The Knowledge Issues Enhanced the Teaching of Music Technology

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Abstracts

Teachers are underusing music technology in the classroom due to its many issues: Technology, pedagogy, and content knowledge are combined in the TPACK to improve teaching and learning. The purpose of this article is to study knowledge issues for enhancing the teaching of music technology. Music technology includes creation, wave data manipulation, and reproduction. Subject matter, teaching methods, and technology skills are essential for educational success. TPACK helps teachers learn and practice technology integration. It can impact teacher training and professional growth. Music production involves various tools, software, and hybrid teaching, promoting student-centered, patient-oriented learning. Creating music technology classes for instructors with limited expertise is crucial for online and offline learning. Data extraction, music recommendation, analysis, and music therapy are made easier with music software. Music technology offers new ways to enjoy and make music. Due to rapid change, the curriculum cannot keep up with instruction. Teacher methods include integrating disciplines and teaching methods, ICT, service learning, experiential learning, and cooperative learning. Successful music technology teaching requires proper technology use, computer skills, and a dedication to learning.

Keywords: Knowledge; Teaching; Music Technology

Rationale

Education's productivity and efficiency difficulties are much more apparent than in other public policy fields, which have achieved enormous productivity gains in recent decades. Technology has enhanced health care production and efficiency, boosting results despite rising prices. Many wonder why tremendous technology advances have not improved education. The government has invested extensively in classroom technology, especially ICT.The OECD Programme for International Student Assessment (PISA) asked school principals in 2012 if a lack of science laboratory equipment, textbooks, computers, software, and library items hindered instruction. The responses were averaged to create an OECD-wide school educational resource quality measure with a mean of 0 and a standard deviation of 1. Positive figures imply principals think a lack of educational resources slows learning less than the OECD norms, while negative figures suggest In 2012, less than 10% of 15-year-olds in OECD countries attended schools whose principals said a shortage of resources hampered instruction. Only 9% of students were at schools where administrators reported a substantial computer shortfall hampering education, while 5% reported a software shortage. At least 15% of pupils in Brazil, Greece, Iceland, Indonesia, Mexico, Sweden, Tunisia, and Turkey attended schools where principals said a lack of computers impeded education. Australian, Czech, French, Hong Kong, Chinese, Hungary, Italy, Korea, Macau, China, and Slovak principals are the most optimistic,

* Received: January 27 2024; Revised: January 30 2024; Accepted: February 2 2024

with over 96% saying computer shortages do not hinder school instruction. (OECD, 2016 : 67-69).

The music educators are exploring how technology and media allow for new and emerging ways of engaging with music and learning. Information and Communication Technology (ICT) menning includes hardware and software related to communication systems, transmission mediums, software programmes, and standards. ICT has become a crucial element of our daily lives and has rapidly invaded education, changing teaching methods and engaging pupils. Environmental protection uses ICTs to assess dangers and organise prevention. ICT includes technologies that enable communication, information sharing, and social change. (Annur & Ponnusamy, 2020 : 9-11). My broad academic and personal expertise will inform this study's complete investigation. The EC-funded CIRCUS project (Content Integrated Research into Creative User Systems), the invited EPSRC Music Technology workshop, and the EC "creativity and technology" workshop have examined the challenges of teaching creative and music technology courses in higher education. These attempts have improved the subject's comprehension. The focus is on Europe, although most difficulties are anticipated in the UK. This study examines this field's major obstacles and potential. It shows how many universities are using their potential to develop academically. The report will first define "music technology" in a realistic academic setting, then investigate the challenges of teaching it in higher education. (Boehm, 2001 : 1-2) Music educators frequently utilise technology improvements in their teaching. A significant portion of music educators' attention towards technology and media has been directed towards the tools and methods that imitate various aspects of teaching and learning, such as reading and composing music using standard notation in music applications or performing with MIDI (Musical Instrument Digital Interface) keyboard controllers. (Tobias, 2016 : 5-6 ; Burnard, 2011 : 157-171).

Education's productivity and efficiency issues are even more apparent when compared to other public policy areas, which have seen huge productivity advances in recent decades. Even though costs have increased, technology has increased production and efficiency in health care, improving results. Many observers question why massive technological breakthroughs have not improved schooling. Governments have spent heavily in classroom technology, especially ICT. Undoubtedly, ICT (Information and Communication Technology) is a widely used phrase that refers to information. Technologically-dependent communication This is frequently associated with the allocation of funds towards technological advancements in different educational institutions. Music technology is one of the specific areas that benefits from such investments. There is an expectation that the investment in Technology will encompass art and music as well. This marks the initial stage of comprehension among those responsible for allocating the Technology budget, who previously believed that art and music are skill-based disciplines that do not necessitate the use of technology. (Andrew, 2015 : 15-22).

The material is presented by the author for clarity A Literature Review of Music in Computer Science by Warnars & Rusli (2021 : 1503-1516) Most academic study on music digitization believes that it has numerous beneficial consequences in the computer science-backed music world. This work analyses and examines publications on computer science technologies used to manage digital music data, or sound. Many studies have examined how individuals see technology in music instruction and recommended various solutions. This paper reviews the literature on the rise of digital music, its impact on the music industry, and how

computer science can be integrated into music education. The process involves four steps: paper collection, selective filtering, classification, and analysis and summary.

The first step involves collecting academic papers using Google Scholar, focusing on the search term "music in computer science." The second step is selective filtering, skimming out papers not related to music in computer science. After selective selection, only 62 papers remain. The third stage involves classification, divided into three sub-topics: the rise of digital music, how computer science can be integrated into music education, and music creation through the use of computer science. The paper quality sub-classification is then carried out, with 62 papers categorized based on paper quality. The paper quality sub-classification is divided into five types: B.S Thesis, Ph.D. dissertations, Journal Q1, 11 Journal Q2, 4 Journal Q3, 1 Journal no Q, and 32 conference proceeding. The most references are conference proceedings, with journal no Q as the minor reference. The final step is analysis and summary, where key points from each academic paper are taken and used as material for the literature review. The paper explores the origins of digital music, its integration into music education, and its potential for music creation through computer science. The paper also discusses the importance of paper quality in the music industry and its potential applications in various fields. (Warnars & Rusli, 2021 : 1503-1516)

However, there is a fear of music piracy, which reduces music revenue and eliminates the incentive to create innovative music. An analysis of 16,500 clickstream activities of internet users in 2011 showed no evidence of unauthorised music downloads on digital music purchases. Several hypotheses test the interaction, which is correlated with action in terms of piracy in terms of digital music. The hypothesis obtained in the study is that the internet is used to commit cybercrimes, especially in terms of piracy of digital music without the owner's permission. This literature review explores the impact of digitization on the music industry, highlighting its positive aspects such as increased music variety and quality. Computer science in music is often used to integrate music theory and instrument playing into education, with research focusing on music teachers' views and course recommendation systems. Additionally, computer science is used to create music through automatic music generation, interactive composition workshops, and computer music languages. The review concludes that music is constantly evolving, with potential for further advancements in the industry. Despite its shortcomings, the technological study makes it evident that the field of music technology is developing quickly. Consequently, there is a deficiency of pedagogical expertise appropriate for instructing music technology.

Many questions remain about why education has not benefited from technology. People use ICT daily, and the government has invested heavily in it. Technology has greatly impacted music education, but teaching college-level creative and music technology courses remains difficult. Music educators teach with MIDI keyboard controllers and music software notation. Many outsiders wonder why education has not benefited from the tremendous technological advances that have improved other public policy domains, like healthcare, which have seen efficiency and productivity gains. Technology budget managers at the school realize that art and music investments will include music technology. This article fails to address budget-friendly hardware and associated devices that may be used for learning about music technology. As a result, the framework for the study of music technology teaching in this article is described as content knowledge in music technology education that has occurred during the course. This study examines music technology teaching and learning's major challenges and opportunities to show its academic potential.

Detail

TPACK Constructs: Technological Pedagogical Content Knowledge is a theoretical construct that describes the knowledge that teachers use to teach with digital tools and resources. It integrates technology, pedagogy, and content knowledge to enhance teaching and learning. Koehler & Mishra (2008 : 3-29) Research report on TPACK Constructs: A Sustainable Pathway for Teachers Professional Development on Technology Adoption. Teachers in Cameroon's primary schools have been trained in computer skills, but many are unable to use them in education. A study was conducted to determine what skills teachers need to integrate technology into their classrooms to guarantee that teacher training programmes are effective. This study used a quantitative survey to determine primary school teachers' skill needs. Using stratified random sampling, 400 primary school teachers from all 10 Cameroonian regions were recruited. Statistics were examined using the mean and standard deviation. The survey found that teacher-participants had better content, pedagogy, pedagogical content, and technology content knowledge. The fact that training programmes do not provide professional development on technology adoption contributes to their low performance in the TK, TPK, and TPACK. Sector stakeholders should build training packages that focus on the TPACK structures. This will encourage teachers to use the tool for instruction. Educational research began using Technological Pedagogical Content expertise (TPCK) to understand teacher technology integration expertise.

Educational research began using Technological Pedagogical Content expertise (TPCK) on Shulman’s construct to understand teacher expertise needed for technology integration. The term TPCK was renamed TPACK (pronounced “tee-pack”) to make it simpler to remember and better combine technology, pedagogy, and subject understanding. TPACK explains the links and complications of technology, pedagogy, and content. An intuitive grasp of teaching material with suitable pedagogical techniques and technology lies at the junction of these three knowledge kinds. Convergent among these three categories of knowledge lies an innate comprehension of instructing subject matter utilising suitable pedagogical approaches and technologies. A total of seven elements comprise the TPACK framework. They are characterised as: (Schmidt et al, 2009 : 125).

1. Technology knowledge (TK): This includes understanding of basic technologies like pencil and paper, as well as modern technologies like the Internet, digital video, interactive whiteboards, and software programmes.

2. Content knowledge (CK): Includes subject matter knowledge for learning or teaching. Teachers must understand their curriculum and how knowledge differs by subject.
PK refers to teaching techniques and procedures, including classroom management, assessment, lesson plan creation, and student learning.

4. Pedagogical content knowledge (PCK) explores the teaching process. Pedagogical content knowledge varies by curriculum area, combining material and pedagogy to improve teaching techniques.

5. Technological content knowledge (TCK) describes how technology may produce new content representations. According to this theory, instructors may alter how students practise and comprehend knowledge by using specialised technologies.

6. Technological pedagogical knowledge (TPK) involves knowing how different technologies may be employed in education and how this may impact instructors' teaching methods.

7. Technological pedagogical content knowledge (TPACK): Teachers need this expertise to integrate technology into their teaching practices across all curriculum areas. By teaching material using suitable pedagogical techniques and technology, teachers intuitively comprehend the intricate interaction between the three fundamental components of knowledge (CK, PK, TK).

The framework designs and evaluates teacher knowledge for successful student learning in diverse curriculum areas. Thus, TPACK helps instructors understand what knowledge they need to incorporate technology and how to build it. Using TPACK to measure teaching knowledge may affect preservice and inservice teacher training and professional growth. (Koehler & Mishra, 2008 : 3-29).

Music and art instructors must possess a thorough understanding of TPACK (technological pedagogical topic knowledge) and carefully choose the suitable topic for evaluating outcomes. In Kara's paper titled "An Investigation of Technological Pedagogical and Content Knowledge (TPACK) Competencies of Pre-Service Visual Arts Teachers" (Kara, 2021 : 527–528), the objective of this research was to assess the TPACK (Technology, Pedagogy, and Content Knowledge) proficiencies of prospective visual arts educators. The results indicated that pre-service visual arts instructors had low levels of technological knowledge but high levels of content knowledge in their TPACK skills. Based on the study results, allowing pre-service visual arts instructors to teach a few lessons during practical training within the context of school practice did not enhance the development of TPACK abilities. Therefore, it is essential to include TPACK planning and activities in the actual training and practice of teacher candidates. According to the article by Elena Macrides and Charoula Angeli (Macrides, & Angeli, 2018 : 181-190), music may be used to study TPACK via effect. Findings The authors offer TPACK-based design principles for music in the emotional domain and discover relationships between musical content, feelings, and technology. An empirical study of the design guidelines found statistically significant differences between the control and experimental groups, favouring the experimental group.

Thus, further research is needed to evaluate the design concepts. Including impact in design is hard and mainly uncharted; thus, further study is necessary. The study fills a vacuum in music education by giving instructors precise instructions on how to create technology-based music sessions with impact. Hence, it is essential to do research in order to provide music and art educators with a comprehensive comprehension of Technological Pedagogical Content Knowledge (TPACK) across several dimensions.

Technological Pedagogical Content Knowledge (TPACK) in Education

- TPACK Constructs: Technological Pedagogical Content Knowledge (TPACK) is a theoretical construct that combines technology, pedagogy, and content knowledge to enhance teaching and learning.
- The TPACK framework comprises seven elements: Technology knowledge (TK), Content knowledge (CK), Pedagogical content knowledge (PCK), Technological content knowledge (TCK), Technological pedagogical knowledge (TPK), and Technological pedagogical content knowledge (TPACK).
- It can affect preservice and inservice teacher training and professional growth.
- Music and art instructors must possess a thorough understanding of TPACK and carefully choose the suitable topic for evaluating outcomes.

- Kara's paper titled "An Investigation of Technological Pedagogical and Content Knowledge (TPACK) Competencies of Pre-Service Visual Arts Teachers" found that pre-service visual arts instructors had low levels of technological knowledge but high levels of content knowledge in their TPACK skills.
- Further research is needed to evaluate the design concepts and include impact in design.

Music application: Music mining has various applications. Content-based music retrieval organises music databases using melody, instrument, and pattern. Textual analysis can be used to assess music therapy session verbal communication, revealing emotions and topics. Music extraction also involves genre classification, emotion/mood classification, music grouping, automatic tag labelling, audio fingerprint detection, cover song detection, and self-organizing maps and visualisations. (Zou, 2020 : 1-7) These apps help extract useful information from music collections, enabling music recommendations, analysis, and music therapy interventions.

Scope of Music Technology: Music technology encompasses a broad range of *tools used to create and practices related to the creation, wave data, reproduction, including both acoustic and electronic instruments, transmission of music, sound recording and playback, broadcasting, even the sound of human body and software.* Music technology courses attract students with diverse musical backgrounds and interests, such as sound engineering, acoustics, live sound reinforcement, computer programming, and software application design. (Hesmondhalgh & Meier, 2018 : 1555-1570; Creech, 2019 : 117). The field of music technology also offers new possibilities for music appreciation and creation, such as music signal processing, music understanding technologies, singing synthesis technologies, and music interfaces. Music technology plays a role in electronic music production, remixing, and experimentation, as well as music for media and performance. This expansive view of music technology allows for a deeper understanding of the continuities and relationships between different technologies and their cultural contexts. (Boehm, 2005 : 85-90 ; Bauer, 2014 : 15-20).

Research by Boehm (2001 : 1-2) a presentation the “Between Technology and Creativity, Challenges and Opportunities for Music Technology in Higher Education”. A offering at Bath Spa College University in June 2001 gave me the occasion to rethink the existing challenges and opportunities of music technology within higher education today. A famous application, content-based music retrieval is a prominent application that leverages the attributes of music, such as melody, instrument, and rhythms, to efficiently categorise music collections. Text mining technologies may be used to evaluate verbal communication in music therapy sessions, providing useful analysis of the feelings and topics spoken during these sessions. Moreover, music mining involves several tasks like as classifying genres, categorising emotions/moods, grouping music, automatically labelling tags, performing audio fingerprinting, identifying cover songs, and utilising self-organizing maps and visualisation techniques.

Music applications or software enable the retrieval of important information from music collections, enabling activities such as music recommendation, music analysis, music therapy treatments o create the music creation. Computing technology research includes audio data mining. Audio data can be automatically analysed and searched/indexed using these methods. The expanding amount of digital content on computers has made audio data management and retrieval harder. Scientists have developed more useful applications for society due to audio

data mining technology advances. (Shetty & Hegde, 2019 : 67-80). Content processing of music is a term that encompasses feature extraction and modelling techniques for enabling retrieval, interaction, and creation functionality in the music domain. It involves activities such as listening to music in new ways, interacting with music, finding and comparing music, performing and editing music, exchanging music with others, teaching music, analysing music, and criticising music. The digital processing of music has been a reality for many years, but there is still much to learn about the role content processing will play the rise of mobile-based imaging technology has led to an increase in demand for vertical video content, which can enhance the quality of video content on platforms like TikTok. The combination of internet and TV, along with the emergence of IPTV, has made the distribution of digital content a key industry, but it also brings challenges such as copyright issues. (Silvey, et al., 2019 : 55-60).

The study surveyed the uptake of software and hardware for music production by Mutavati & Muranda (2023 : 56-57). The study examined music production software and gear adoption. Zimbabwean music creators struggle to acquire production software and gear, according to the study. Qualitative research purposively sampled 26 musicians and music producers from Harare, Zimbabwe's capital, and Midlands State University in Gweru. Researchers obtained informed permission and assured participants they might leave the trial at any moment. Interviews via video and phone conversations and thorough questionnaires with open-ended questions collected data. Notetaking and voice recording recorded data. The researchers used Actor-Network Theory to thematically examine the data. Researchers examined its instruments and music producing equipment. Cubase, Fruity Loops, Logic Pro X, and Pro Tools 12 were used to produce music, along with minor audio interfares, keyrigs, and live instruments including Mbira, Marimba, guitars, keyboards, live drums, ngoma, and congas. Some software was cracked owing to excessive purchase costs. Free online resources were difficult to access owing to poor internet connectivity and expensive data charges. Formal music producing training was scarce. Despite hurdles, analogue and digital music creations were done. To learn music production, aspiring producers should use the internet's free resources. To fully understand Zimbabwean music creation, future studies should be geographically broad.

However, music producers have increasingly adopted new technologies and production techniques, including hardware DAWs. Access to open source resources and formal institutions for tuition in music production remains limited. Despite this, some producers have embraced software sound samples for manipulation and unique sound creation. There are setbacks such as high costs, dependency on evolving technology, and the loss of human touch. To improve quality, producers should play actual instruments and adopt authentic software, while also avoiding cracked software to combat piracy.

From the table there are a number of related programs. When the author asks teachers to choose the necessary programs for students, they can choose as follows.

Table 3: Music software required for students

	Product	Best for
1.	Pro Tools	The Best Digital Audio Workstations (DAWs)
2.	Logic Pro	The Best Digital Audio Workstations (DAWs)
3.	Cubase Pro	Ultra-flexible recording and production environment, a top-notch digital audio workstation particularly suited to MIDI editing
4.	Sibelius	Division of Avid Technology since 8/2006. Avid also sells the Pro Tools DAW
5.	Overture	Includes VST hosting as well as being a scorewriter
6.	Freemake Audio Converter	The program is used to convert across different audio formats, merge audio files, and extract audio from video files

Furthermore, it should be noted that the aforementioned music software only constitutes a portion of the instructional materials, which educators are unable to fully cover. Additionally, there is a constant emergence of new platforms, such Broadcasting, Short on YouTube, and Tiktok, among others. The rapid pace of change renders the curriculum inadequate in keeping up with instruction. Conversely, it is imperative to impart critical thinking and fundamental abilities necessary for thriving in the dynamic realm of social media.

Music Technology and Applications

- Music technology includes various fields like sound engineering, acoustics, computer programming, and software application design.
- Content-based music retrieval uses attributes of music to categorize music collections.
- Textual analysis can assess verbal communication in music therapy sessions.
- Music extraction involves genre classification, emotion/mood classification, music grouping, automatic tag labelling, audio fingerprint detection, cover song detection, and self-organizing maps and visualizations.
- Music applications enable the retrieval of important information from music collections.
- Advances in audio data mining technology have made audio data management and retrieval harder.
- A study by Mutavati & Muranda (2023 : 56-64) revealed that Zimbabwean music creators struggle to acquire production software and gear.
- To improve quality, producers should play actual instruments and adopt authentic software.
- Teachers should choose necessary programs for students.
- The curriculum needs to keep up with the rapid pace of change and impart critical thinking and fundamental abilities.

Methods for teaching music technology: There are various methods for teaching music technology. Teachers should have a willingness to experiment and ask for help, focus on musical fundamentals, and have a deep knowledge of software and hardware. It is important to use innovative technologies that are tailored to the individual characteristics of students and

the specifics of music education. Information technology can be used to organize and manage the learning process using computer technology. The selection of appropriate technology should take into account the readiness and interest of students. Image processing technology can enhance the immersion and participation of online teaching, improving the quality of music teaching and learning. (Peterson Miller, et al., 1991 : 183-185). The author introduces pedagogical approaches that might be employed alongside elucidating and illustrating the utilisation of diverse music software. The explanation may be found on YouTube and in the respective program's user manual.

Integrated teaching: Integrated teaching emphasizes productivity by integrating different disciplines and teaching methods to improve learning outcomes and reduce costs. It involves the use of music ICT, service learning, experiential learning, and cooperative learning to enhance the quality and efficiency of music education. By linking these four learning domains, teachers can facilitate creative autonomous learning in diverse settings, taking advantage of advances in music technology. Integrated teaching has been shown to be effective in music technology, with students reporting improved knowledge acquisition and skill development. It also promotes a student-centered, patient-oriented approach, leading to the development of well-rounded healthcare professionals. The integration of music software applications and tools, such as project management software and database managers, can also enhance productivity in music education by providing real-world scenarios and practical skills. (Souto Iglesias, et al., 2011 : 3155-3163) Integrated teaching techniques link academics and skills in the learning process. These strategies seek to reduce topic obstacles and improve understanding, retention, and application. Integration approaches learning and instruction holistically, reflecting real-world interaction. Students learn how to apply their knowledge to business and life. (Yusupova & Rakhmonova, 2022 : 2579-2583). Integrated teaching may happen at various speeds, and certain topics integrate better. Students may learn the language and enhance their communication abilities by combining listening, speaking, reading, and writing. In medical education, integrated teaching works better than lecturing. Integration is more successful than lecturing in education. Music is a suitable topic, thus it's constantly taught.

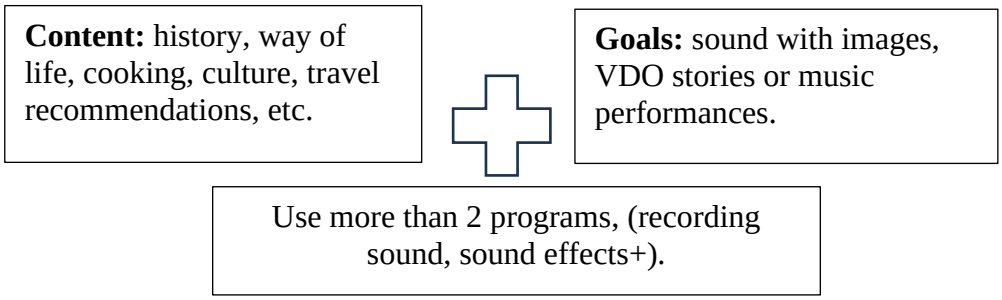

Figure 1, Integrated teaching emphasizes results by using various programs to create results.

Mark Bedoya Ulla and William Franco Perales (2022 : 1-5) They presented a paper titled Hybrid Teaching: Conceptualization Through Practice for the Post COVID19 Pandemic Education. Interesting teaching includes:

Hybrid teaching: These definitions employ hybrid and blended learning interchangeably, emphasising residential classroom instruction with computer-mediated

training. Linder (2017 : 26-27) defines hybrid teaching as using technology to create a unique learning environment that meets students' requirements and preferences. This description aligns with Garrison and Kanuka's (2004: 30-35) definition of blended learning, which combines classroom and online learning. Evidence-based practice and the particular requirements of the setting are factors that influence blended learning designs, according to Garrison and Vaughan (2013: 20-23). Both hybrid and blended learning prioritise the teaching environment and student learning experiences in their instructional designs. Therefore, the teaching of music technology, which uses a combination of and mixed methods, must be taught simultaneously in the classroom, in face-to-face workshops, and co-teaching with students online or co-teaching simultaneously. It can be said that it is hybrid teaching and hybrid classes.

In summary, Hybrid teaching, also known as hybrid classroom instruction and hybrid learning, involves integrating technology and combining students from offline and online settings. Hybrid teaching involves synchronous classroom instruction or offline and online education via Zoom. Unlike entirely online classrooms, hybrid teaching enables online students to participate in classroom discussions with their peers via Zoom.

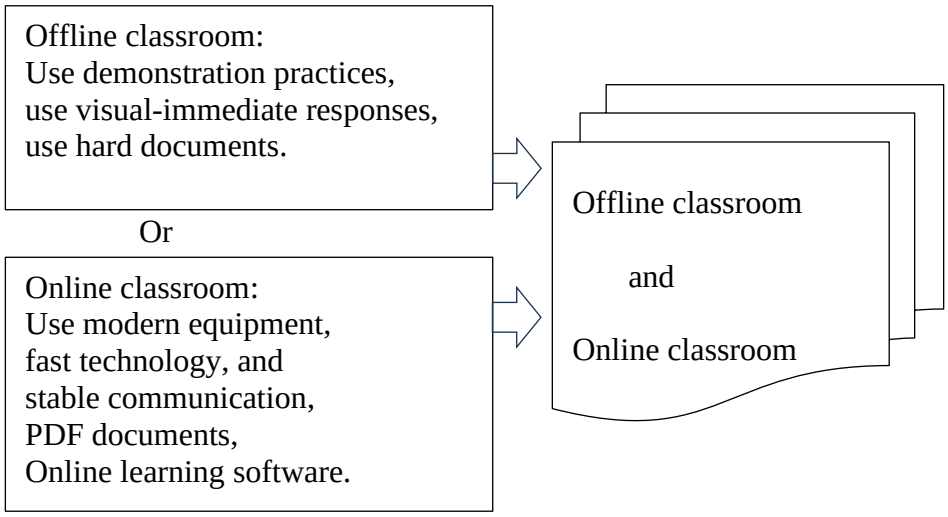

Figure 2, Hybrid teaching

The author suggests creating music technology classes tailored for instructors who possess little expertise. When it comes to creating activities that promote both online and offline learning, it is important to clearly establish the objectives of the work for the final assessment, which might include various forms such as songs, movies, soundtracks, or sheet music. Furthermore, arranging events to showcase academic content to students via exhibits, lectures, or competitions (both online and offline). These exercises will enhance student capacity to think more creatively than at their regular level. Enlisting external experts as judges, if feasible, would further enhance the quality of the activity.

The last component of music technology instruction is the people component, including educators, students, and other individuals providing assistance. Guidance is required for the use of various technological gadgets, including personal computers, mobile phones, headphones, keyboards, licenced software, and platforms for publishing works. These fundamental elements, although seemingly simple, are essential yet might be overlooked if not

given proper attention. Irresponsibility will result in the squandering of both the laboratory's resources and the time of one's peers. Hence, proficiency in computer equipment utilisation is crucial, alongside the cultivation of positive practices, unwavering commitment, accountability, and a strong inclination towards acquiring knowledge.

Hybrid Teaching in Music Education

- Music technology includes tools like sound engineering, acoustics, live sound reinforcement, computer programming, and software application design.
- Content-based music retrieval uses music attributes to categorize music collections.
- Music applications or software enable the retrieval of important information from music collections.
- Advances in audio data mining technology have made audio data management and retrieval harder, but scientists have developed more useful applications.
- Zimbabwean music creators struggle to acquire production software and gear, requiring producers to play actual instruments and adopt authentic software.
- Teachers should experiment, focus on musical fundamentals, and have a deep knowledge of software and hardware.
- Hybrid teaching combines various methods and tools to enhance learning outcomes and reduce costs.
- Hybrid teaching techniques link academics and skills in the learning process, improving understanding, retention, and application.
- Music technology classes should be tailored for instructors with little expertise.
- Successful hybrid teaching in music education requires proficiency in computer equipment usage, positive practices, commitment, accountability, and a strong inclination towards knowledge acquisition.

Conclusion

Technological Pedagogical Content Knowledge (TPACK) is a theoretical construct that combines technology, pedagogy, and content knowledge to improve teaching and learning. It comprises seven elements: Technology knowledge (TK), Content knowledge (CK), Pedagogical content knowledge (PCK), Technological content knowledge (TCK), Technological pedagogical knowledge (TPK), and Technological pedagogical content knowledge (TPACK). It can affect preservice and inservice teacher training and professional growth. Music and art instructors must possess a thorough understanding of TPACK and carefully choose suitable topics for evaluating outcomes.

Music production involves various tools, including acoustic and electronic instruments, sound recording, playback, broadcasting, and even the human body. Software plays a crucial role in music production, enabling retrieval of important information. Hybrid teaching, a combination of music ICT, service learning, experiential learning, and cooperative learning, promotes a student-centered, patient-oriented approach, fostering well-rounded healthcare professionals.

Creating music technology classes tailored for instructors with limited expertise is essential for promoting both online and offline learning. Activities that showcase academic content and involve external experts can enhance student creativity. The people component of music technology instruction is crucial, including educators, students, and others providing assistance. Proficiency in computer equipment usage, positive practices, commitment,

accountability, and a strong inclination towards knowledge acquisition are essential for successful integration of music technology in music education.

However, in order to effectively instruct music technology, instructors must possess a dual skill set consisting of proficient music knowledge and technology skills. Linked to Tpack's consistency in employing a variety of software, particularly when instructing students in computer music creation. and should be instructed in a manner that incorporates learning principles from other scientific disciplines. On the contrary, this article comprises an analysis and investigation of foreign documents pertaining to music technology education, which will serve as a model for document review in Thailand. Consequently, imminent investigation will be conducted in Thailand by the author.

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