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Music Information Technology as a Practical Direction for Developing the Innovative Abilities of Future Music Educators

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Abstract: In the contemporary education landscape, music education often finds itself sidelined or undervalued, prompting educators to continually seek its significance. As the 21st century unfolds, education is not just about knowledge dissemination but is evolving to emphasize societal integration and interaction. Music education, in tandem, is transitioning from mere musical training to nurturing diversified thinking and societal viewpoints. Yet, the potential of music information technology in this redefined context remains under-explored. This study delves into this domain, employing the Technological Pedagogical Content Knowledge (TPACK) integration framework and the Project-Based Learning (PBL) method. Findings underscore the centrality of the TPACK framework in the teaching process, emphasizing that educators must not only master content and pedagogical knowledge but also adeptly harness technology to augment teaching and learning. This manuscript uniquely positions music information technology as a pivotal tool for cultivating the innovative prowess of future music educators.

Keywords: Music Education; 21st Century; Music Information Technology; Technological Pedagogical Content Knowledge (TPACK); Project-Based Learning (PBL); Technological Knowledge (TK); Content Knowledge (CK); Pedagogical Knowledge (PK); Societal Integration; Innovative Abilities; Music Educators.

1. Introduction

The issue of music education being at the bottom or overlooked among many disciplines still exists in the education sector of most countries in the 21st century, and this phenomenon has always been the driving force for music educators to seek the significance of music education. With the progress of the times, people's understanding of education is becoming more diversified. Schools are no longer merely institutions that impart knowledge, nor are they limited to book education, but emphasize interaction with society and integration. In addition, music education is no longer limited to providing music training, but a process of cultivating diverse thinking and social perspectives. The rapid development of technology is profoundly changing our way of life, including how we educate and learn. Music education, as an important field of education, is also undergoing this transformation. Music information technology, as a product of technological development, has become an important part of music education, providing teachers and students with new ways of learning and teaching. However, how to effectively use music computer technology to improve teaching effectiveness and students' innovative abilities is still an important issue.

2. Technological Pedagogical Content Knowledge (TPACK)

2.1. Technical Knowledge in an Educational Context

The development of music information technology provides new possibilities for music education. Through the integration with new technology and information, teachers can more effectively organize and implement teaching activities, and also provide richer and more diversified teaching resources. Students can also better understand and master music knowledge through the use of music information technology, and can also improve their innovative abilities.

In this regard, the research of Tejada and Morel provides some valuable insights [12]. The music technology curriculum they designed is based on two key components: the Technological Pedagogical Content Knowledge (TPACK) integration framework and the Project-Based Learning (PBL) method. The goal of this design is to improve the initial teacher education of music technology.

The TPACK framework is a theoretical model that emphasizes the interaction and integration of Technological Knowledge (TK), Content Knowledge (CK), and Pedagogical Knowledge (PK). The core concept of this model is that teachers not only need to master content knowledge and pedagogical knowledge in the teaching process, but also need to understand and master how to use technology to support teaching and learning.

In the TPACK framework, Technological Knowledge (TK) refers to the understanding and ability to use technology, including the use of various educational technology tools and resources, and how to integrate these technologies into teaching. Content Knowledge (CK) refers to the understanding and mastery of a specific subject area, including the concepts, theories, and methods of the subject. Pedagogical Knowledge (PK) refers to the understanding and mastery of teaching methods and strategies, including how to design and organize teaching activities, how to evaluate students' learning effects, and how to manage the classroom, etc.

The TPACK framework emphasizes the interaction and integration of these three types of knowledge. That is, teachers need to integrate these three types of knowledge in the teaching process in order to incorporate ICTs into their teaching practices in any given content area. For example, teachers may need to understand how to use specific

technology tools to support student learning (TK), while also understanding the core concepts and theories of the subject (CK), and how to design effective teaching activities (PK).

In the paper "The Implementation of TPACK Framework Based Interactive Digital Learning for Cruise Vocational School (SMKP) Sinar Bahari Palembang", the authors used the 4-D method, namely Define, Design, Develop, and Disseminate. The research results show that using interactive digital learning with the netboard application, quizwhizzer.com, and Qodlu is the best way to implement TPACK. Each student at the Cruise Vocational School (SMKP) Sinar Bahari Palembang enjoys fun learning and has a better personal approach to the course. The article points out: The TPACK framework (Technological Pedagogical Content Knowledge) is a very important aspect of learning activities, it is not only about how to develop a good teaching process, including giving and scoring assessment tools, but also includes understanding student behavior and its psychological aspects. Pedagogy is about teaching in specific methods and strategies in order to understand the character of students more deeply, thereby formulating specific teaching strategies for specific students [10].

However, the TPACK framework does not explicitly stipulate how to achieve this integration or interaction. In fact, how to effectively integrate these three types of knowledge may depend on the teacher's personal experience, educational background, teaching environment, and the specific subject area they teach. Therefore, understanding and applying the TPACK framework may require teachers to engage in continuous reflection and learning.

Project-Based Learning (PBL) is a teaching method that encourages students to learn and apply knowledge through actual projects. In this course, students need to collaborate to design teaching materials that will assist music teachers in their daily professional practice. These projects aim to solve multidimensional problems in other subjects in degree courses, while also providing prospective teachers with a meaningful learning environment.

In Tejada and Morel's study [12], the project outlines a design and evaluates and verifies an Information and Communication Technology (ICT) training course, which is part of the initial teacher education program for prospective music teachers at a university in Spain. The main goal is to improve the initial teacher education course design of music technology through two key components: (1) Constructivist learning through collaborative projects (PBL); (2) Technological Pedagogical Content Knowledge (TPACK) integration framework. In the course, the students completed four real-life projects, three of which involved producing educational materials using only music technology, and one involved an ICT research project. The results obtained from the final product evaluation and self-assessment questionnaire indicate that the course was warmly welcomed and highly rated by the participants. In their self-assessment responses, the students talked about the academic value of the course, their confidence in their own skills, their willingness to use ICT in future teaching environments, the importance of ICT in their degree courses, in fact, the course exceeded their expectations of achievement [12].

Research has proven that through this approach, music information technology can not only improve teaching efficiency but also stimulate students' innovative abilities. Students enhance their innovative abilities by using music technology to complete actual projects. At the same time, this method can also help students better understand and apply the theoretical knowledge of music education.

Furthermore, music information technology can also help improve students' attitudes towards music education. Atabek and Burak's study found that prospective teachers have a positive attitude towards using information technology in music education [2]. This positive attitude may have a positive impact on their future teaching practices.

In this study, the authors mainly discuss how digital multimedia VR technology changes the traditional music education model. The article uses the implementation of a digital multimedia VR art course as an example, mainly discussing the application of VR technology in art teaching, especially in music education, through questionnaire surveys, interviews, and classroom observations. VR technology provides a real situational experience, allowing students to delve into the situation, and can send out images with the calculation of the computer as the students' usage location moves. The real situational experience generates a desire for students to learn, stimulates students' intrinsic motivation in music teaching, and provides future music teachers with professional innovation. The article fundamentally discusses the innovation of music courses in the era of digital multimedia VR technology. The experimental results show that as many as 72,2% of students stated that the implementation of the digital multimedia VR art course is effective, and their music teachers occasionally use digital multimedia VR teaching facilities for music course teaching, and this data is on the rise.

In the intelligent education environment, the continuous penetration of information technology in the teaching field, its role and advantages are constantly reflected. Related scholars have given more and more attention to the deep integration of information technology and teaching. Information technology can help music teaching provide a more vivid teaching experience, break the solidified barriers of traditional teaching models, and through the deep integration of information technology in music teaching, the teaching classroom can become a key platform for students to develop innovative thinking abilities and personalized art styles.

In the current 21st century where technology is developing rapidly, 5g networks and artificial intelligence have become the new technology darlings in various fields around the world. Artificial intelligence technology originated in the 1950s and is a concept, methodology, tool, and implementation system that uses digital computers or computer-driven machines to replicate, extend, and enhance human intelligence. At present, artificial intelligence technology has transformed from a concept to reality, achieving functions such as audio recognition, image recognition, language recognition, and natural language processing, and is now widely used in various fields, including education, medical, security, finance, and autonomous driving. And the latest ChatGPT has also brought disruptive changes to various fields. As a result, the technological revolution they brought about is also booming in the traditional and stable education field.

In the field of music education, the application of technological means has paved the way for creating new works and new paths and teaching concepts for music educators. Now, in the field of artificial intelligence and big data, a new concept has emerged to promote the development of music education by teaching and using artificial

intelligence technology in art education. The current rapid development trend of big data and the Internet has also triggered the reform and innovation of education in universities across China. The research on online music education, the characteristics of music education under the big data Internet, exploring the informatization mode of music education, realizing the innovation and integration of music education and big data information means, truly achieving the seamless connection of online and offline music education resources, better enhance the intrinsic driving force to promote the innovation and development of music education under big data.

However, despite the great potential of this cross-disciplinary integration model in theory, there may be some challenges in practical application. For example, teachers need to have sufficient technical knowledge and skills to effectively use the music information technology platform. For instance, a study by Mawusi and Kwadwo found that although most music teachers have good academic qualifications and rich teaching experience, they lack the ability to teach music using computer technology [9]. Therefore, improving teachers' computer technology capabilities is key to fully applying music computer technology in music education. In addition, teachers also need to have good project management and collaboration skills to effectively guide and support student learning.

To address these challenges, we need to develop effective teacher training and professional development programs. These programs should include technical training to enhance teachers' technical knowledge and skills. At the same time, these programs should also include training in project management and collaboration skills to help teachers more effectively guide and support student learning. In addition, we also need to develop effective evaluation and feedback mechanisms to monitor and evaluate the application of music information technology in music education. These mechanisms can help us understand the needs of teachers and students, as well as the development path of the entire information platform. In this way, we can timely adjust our teacher training and professional development programs to better integrate technology with education and promote the innovative thinking ability of future music teachers.

Technical knowledge (TK) in the context of music education refers to an understanding of how to utilize a variety of digital tools and resources to perform tasks, solve problems, and achieve educational goals. This includes knowledge of music production software, digital audio workstations, online collaboration tools, and other technologies used in music composition and performance.

In today's era, digital technology offers countless new possibilities in the field of music education. Digital technology tools are an invaluable medium in the teaching and learning process at all levels of education from elementary school to college and professional. A study by García-Fernández et al. found that despite the maturity of technological resources on the Internet, the use of technological resources in music education is still relatively scarce. Research shows great potential for further integration of technological tools in music education [5].

Digital storytelling, a type of participatory media production, is another example of how technical knowledge can be applied in the context of music education. Lang et al. discussed how digital storytelling can be used as a tool for education and outreach as well as therapeutic interventions [8].

The previous COVID-19 pandemic accelerated the digitization of education around the world. A study by Khoruzha et al. discussed how the application of digital tools and services became a priority during distance learning, including in the context of doctoral education [7]. The digitalization of global education also provides countless possibilities for the resource integration of digital technology in the field of education.

A study by Antón-Sancho and Sánchez-Calvo found a significant increase in the use of digital tools in teaching activities during the pandemic, especially in areas where such tools were less used before the pandemic [1].

Technical knowledge (TK) plays a vital role in modern music education. It involves understanding and applying a range of digital tools and resources to enhance the teaching process. Integrating traditional knowledge into music education can improve learning outcomes and equip students with valuable skills for the digital age, making good use of technical knowledge (TK) is crucial to transforming music education.

2.2. Content Knowledge in Educational Context

Content knowledge (CK) in the context of music education refers to an understanding of music theory, history, composition, performance, and other aspects that make up a musical subject. This includes knowledge of different musical genres, instruments, compositional techniques and the cultural and historical context of various musical compositions.

In a study by A. Yeriomenko titled "Cyclic forms in Anatolii Haidenko’s creativity: genre-style features" [16], the importance of knowledge of musical content is emphasized. The study emphasizes the importance of understanding the aesthetic, genre, and stylistic constants of a composer's creative activity. This understanding forms part of the knowledge of musical content and is essential to the analysis and appreciation of music.

Another study by H. Tsap, entitled "Jazz performance of 1920s as a component of popular American music" [13], highlights the role of content knowledge in understanding and interpreting genre-specific characteristics of jazz. Research points to an in-depth understanding of jazz genres, styles and performance practices, which are part of content knowledge and are critical to appreciating the music and its cultural significance.

Furthermore, a study by S. Tsatas entitled "Decolonized listening in the archive: a study of how a reconstruction of archival processes and spaces can contribute to decolonizing narratives and listening" [14] highlights the role of content knowledge in understanding cultural importance. and the historical context of Aboriginal music. The study argues that by focusing Aboriginal traditional knowledge in archival settings, Aboriginal music records can be described and preserved according to Aboriginal frameworks, thereby enriching content knowledge for music education.

And a study by L. P. Tutom, S. Nadarajan and Y. Djaelani titled "Interpretation, imagination, and transformation in the creation of 'Timang XekorY' " [15] highlights the role of content knowledge in the creative process. music creation. This study shows how understanding the traditional Iban prayer ritual Timang Tuah, part of content knowledge, can inspire and guide the creation of musical performances.

These studies highlight the importance of content knowledge in music education as it provides the necessary foundation for understanding, appreciating and composing music. At the same time, on the basis of these contents, through the addition of new media technology, the most cutting-edge content knowledge in the industry will be brought into college education, so that music education can always maintain a keen sense of the market, acquire multi-dimensional thinking, and improve innovation capabilities.

2.3. Pedagogical Knowledge in an Educational Context

Pedagogical knowledge (PK) refers to the understanding of how the teaching and learning process works. This includes knowledge of different teaching strategies and approaches, knowledge of learner characteristics, knowledge of assessment methods and knowledge of how learning activities are planned and managed.

In teaching, PK is crucial because it provides the foundation for effective teaching. It involves understanding how students learn, what teaching strategies work best, and how to assess student learning. For example, a study by Ogienko [11] defined instructional facilitation as a key element of teacher professionalism, which includes understanding and support as the basis for teacher-learner interaction. It emphasizes the recognition of each individual's unique individuality and collective decision-making responsibility, which are integral to PK.

In addition, PK also extends to understanding the use of technology in teaching. As suggested by Jamil and Bhuiyan [6], deep learning elements in maritime simulation programs can be enhanced by well-defined learning outcomes, improving learning content, and facilitating learning readiness and extended tasks. This highlights the importance of PK in creating an effective learning environment.

On the other hand, PK also involves understanding the role of peer interaction and feedback in learning. Elizondo-García and Gallardo [5] found that peer feedback is a practice that can enhance learning in settings with diverse student profiles and limited teacher involvement. This suggests that PK also involves understanding how to facilitate effective peer interaction and feedback. Cotič et al. [3] found that PK also involves understanding the importance of experiential learning. Experiential learning of the environment through hands-on activities is important to students because it motivates, stimulates learning, and positively impacts understanding of the natural sciences. This emphasizes the importance of PK in promoting practical and experiential learning activities. These massive multidimensional studies provide a reference for establishing the importance of adding new media technology in the field of music education. (PK) Proper use can effectively enhance teaching interaction and feedback through new media technology, expand the immersive experience of practical activities, and improve students' professional vision and scene association.

3. Conclusion

PK is a multifaceted concept that involves understanding various aspects of teaching and learning. For teachers, developing strong PK capabilities is critical to effectively facilitating learning and improving student achievement.

As mentioned earlier, TPACK emphasizes the intersection of technical knowledge, pedagogical knowledge, and content knowledge. Adding new media technology to teaching design is an important direction to improve teaching creativity, which may be reflected in many aspects. For example, the use of new media technologies (technical knowledge) can provide students with hands-on, immersive experiences in composing and performing music. A combination of guidance from new media industry mentors (content knowledge) will allow students to develop a deeper understanding of the subject matter. Furthermore, the innovative teaching methods (teaching knowledge) employed will facilitate effective learning.

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