Music education in an era of the digital transformation

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Abstract. With the advent of the Fourth Industrial Revolution era, it is anticipated that profound changes will occur not only in the demographics, politics, economy, and science and technology of global society but also in all fields, including values and ideologies. Over the past three years, as the world has experienced the COVID-19 pandemic, it has been rapidly transitioning into a digital society. Consequently, based on the experiences of the past three years, it is necessary to examine the impact of this transition to a digital society on music and music education, which are often perceived as the most analogous among human artistic activities. To achieve this, this study aims to investigate the advantages and limitations of conducting music education in a digital learning environment, the technological constraints, the utilization of instructional media and teaching strategies to overcome these limitations, and the challenges that future music education will face.

1 Introduction

In May of 2023, the World Health Organization (WHO) declared the end of the COVID-19 public health emergency and the onset of an endemic phase. This declaration comes just 3 years and 2 months after the initial pandemic declaration in March 2020. Over the past three years, the world has undergone significant changes in various aspects of human life, including the economy, culture, society, and education, due to the impact of COVID-19 (Corona Virus Disease). In the education sector, in early 2020, the world experienced school closures, alternating between in-person and remote education, and eventually exploring new possibilities in online and blended learning.

COVID-19, along with predictions that it won't be the last pandemic, has intersected with the timing of the Fourth Industrial Revolution and the future of education. Its effects have not been insignificant in the realm of music education and performance, with a focus on digital platforms. Therefore, this study aims to investigate the influence of Digital Culture on music education based on experiences over the past three years.

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2 Understanding remote education

2.1 Definition of remote education

Regarding remote education, Schlosser & Simonson [1], define it as "the utilization of a structured education format in which learners are separated and an interactive telecommunication system connects learners, resources, and instructors." Moore & Kearsley [2], define "distance education as learning that occurs when the teaching is delivered from one place and the learning from another, requiring special pedagogical techniques and the use of special communication technologies, electronic or other."

The Ministry of Education in South Korea [3], defines remote classes as "a form of instruction in which teaching and learning activities occur in different times or places." A common aspect in various perspectives on remote education is the recognition that interactional learning takes place between instructors and learners despite the physical distance between them. In other words, while traditional education involves sharing the same physical space and time, remote education can be understood as education that takes place with the use of instructional media like computers, bridging the gap of physical distance.

In the late 1990s, with the advent of e-learning, online courses were introduced for university education and corporate training through platforms like edX, Coursera, Khan Academy, and others, collectively known as Massive Open Online Courses (MOOCs). In the field of music, courses focusing on theory, appreciation, and related subjects were offered, such as "Introduction to Music Theory," "World Music: Global Rhythms," "Music for Wellness," "Copyright Law in the Music Business" and so on.

2.2 Types of remote education

Remote education can be classified into three main types: Synchronous classes, Asynchronous classes, and Hybrid classes [4]. Synchronous classes involve real-time interaction between teachers and students, where they meet remotely at the same time and engage in face-to-face instruction. Asynchronous classes refer to remote video-based learning where students engage with pre-recorded videos created by instructors. Hybrid classes combine both synchronous real-time sessions and asynchronous video-based learning, creating a blended approach to instruction.

When it comes to remote instruction in applied music lessons, the common image is often that of one-on-one real-time remote lessons, where one instructor guides one student. However, in cases like chamber music, orchestral ensemble, choir, or orchestra courses, where multiple students need to be guided simultaneously, synchronous ensemble performance is challenging due to timing constraints. In these scenarios, it's not feasible for all students to play together in real-time.

In such cases, instructors might utilize a hybrid approach. This could involve students watching pre-recorded videos created by the instructor, or, depending on the situation, breaking into smaller groups for real-time remote instruction. This hybrid model allows for a combination of asynchronous and synchronous methods, catering to the specific demands of ensemble playing and group instruction. However, no matter how effective

the methods employed are, there are limitations to replicating the quality of in-person practical lessons.

3 Instructional media required for online music education

3.1 Platforms and programs utilized for remote music instruction

During the actual pandemic period, various remote education platforms were utilized to conduct different types of remote classes. In South Korea, for real-time interactive lessons, video conferencing tools such as Naver Line, Google Hangout, MS Teams, Zoom, and Cisco Webex were commonly used. To facilitate asynchronous learning, instructors made use of self-produced videos or educational content created by institutions like EBS (Educational Broadcasting System) in Korea.

Lim & Kwon [5], conducted a survey study targeting 37 middle school and high school music teachers in South Korea who conducted remote music classes during the first semester of 2020 when the world was grappling with COVID-19-related closures. The teachers were asked about the platforms they utilized for "non-face-to-face online remote music classes." For "information acquisition and sharing," the majority (35%) used platforms like YouTube, Instagram, and Facebook. Next, platforms like Google Classroom and MS Teams (29%) were used to "support teacher-student activities," while platforms like Zoom and Webex (11%) were used to "support remote classes." Additionally, EBS (Educational Broadcasting System) online classes which is South Korea's public educational broadcasting network were widely used (25%), and various platforms such as Naver Cafe, Naver Form, school websites, e-learning platforms, and KakaoTalk were also noted to be in use (25%).

The survey results regarding the "software and programs" used by teachers for "non-face-to-face online remote music classes" are presented in Table 1. It was observed that teachers use a varying number of programs, ranging from 1-2 to 6-7 or more, based on their individual equipment and ICT competency.

Table 1. Programs and Software Used for Remote Music Instruction.

Types	Software & programs
Video Editing	Vapmix, GomMix, bandicam, Movavi, Vllo, oCam,, Kinemaster, PowerDiroctor, etc.
Screen Recording	PowerPoint, Gom Cam, OBS, Screencastify, Captura, ZOOM, etc.
Presentation	PowerPoint, MiriCanvas, keynote, etc.
Note-taking Apps	ICanNote, ICanScreen, Notability, etc.

3.2 Establishing an educational setting aligned with the nature of music instruction

First and foremost, to conduct live remote music lessons, the essential equipment includes a smartphone or a computer with a built-in camera and microphone, a stable internet connection, and an account on remote teaching platforms like Zoom or Skype. For those

seeking a better internet connection, video quality, or audio quality, the following considerations can be helpful. Firstly, a wired internet connection is generally more stable than a wireless connection, and if using a wireless connection, it's advisable to avoid heavy uploading tasks during the session. When using a smartphone or tablet PC, additional equipment like an external webcam, USB content microphone, and a tripod or stand to hold the device might be necessary.

In terms of remote teaching platforms, Skype allows screen sharing but lacks additional features. On the other hand, Zoom has received favorable reviews for its audio quality, supports multiple camera views, offers recording capabilities, and allows multiple participants to join simultaneously.

Next, remote video music lessons offer a solution for areas with weaker internet connections. Essentially, pre-recorded videos enable interaction between the teacher and student. The teacher can watch and provide feedback on practice videos uploaded by the student before the music lesson begins. For institutions or individuals without a dedicated portal to handle large video uploads, using a YouTube account for video uploads is recommended. Unlike real-time remote music lessons, remote video music lessons allow students to replay and review the teacher's demonstrations or explanations multiple times for better understanding.

3.3 Creating an App for student-directed music practice

The COVID-19 pandemic accelerated the digital transformation of everyday life at an unprecedented pace. Online schooling, accompanied by the development of teachers' and students' ICT skills, witnessed rapid expansion, incorporating various smart devices and educational applications for online education [5].

To enhance learning outcomes, the use of various smartphone apps as learning tools has become commonplace. App development has transitioned from being solely in the hands of computer programmers to a time when non-experts can create simple apps for everyday use. Indeed, commercialized apps often have constraints when it comes to offering content specifically tailored to learning needs. As a result, they might primarily provide indirect learning support rather than directly addressing educational objectives.

To overcome such limitations, recent research has been focusing on teachers using free app development tools, avoiding the need to learn programming languages like Java or C++. These tools enable educators to develop and utilize apps without such expertise. In the realm of school education, there is a growing interest in the use of platform-based educational programming languages *like Teachable Machine, Scratch, MBlock5, Machine Learning for Kids, and App Inventor*, for app development tailored to artificial intelligence education.

In the field of music education as well, the utilization of virtual instrument apps based on smart devices and mobile media is on the rise, aiming to overcome the physical limitations of classroom instruments. Kwon & Jung [6], [7], explored the enhancement of teachers' digital literacy and the potential for creating new teaching materials by using the free app development tool App Inventor to create a recorder learning app for elementary music education. Additionally, recent research has also delved into various teaching methods that leverage metaverse technology for music education [8].

4 Teaching strategies for effective remote music instruction

Casarroti [9], Cremaschi [4], and Ajero [10], provide common strategies for remote applied music instruction suggesting methods of communication, sheet music distribution, and assignment submission as follows:

- Speak slowly and avoid interrupting until either the teacher or student has finished speaking.
- Refrain from giving instructions or speaking while the student is performing. Offer feedback after the designated part of the performance.
- Convert the same sheet music with marked measures into a PDF file and share it on the remote teaching platform.
- Utilize the whiteboarding feature to annotate the sheet music.
- Upload shared materials (documents) to a cyber university or platforms like Google Drive for sharing with students.
- Use the chat function for assigning tasks instead of verbal communication.

For performers and music teachers who seek the most analog forms of sound art, conducting remote applied music instruction can feel cumbersome, complex, and unnatural. However, merely replicating traditional music teaching methods in front of a computer or tablet PC faces both technical and educational limitations. Especially in the context of music conservatories or universities, running specialized practical courses remotely demands the development of innovative teaching strategies that align with the characteristics of the courses.

5 Conclusion

As we embrace the era of the Fourth Industrial Revolution (4IR), the active utilization of Information and Communication Technology (ICT) has begun to influence even the domain of artistic creation, long considered uniquely human. Especially in 2020, the global impact of the COVID-19 pandemic led to significant changes in every aspect of human life, including economy, culture, society, and education. This crisis accelerated the pace of change towards the future of education. While not accustomed to using tools for remote online learning, over the past three years, we have strived to enhance our digital literacy, going beyond simple educational app usage to embracing educational technology, AI, AR, VR, metaverse, and more, in the creation of learning environments.

Amidst the rapid transformations brought about by this digital culture, at this juncture where we cautiously look towards the future, it's essential to remember the essence of music education that restores human qualities. Whether the changes represent a challenge or an opportunity for music education, deliberate efforts towards qualitative improvement are necessary.

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