

Exploring the TPACK Proficiency of Music Teachers: A Review

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Abstract: The rapid advancement of technology has transformed education, especially during health crises and natural disasters, when the importance of technology integration in teaching and learning becomes most apparent. Substantial literature highlights the role of policymakers in facilitating technology adoption and emphasizes the need for institutional support and professional development for teachers. Technological competence is crucial, and models like the TPACK framework guide effective technology use. However, there is a need for further exploration of TPACK in music education in China. Through a literature review, this paper aims to identify existing research gaps in terms of utilizing the TPACK framework in teaching music education. The study aims to provide future research perspectives, contributing to filling the gap and further enriching the ongoing discussion on the development of competency for technology-supported music education teaching.

Keywords: TPACK Proficiency, Music Teachers,

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INTRODUCTION

The world has recently experienced an unheard-of explosion in technological development, altering every aspect of human existence. Education is one area where technology has had a significant impact. The conventional educational approach, which relied on textbooks, chalkboards, and in-person interaction, has progressively given way to a dynamic learning environment with a strong digital component. Technology in education has changed how knowledge is taught and acquired, thus, providing new opportunities for further improvement in teaching and learning. The advantages of adapting educational technology, such as learning managements systems, has been underscored during health crises or even during natural phenomena when onsite classes are prohibited. However, additional competencies are needed for the successful utilization of technology in classroom. The use of educational technology necessitates additional training that will equip teachers with adequate technical knowledge.

Sangeeta and Tandon (2020) underscored the importance of the educational institutions' policymakers in providing an environment that supports the use of technology. The findings suggest performance expectations and facilitating conditions positively influence teachers' behavioral intentions and attitudes towards online learning. The policymakers shall craft policies that would ensure the provision of pre-requisite conditions to facilitate the smooth integration of technology into classrooms. Considering how technology may lead to new ways of teaching and learning, schools must provide an environment conducive to technology-enhanced teaching and learning. It concurred with Biasutti et al. (2021) that asserted that there is a need to revise curricular activities and teaching methodologies to make them suitable for online instruction, thus arguing that online teaching is time-consuming.

Moreover, it was found that teachers are fully aware of the advantages and limitations of e-learning and emphasize the need for increased institutional support and expanded opportunities for professional development. These findings can be attributed to the diverse forms and degrees of technology integration in classrooms. Therefore, teaching methodologies should be adjusted to ensure suitability; otherwise, it undermines the use of technology to enhance teaching and learning.

Technological competence has grown in importance in the educational setting, and it is now one of the most important skills for teachers to possess in today's society. In the past years, several Information and Communication Technology (ICT) integration paradigms or models have been developed in the past years to guide the teachers in integrating technological tools effectively in their

teaching. According to Kimmons (2016), these paradigms or models explain the use of ICT in educational environments, and how it might supplement and improve instructional strategies. Among the widely recognized ICT integration models in education include the Cone of Experience (Dale, 1969), TPACK model (Mishra & Koehler, 2006), First Principles of Instruction (Merrill, 2002), ADDIE model (Gagne et al., 1974), ASSURE model (Heinich et al., 2002), and SAMR model (Puentedura, 2010). Although most models and frameworks focus on how teachers can use technology in various ways and forms in the classroom, there is a rising interest in further understanding the knowledge and abilities required to use technology effectively.

Among the mentioned frameworks, the Technological, Pedagogical, and Content Knowledge (TPACK) model provides a comprehensive explanation of how to augment teaching with Information and Communication Technology (ICT) by allowing technological knowledge to blend with two other forms of knowledge: content and pedagogical knowledge. Mishra and Koehler (2006) asserted that the blending of knowledge in technology, pedagogy, and subject matter results in creating seven (7) forms of professional knowledge, which are crucial in effectively using technology in teaching.

The TPACK underscores the importance of developing technological competencies to support teachers' existing pedagogical practices. It is aligned with Li's (2023) findings, which found out in its study that most educators possessed sufficient non-technology-related expertise but exhibited a deficiency in technology-related knowledge. The same was reflected in Foulger et al. (2017), which emphasized the need to develop Teacher Educator Technology Competencies to produce technology-using teachers. However, besides technological competencies, other various barriers may impede teachers from using technology in their classrooms (Blackwell et al., 2013; Dinc, 2019; Wood et al., 2007).

Despite the existence of substantial literature that has used the TPACK framework, there is still a need to explore their use in the context of music teachers in China, specifically in the Jiangsu province. For TPACK, the nature and content of the subject areas vary; thus, TPACK development may also differ depending on the subject area (Zhang & Tang, 2021). Furthermore, Yu, et al. (2014) asserted the importance of exploring how TPACK reflects among various subject area teachers. This study aims to describe the TPACK-related professional knowledge of music teachers. The research will be significant for the development of professional development programs for music teachers in China.

METHODS AND MATERIALS

This paper conducted a comprehensive review of studies grounded in the TPACK framework. The search encompassed various research databases such as Google Scholar, the Chinese National Knowledge Infrastructure (CNKI), and the TPACK database curated by the College of William & Mary in Virginia, USA. Utilizing keywords such as "TPACK," "Music Education," and "Music Teachers," the analysis focused on identifying and examining studies that explored the application of TPACK in the context of teaching music education.

REVIEW OF RELATED LITERATURE

3.1 Integration of Technology in Education

The convergence of pedagogical skills and technology adoption has taken on increasing importance in the field of music education. It is impossible to overestimate technology's promise to improve music instruction and engagement as it continues to transform the educational landscape. A crucial component of contemporary music education has emerged: assessing teachers' pedagogical expertise and technical integration skills.

Pedagogical competencies are the knowledge, abilities, and methods a teacher uses to successfully explain musical concepts to pupils, encourage creativity, and support their musical development. Unlocking novel and creative methods for teaching and studying music requires understanding how to apply these competencies to contemporary technology tools.

According to Kibici and Sarikaya (2021), all educational systems have significantly adjusted due to the COVID-19 epidemic. Many academic institutions started creating online remote learning programs without considering the necessary infrastructure and strategy. The effectiveness of online learning for the music classroom depends on various factors, with online learning preparedness being one of these factors. In the Biasutti et al. (2021) paper, participants discussed how they had developed skills, including adaptability, creativity, and problem-solving, to manage technology when creating curriculum and

utilizing various remote learning devices. They altered the curriculum, integrating musical instruments into online teaching techniques. Participants claimed that online teaching required a lot of time, such as organizing activities, preparing materials, and investigating the latest technological possibilities, and that it was upsetting to have lost a healthy work-life balance. They noted that the way they managed their activities had become more coordinated. Internet platforms have been shown to be helpful for exchanging information, communicating, and keeping track of work progress. Additionally, participants gained knowledge of systematic video clip utilization for modeling and teaching.

Use of Technology to Facilitate Teaching Process

The use of technology to facilitate the teaching process has seen significant growth and transformation in recent years. With advancements in digital technologies and increased access to the internet, educators have embraced various tools and platforms to enhance their teaching practices and create more engaging learning experiences for students.

Many studies have explored how Chinese teachers integrate technology into their pedagogical practices. Researchers have examined the use of multimedia tools, interactive whiteboards, educational apps, and online resources to enhance instructional delivery and engage students in the learning process (Xue & Churchill, 2020).

The Use of Technology for Student Assessment

For the assessment of students, technology may be used for online quizzes and tests. Many Chinese teachers have adopted online assessment tools to conduct quizzes and tests. These tools offer automated grading and real-time feedback, enabling teachers to identify students' areas of strengths and weaknesses (Chen et al., 2022). Competencies under this dimension include creating effective online assessments, which entails teachers being skilled in designing online quizzes and tests that align with learning objectives and accurately measuring students' understanding. Teachers should also be competent in analyzing assessment data. Competent teachers can analyze data from online assessments to identify trends and make data-driven instructional decisions.

Moreover, e-portfolios and digital projects provide opportunities for students to showcase their learning progress and achievements through multimedia formats (Oh et al., 2020). Teachers' competencies include Guiding Portfolio Development, which entails that teachers should be able to guide students in creating comprehensive and reflective e-portfolios that demonstrate their growth and learning outcomes. Another competency of teachers is to assess digital projects. Using rubrics and other assessment tools, competent teachers can evaluate digital projects based on creativity, content, and presentation skills. Technology can facilitate peer assessment, where students provide feedback and evaluate their peers' work (Zheng et al., 2019). Teachers' competencies in technology-enabled peer assessment include structuring peer assessment activities where teachers should design peer assessment tasks that foster constructive feedback and promote a positive learning environment. Teachers should also be able to monitor and facilitate peer feedback. Competent teachers guide students' peer assessment processes, ensuring the quality and fairness of the feedback provided.

Chinese teachers' technology adaptation involves their competencies in using technology to facilitate the teaching process and for student assessment. Teachers need to possess knowledge of educational technology, design technology-enhanced lessons, and adapt technology to the classroom context. Additionally, they should be adept at leveraging technology to conduct online quizzes, facilitate e-portfolios and digital projects, and support technology-enabled peer assessment.

3.2. The Technology Acceptance among Teachers

The use of technology in education has become increasingly prevalent globally, including in China. Chinese teachers' technology adaptation refers to their ability to effectively integrate technology into their teaching practices, enhancing their students' learning experiences. This adaptation includes using technology to facilitate the teaching process and assess student learning. In this section, we will discuss the literature on the technology adaptation of Chinese teachers, focusing on using technology to facilitate the teaching process and student assessment.

A study by Liu et al. (2018) found that Chinese language teachers' perceptions of technology and instructional use have improved in recent years. The study also found that teachers' self-efficacy in using technology has increased, and they now have greater access to technology resources. The study also found that the relationship between teachers' perceptions of technology and their instructional use of technology is mediated by teachers' self-efficacy in using technology. It means that teachers who believe they can use technology effectively are more likely to use it in their instruction, even if they have a low initial perception of its usefulness or ease of use.

The study's implications include designing and implementing technology-enhanced learning programs for Chinese language teachers. The study suggests that programs should focus on increasing teachers' perceptions of the usefulness and ease of use of technology and their self-efficacy in using technology. Additionally, programs should ensure teachers can access the necessary technology resources and support.

In another study, Chinese teachers increasingly use technology to support student learning by (Xue & Churchill, 2020). The study found that teachers use technology to provide personalized instruction, facilitate collaboration, and assess student learning.

However, Chinese teachers still face some challenges in adapting to technology. One challenge is that teachers may not have the necessary training to use technology effectively and another is that schools may not have the resources to provide teachers with access to technology.

Despite these challenges, the technological adaptation of Chinese teachers is a positive trend. As teachers become more familiar with technology, they are finding new and innovative ways to use it to support student learning.

3.3. The Teachers' Technology Competencies

One of the education methods frequently used in China is "demonstrative lessons" which refers to a particular educational style where the teacher or instructor actively demonstrates a concept, skill, or procedure to the pupils. A demonstrative lesson's main objective is to give students a specific, concrete illustration of how to carry out a task, use a skill, or comprehend a certain idea. (Zhang et al., 2022) explains that demonstration classes are offered in China as examples of top-notch music teaching. However, the effectiveness of display lessons and how it relates to the development of school music education in China have not yet been the subject of any research. This content analysis sheds light on how music demonstration lessons are taught in China and contextualized for student-centered instruction.

Another article by Fang (2018) illustrates that the computer is the central component of multimedia technology. It combines text with multimedia elements such as graphics, photos, music, animation, and video to establish logical connections between data, representing more profound and more complex ideas or techniques. Each sensory teaching technique allows for the quick imparting of knowledge when using multimedia with students, helping them experience previously unseen profound emotions. A typical application in the country, Courseware, stands as the ultimate teaching tool of the present era. It also ushers its advantages in music. Through their emotional experiences with music and art, today's college students can derive psychological pleasure and aesthetic gratification, enabling them to develop enduring understandings of life and the future (Valencia et al., 2023).

Technology has become an increasingly significant aspect of kids' lives outside of school, and it may also help them comprehend complicated topics or inspire peer cooperation within the classroom. Because of these advantages, contemporary educational practice recommends that instructors include some technology in their classrooms. However, many teachers confront challenges in doing so. Cost, availability, and time are frequently significant hurdles to classroom adoption. Another barrier is a need for knowledge about how technology might best help students across various subject matters (Kurt, 2019). Punya Mishra and Matthew J. Koehler's (2006) TPACK framework, which focuses on Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK), provides a fruitful solution to many of the quandaries that teachers face when implementing educational technology (edtech) in their classrooms. The TPACK framework illustrates how content (what is being taught) and pedagogy (how the instructor transmits that subject) must form the foundation for any effective edtech integration by discriminating between these three forms of knowledge. This sequence is critical because the technology being introduced must communicate the material while supporting the pedagogy to improve student learning experiences.

3.4. TPACK and Music Education

The School of Education at the College of William & Mary in Virginia, USA, has developed a comprehensive database containing scholarly publications that utilize TPACK as their theoretical foundation from 2009 to the present. This effort has resulted in the successive publication of at least 50 newsletters on the use of TPACK. These newsletters provide global scholars with ample resources on the application of TPACK in various study contexts, sourced from journal articles, empirical research, published literature reviews, books or book chapters, theoretical publications, dissertations, and theses. As of the present, the TPACK database has compiled more than 3,000 studies.

This database was utilized by the study to identify research on the concept of TPACK in the field of music education. Keywords such as music, music education, music teaching, and music learning were entered into the database's search engine, yielding 30 studies. The earliest study on the use of TPACK in music education was conducted by Bauer et al. (2012), while the most recent study was conducted by Feng (2024). The researcher categorized the studies according to their research design and found that among the 30 papers, there were 10 case studies, 1 comparative study, 1 correlational study, 2 curriculum development studies, 3 experimental studies, 1 Grounded Theory study, 3 literature reviews, 3 phenomenological studies, 1 Sequential Exploratory study, 3 Survey Descriptive studies, and 2 Systematic Reviews. Additionally, the research participants included music students at the secondary and tertiary levels, as well as pre-service and in-service music teachers.

In addition to the studies included in the TPACK database, several other studies on the use of TPACK in music education were identified. For instance, Zhang et al. (2022) described the implementation of student-centered pedagogy in primary music demonstration lessons in Guangdong, China, examining how teachers can utilize technology to implement student-centered approaches in music education. Their findings indicated that technology can enhance student engagement and interaction in learning experiences. Similarly, Valencia and colleagues (2023) explored the challenges of integrating technology into education, using advanced medical training as an example. They identified various factors hindering the adaptation of technology, including insufficient teacher training, limited access to technology, and the necessity for pedagogical innovation. Additionally, Dammers (2019) emphasized the role of technology in supporting music teacher education, highlighting its potential in providing pre-service teachers with teaching practice opportunities, access to resources, and professional development support. Lastly, Liu et al. (2018) investigated the relationship between Chinese language teachers' perceptions of technology and its instructional use, revealing a positive correlation between the two.

RESULTS

The studies reviewed shed light on the potential of technology as a valuable tool for music education, suggesting its capacity to support student-centered and interactive pedagogical approaches. However, they also highlight several challenges that must be addressed to effectively integrate technology into music education, including the need for teacher training, access to technology, and pedagogical innovation. Despite the promising findings regarding technology's role in enhancing pedagogical competencies, there remains a notable gap in research attention towards the utilization of the TPACK framework specifically within the context of music education.

While the TPACK database has compiled over 3,000 studies, only 30 studies, or 1% of the database, were identified concerning TPACK in music education. This indicates a significant gap in research attention towards how TPACK can be effectively utilized within the unique context of music education. Furthermore, there is a methodology gap, as none of the identified papers have utilized a sequential explanatory mixed-methods research design. This approach, which merges both quantitative and qualitative data, could result in a clearer picture of the use of TPACK in music education. Lastly, there is a population gap, as few or no studies have explored the TPACK of Music Teachers of Higher Vocational Schools, especially in the Chinese context.

LIMITATION AND EXPECTATION

5.1 Scope

The study synthesized research on TPACK exclusively from three databases, without incorporating additional databases into the review process. Future researchers may explore the inclusion of studies from other scholarly databases to enhance and broaden the synthesis further.

5.2 Generalizability

The utilization of TPACK in this study is specifically within the context of teaching music education. It is important to note that the findings of this study cannot be generalized or extrapolated to other subject areas or fields of specialization. Future researchers are encouraged to explore the application of the TPACK framework in diverse subject areas or fields of specialization to enhance the ongoing discussion on its efficacy and potential implications.

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