and assessment to classroom management. This trend also aligns with and promotes the implementation of Resolution 29 of the Ministry of Education and Training on “Fundamental and Comprehensive Innovation in Education and Training”.

In teaching, AI can assist lectures in creating customized lessons for individual students^[5], while helping lecturers track students' progress and provide appropriate recommendations to enhance teaching quality^[6]. Furthermore, AI can also aid students in developing self-learning skills, identifying students' level of understanding, and offering them materials and exercises suitable for their proficiency level^[7, 8]. By implementing AI in education, schools can enhance teaching quality, ensure fairness, and minimize assessment time^[9].

The article explores and proposes some directions for applying artificial intelligence in teaching music for primary education students at Tan Trao University.

2. Content

2.1. Overview of Some Applications of Artificial Intelligence in Teaching

The application of artificial intelligence (AI) in teaching is a topic of great interest to many researchers and educators seeking exploration. Globally, I have noted several prominent studies on this issue, such as:

Google's research in the work “Using Machine Learning to Improve Student Outcomes”^[1] focused on leveraging artificial intelligence to enhance students' academic performance. This study was conducted in a mathematics class at a high school in California, USA. Teachers utilized an automated tool to generate customized assessments based on each student's proficiency.

This tool employed artificial intelligence to analyze data from previous assessments and formulate questions tailored to individual students' abilities. These assessments were designed to target the skills and knowledge areas that students needed to improve upon. The results indicated that using automated tools to create customized assessments significantly improved students' learning effectiveness. Students achieved higher scores on assessments and made faster progress compared to students in the control group, where assessments were designed in a traditional manner. However, the authors of the study also recognized that applying artificial intelligence in teaching still faces numerous challenges and requires further research to ensure accuracy and fairness.

The authors Chassignol, M., Khoroshavin, A., Klimova, A., & Bilyatdinova, A. in the study "Artificial Intelligence Trends in Education: a Narrative Overview" [2] focused on presenting key trends and applications of AI in education, including machine learning, chatbots, personalized learning, and virtual and augmented reality applications.

Trotter (2006) in the article "Student Perceptions of Continuous Summative Assessment" [3] concentrated on studying students' perceptions of continuous summative assessment. The research results provided insights into students' perspectives and perceptions of this assessment format. This could help educators and educational managers better understand students' opinions and perceptions of continuous summative assessment.

In the article "Towards Next-generation Teaching, Learning, and Context-aware Applications for Higher Education: A Review on Blockchain, IoT, Fog and Edge Computing Enabled Smart Campuses and Universities" [6], authors Fernández-Caramés, T. M., & Fraga-Lamas, P. focused on examining the applications of Blockchain technology, IoT (Internet of Things), Fog Computing, and Edge Computing in building smart campuses and universities, creating applications aimed at enhancing teaching, learning, and context awareness in higher education.

Regarding the learning environment and models, author Ahmed, H.M.S in the article "Hybrid E-Learning Acceptance Model: Learner Perceptions" [8] focused on the Hybrid E-Learning acceptance model and learners' perceptions of this model. The research results can provide information on learners' acceptance, opinions, and perceptions of the Hybrid E-Learning model.

Furthermore, there are numerous other studies related to the application of AI in education, ranging from theoretical to practical aspects [9, 10],... Stemming from various purposes, these studies have implemented and provided evaluations, assessments, as well as practical solutions to increasingly feasible technology integration in education, enhancing training effectiveness.

In Vietnam, the application of AI in education is being developed and widely implemented, especially in the context of the COVID-19 pandemic, where online teaching has become prevalent.

The 8th Central Committee of the Party (11th term) adopted a Resolution on "Fundamental and Comprehensive Renewal of Education and Training" [4], affirming the need for strong innovation in teaching and learning methods towards modernization, promoting active and creative learning, and applying knowledge and skills of learners. To enhance the effectiveness of teaching, the education sector is paying much attention and investment in the application of information

technology in general and educational software in particular in teaching activities. In Decision No. 117/QĐ-TTg 2017, the Project "Strengthening the Application of Information Technology (IT) in Management and Support for Teaching and Scientific Research to Improve the Quality of Education and Training for the 2016-2020 period, towards 2025" outlined the objective: "Enhancing the application of IT to promote the innovation of content, teaching methods, assessment, evaluation, scientific research, and management activities at educational institutions within the national education system". IT is one of the crucial means, bringing advantages in teaching such as enabling teachers to update information, innovate teaching methods (from direct to online teaching, application of technology-based games, etc.), engaging students actively and encouraging their participation in learning, as well as innovating school management and teaching methods. Using software in teaching activities is also a requirement in innovating teaching methods to actively engage students with the assistance of modern teaching aids.

The application of artificial intelligence in teaching higher education first and foremost requires "learner digitization". "Learner digitization" involves collecting current and potential learning behavior data of learners, whereby learning activities and the learner's developmental process can be monitored, quantified, and recorded to serve as a basis for accurate proposals and evaluations. For learner digitization, it is initially necessary to discuss and analyze theories, including understanding theories of learning and standards of data formats from various sources for mutual conversion. This requires technical support and the use of intelligent technology to collect, analyze, and apply data.

The transformation of artificial intelligence in teaching at university is primarily accomplished by understanding the learners and the learning process. Understanding learners and the learning process, also known as learner modeling. The purpose of learner modeling is to accurately describe the learner model through analyzing knowledge level, cognitive development, learning status, learning styles, and learning motivation of the learner through comprehensive, multi-level, and multimodal data analysis.

University educators must possess certain educational and teaching knowledge to conduct teaching and enhance the learning effectiveness of learners through specific educational and teaching methods. The application of artificial intelligence in teaching at university must also be based on certain educational and teaching methods and the development of corresponding teaching strategies, thereby promoting the learning behavior of learners. In artificial intelligence in education, this process is carried out through continuous assessment, thereby providing the most appropriate feedback to learners at the right time. Continuous assessment is based on two aspects: understanding the learner's state. For example: mastery of instructions, learning ability, and the learner's emotional state; basic understanding of domain knowledge, such as the relationship between the current content and other content, previous knowledge related to the learning content...

In the field of education, the application of artificial intelligence holds significant potential and opportunities, with the Intelligent Tutoring System (ITS) being one of the most advanced applications. The intelligent tutoring system primarily consists of four main areas: the learner domain, the subject domain, the teaching method domain, and the

interactive interface domain. These areas, based on artificial intelligence platforms, provide four main interconnections: learner digitization, learner modeling, knowledge domain modeling, and accurate teaching deployment. These interconnections can help educators better understand learners' learning situations, provide personalized learning services to learners, and optimize teaching methods and resources. Therefore, the application of artificial intelligence in university teaching plays a positive role in improving teaching quality, promoting learner development, and fostering educational innovation.

Below are some examples of the application of artificial intelligence technology in education in Vietnam:

Virtual reality-enhanced learning: Virtual reality applications such as Vdict's Image Dictionary and Viettel's Virtual Reality Enhanced Learning allow students and teachers to interact with virtual objects, perform actions on 3D models, enhance learning experiences, and improve problem-solving abilities.

Virtual assistants and chatbots: Virtual assistants and chatbots are developed to answer students' and teachers' questions, provide useful information, and support the learning and teaching process. An example is the HOCMAI chatbot from Hocmai.vn.

Machine learning and data mining: Machine learning and data mining solutions are used to analyze student data and provide personalized feedback to each student. An example is the Smart Classroom IoT application from the Posts and Telecommunications Institute of Technology.

Online learning platforms: Online learning platforms such as Edmicro, Topica Native, Hocmai.vn, and Edugear use artificial intelligence technology to optimize learning experiences and provide personalized learning content for each student.

However, the use of artificial intelligence in education also poses many challenges and controversies, such as the accuracy of solutions, the potential unwanted impacts of automated teaching on students' learning processes, and the need for teacher intervention to ensure accuracy and optimize outcomes.

2.2. The Current Situation of Teaching the Music Subject for Primary Education Students at Tan Trao University.

2.2.1. Introduction to Primary Education, Tan Trao University, and Music Subject

Tan Trao University is located in Yen Son district, Tuyen Quang province. In its training activities, the university particularly focuses on providing high-quality human resources for rural and mountainous areas. The university also engages in various cooperative activities with domestic and international partners to strengthen and enhance the quality of higher education.

The Primary Education is one of the disciplines under the Faculty of Preschool and Primary Education at Tan Trao University. During the learning process, students are equipped with knowledge of educational theory, child psychology, creative thinking development, teaching skills, and classroom management.

As a subject within the Primary Education program, Music is one of the essential subjects in the primary education curriculum. It helps students develop creative thinking abilities, convey emotions, learn, and absorb knowledge through music. The Music subject assists students in practicing necessary skills such as listening, recognizing, and analyzing sounds, voices, and rhythms, thereby helping

children develop critical thinking, analysis, and evaluation skills, providing them with essential knowledge and skills for teaching primary school students.

To enhance the quality of teaching, in recent years, lecturers teaching the Music subject have constantly innovated teaching methods and applied information technology in teaching. For example:

- Developing an electronic lecture system to help student's access lectures before, during, and after class. Moreover, electronic lectures are linked to various internet resources, providing concrete evidence of music learning.

- Integrating face-to-face and online classes to meet practical requirements while allowing students to actively engage in learning. Online classes: With the development of the internet, lecturers and students can use online teaching platforms such as Zoom, Google Meet, Microsoft Teams, etc., to teach and learn the Music course. By using these technologies, students can participate in remote classes and interact with lecturers and classmates as if they were in a traditional classroom.

- Using some software such as

- + Music notation software: Music notation software helps students learn how to read musical symbols and notes more easily. Some widely used music notation software such as MuseScore, Finale, Sibelius, etc., are extensively used in music education to help students learn how to write and read music.

- + Audio editing software: Audio editing software such as Audacity, GarageBand, Logic Pro, etc., help students record and edit sound. Students can use this software to record their audio tracks and then edit and improve the sound quality.

- + Educational websites: Websites like Musictheory.net and Teoria help students learn basic music theory concepts and explain fundamental terms and concepts. Students can use these websites for self-study and practice exercises easily.

2.2.2. Survey on the Application of Information Technology in Teaching the Music Subject

a. Survey Objectives

The survey aims to achieve the following basic objectives: 1/ To gather reliable data on the current status of applying information technology (IT) in teaching the Music subject; 2/ To analyze the data, assess the situation (advantages and disadvantages), identify the factors leading to difficulties for both lecturers and students in the process of applying IT in teaching the Music subject; 3/ To provide a basis and method for proposing measures to contribute to effective teaching and learning.

b. Survey Participants:

04 Lecturers teaching the Music subject for Primary Education students and 50 Primary Education students.

c. Survey Content:

For lecturers: Survey on the level of IT application usage by lecturers in teaching the Music subject for Primary Education students.

For students: Survey on the level of IT application usage by students in learning the Music subject.

d. Results

The survey investigated the current level of Information Technology (IT) application in teaching the Music subject for Primary Education major students by 4 lecturers. The obtained results are presented in the Table 1.

Table 1: Current Status of IT Application in Teaching the Music subject.

No.	Activities	Level of Usage									
		Daily		Weekly		Monthly		Once or twice per semester		Never	
		Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
1	Lesson planing	9	75	3	25	0	00	0	00	0	00
2	preparing electronic lectures	8	66.7	2	16.7	1	8.3	1	8,3	0	00
3	Researching information and resources for lesson planning	6	50	3	25	2	16.7	1	8.3	0	00
4	Creating videos, documentary photos, and animations for teaching purposes	0	00	1	8,3	3	25	5	41.7	3	25
5	Teaching with projector usage	5	41.7	4	33.3	1	8.3	2	16.7	0	00
6	Online teaching	6	50	4	33.3	1	8.3	1	8,3	0	00
7	Responding to emails from students, colleagues, etc.	0	00	1	8.3	3	25	8	66.7	0	00
8	Organizing computer-based examinations.	0	00	3	25	4	33.3	3	25	2	16.7

Surveying the current level of IT application usage in the music subject learning activities of Primary education

students. The obtained results are presented in the Table 2.

Table 2: Level of IT Application Usage in the Learning Activities of the Music Subject of Primary Education Students

No.	Activities	Level of Usage									
		Daily		Weekly		Monthly		Once or twice per semester		Never	
		Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
1	Online learning	19	38	25	50	4	8	2	4	0	00
2	Finding study materials	17	34	16	32	14	28	3	6	0	00
3	Responding to emails from lecturers	0	00	3	6	4	8	5	10	38	76
4	Completing assignments/ tests given by lecturers	11	22	8	16	18	36	13	26	0	00
5	Interacting with friends	19	38	19	38	7	14	5	10	0	00
6	Playing games/entertainment	28	56	17	34	3	6	2	4	0	00

e. Comments

- The survey results show that almost all teachers have applied IT in teaching activities, but mainly at a basic level. The level of IT application in basic teaching activities is not high. Most students actively use IT in the learning process in the classroom as well as at home.

- However, there are some difficulties in applying IT in teaching the Music subject, such as: Some lecturers have limited IT capacity and skills, only reaching a certain level. Some students, due to family circumstances or regional characteristics, have limited access to IT, so they are hesitant and intimidated when using IT. Although they have been relatively well-equipped with the necessary equipment for teaching, there are many devices that are not synchronized or of poor quality due to various objective and subjective reasons.

Therefore, looking at the reality and through the survey results analyzed above, it is clear that the choice of IT, and how it is used, is very important and necessary in teaching to achieve the best educational effectiveness for students.

3. Some solutions applying artificial intelligence in teaching music subject for primary education students

3.1. Using Voice Recognition Technology

Using virtual reality (VR) technology in practical training is one of the solutions applying artificial intelligence in teaching music for primary education students. Virtual reality technology allows students to experience music lessons in a virtual environment, making their learning experience more engaging and enjoyable.

Virtual reality technology creates an interactive environment for students, allowing them to interact with 3D musical objects, simulate landscapes, stages, and music performance venues. Students can participate in simulated activities,

practice practical skills, improve their singing voice, and engage in music-related games.

With virtual reality technology, students can focus on specific musical skills they want to develop, enhancing their concentration and improving learning efficiency. Additionally, virtual reality technology enables students to experience things that are not possible in reality, such as experiencing different musical environments and confidently performing on stage.

Therefore, using virtual reality technology in music practice training for primary education students is an effective solution to enhance their learning abilities and musical skills.

3.2. Using Chatbots for Learning Support

AI-powered chatbot systems are one of the solutions applying artificial intelligence in teaching music for primary education students. Chatbots are intelligent virtual assistants capable of answering questions related to music theory and practical skills.

Chatbots can be programmed to respond to basic music-related questions, including music terminology, notes, and verbs in music. Additionally, chatbots can provide advice and information on practical skills, such as using different music tools, performing singing techniques, or composing music.

Chatbots can be integrated into online learning platforms, such as websites, learning apps, or online forums. Students can access chatbots anytime to search for information and get answers to music-related questions.

3.3. Developing Learning Applications

AI-powered learning applications in music education can improve students' learning efficiency by customizing learning content to match the level and learning needs of each student. AI can use machine learning algorithms to analyze

input data from students and suggest suitable lessons and practice exercises. Moreover, AI can provide feedback to students on errors during practice and suggest ways to improve.

Furthermore, AI can generate interactive and diverse practice exercises for students to effectively practice their music skills. For example, AI can create exercises tailored to students' preferences and levels, requiring them to perform songs or melodies in pop, rock, or jazz styles.

The use of AI-powered learning applications in music education can help student's access appropriate learning content and practice their music skills effectively. This can significantly improve students' learning efficiency and contribute to the development of music education.

3.4. Using Machine Learning Technology for Data Analysis

Machine learning technology is a method of artificial intelligence used to analyze data and create predictive models. When applied to music education, this technology can help analyze data on students' music skills, thereby assisting teachers in making appropriate teaching proposals and plans for each student.

For example, data on students' music skills such as speed, accuracy, and difficulty of exercises can be collected and analyzed using machine learning algorithms to create predictive models of students' proficiency and potential. Based on these results, teachers can make suggestions on practical exercises and teaching methods suitable for each student, helping them improve their music skills.

However, to ensure the accuracy of the analysis results, it is necessary to have sufficient and accurate data on students' music skills. Additionally, appropriate machine learning algorithms should be used, ensuring transparency and fairness in the evaluation process and teaching proposals.

Training

Virtual reality technology has been widely applied in education, especially in teaching and learning various subjects. In music education, virtual reality technology can help students experience music lessons in a virtual environment.

Instead of just learning from textbooks and having teachers lecture on theory, students will be placed in a virtual environment similar to a real classroom, with musical objects and equipment, allowing them to have a more realistic and immersive experience.

With virtual reality technology, students can practice playing musical instruments, singing, and composing music in a safe environment without being limited by space and time. They can also receive immediate guidance and feedback from teachers, helping them improve their music skills quickly and effectively.

By applying virtual reality technology in music education, students can find learning more interesting and engaging. This can create a positive learning environment, helping students focus more and achieve better results.

4. Pedagogical Experiment

4.1. Experiment Objectives

The pedagogical experiment aims to test the feasibility of the proposed measures regarding the application of information technology in teaching the Music subject. From there, it affirms the effectiveness of the measures and proposals, recommending the application of research results in practice and on a broader scale.

4.2. Experiment Participants

Students in the K6 Primary Education class. The lecturer: Ms. Mai Thi Van Huong.

4.3. Experiment Content

Based on the detailed outline, lesson plan and subject curriculum of the Music 1 subject, we selected a experimental lessons according to the prescribed school year plan and conducted the pedagogical experiment lesson.

4.4. Experiment Organization

Conducting the experimental lesson, Lesson 1, Chapter 4. Rhythm - Tone. The experimental steps are as follows:

Step 1. Send electronic lectures to students for lesson review, and resource search before class.

Step 2. In-class activities involve using educational games through software such as Quizzi, Canva,... Utilize electronic lectures for teaching and expanding students' knowledge through linked resources.

Step 3. Students practice using voice training software.

Step 4. After class, students practice and submit assignments as per lecturer's instructions.

4.5. Results and Evaluation

4.5.1. Qualitative Results:

The qualitative evaluation of the pedagogical experiment's results is based on the evidence gathered during the experiment, practice exercises, classroom observations, feedback, and evaluations from students after the lesson. We observed that the experimental group of students was more enthusiastic, focused, and had a higher level of engagement during the lesson and practice sessions compared to the control group.

The students in the experimental group demonstrated a lively and enthusiastic attitude towards learning. Most of them grasped the lesson content more quickly when the teacher used IT techniques in teaching.

The teaching session was lively and effective; the class organization was appropriate, and the design and use of scientific IT tools were integrated into the lesson, suitable for the students. The control group lesson scored 79 points (rated as good), while the experimental group scored 95 points (rated as excellent).

4.5.2. Quantitative Results

To analyze the quantitative results of the pedagogical experiment, the author of the study examined and evaluated the results of the students' assessment sheets.

Table 3: Test Results of Students' Knowledge and Skills

Class	Number of students	Results							
		Score below 5	Rate %	Score 5 - 6	Rate %	Score 7 - 8	Rate %	Score 9 - 10	Rate %
Experimental group	22	0	0%	2	9.09%	13	59.9%	7	31.82%
Control group	21	0	0%	8	38.09%	11	52.38%	2	9.53%

The results show that after applying IT in the proposed teaching methods, the learning outcomes of students have improved. The proportion of students scoring 5-6 (average) in the experimental group is 9.09%, whereas in the control group, it is 38.09%. The proportion of students scoring 7-8 (good) is similar between the two groups, with the experimental group at 59.09% and the control group at 52.38%. However, the proportion of excellent scores (9 and 10) in the experimental group is significantly higher at 31.82% compared to the control group's 9.53%.

This indicates that the learning outcomes of the experimental group are higher than those of the control group, suggesting that the attitude and academic ability of the experimental group are better than those of the control group. Therefore, it is evident that the proposed measures are feasible and effective. Thus, during teaching, teachers need to pay more attention to the application of IT in teaching and ensure specific impacts in each teaching task and activity in teaching the Music 1 subject. By doing so, the effectiveness and quality of the lessons will undoubtedly be enhanced.

5. Conclusion

The application of artificial intelligence technology in education and teaching will promote the development and innovation of teaching models based on collected data, thereby significantly impacting the development of the education sector. Efficient integration of artificial intelligence technology with education and teaching is also an important guarantee to promote the continuous progress of education. With the emergence of artificial intelligence, it also provides innovative ideas and new directions for the development of education and teaching. Applying artificial intelligence in the teaching process will be highly effective, creating interest in learning and enhancing learners' adaptability, thereby continuously improving learners' levels and learning abilities. At the same time, educators will have sufficient reliable resources to innovate and improve teaching methods and effectiveness. From the 5 solutions aimed at applying artificial intelligence in teaching the music subject for primary education students, we conducted pedagogical experiments to test the feasibility of the measures. The results showed that the experimental group had higher evaluation scores than the control group. The pedagogical experimental results confirm the feasibility of the measures in enhancing the quality of teaching the Music 1 subject by applying artificial intelligence in teaching; thus, contributing to improving the quality of teaching and helping learners achieve the program's learning outcomes.

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