

온라인 음악 실기 수업에서의 싱크룸 활용 가능성과 방안 탐구

Exploring Possibilities and Approaches for Utilizing SYNCROOM in Online Practical Music Classes

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Abstract The purpose of this study is to explore possibilities and approaches for utilizing SYNCROOM in online music practical classes to solve the latency issue, which is often mentioned as a major problem in online music practical classes. To achieve this objective, nine music teachers from professional music education institutions were selected as participants, and they were assigned both roles of instructors and learners in online music classes. Data on their experiences were collected through interviews. The collected data were analyzed, and the following results were obtained. The advantages of using SYNCROOM in online classes were categorized as 'Possibility of real-time musical communication online' and 'Sharing enjoyable musical experiences.' The disadvantages were categorized as 'Disadvantages of using SYNCROOM from practical and environmental perspectives' and 'Limitations in mediating from a pedagogical perspective.' Following strategies are needed to effectively use the SYNCROOM, such as using it with a video conferencing platform like ZOOM, using the SYNCROOM's built-in metronome during performances, and teachers providing students with audio interfaces and microphones for use in the SYNCROOM. These results suggest the meaningful possibility of revitalizing online music classes.

Key words: online music practical class, latency, using SYNCROOM, effective utilization of online music classes, music educator

초록 본 연구의 목적은 온라인 음악 실기 수업의 주요 문제로 거론되는 지연 시간을 최소화할 수 있는 방안으로 온라인 합주 프로그램 싱크룸의 활용 가능성과 방안을 탐구하는 것이다. 이를 위해 음악 전문 교육기관 교사 9명을 연구참여자로 선정하여 온라인 음악 수업의 교수자와 학습자 역할을 모두 수행하게 한 후 경험에 대한 인터뷰 내용을 자료로 수집하였다. 수집된 자료의 내용을 분석한 결과는 다음과 같다. '실시간 온라인 상에서 음악적 소통의 가능, 즐거운 음악적 경험 공유'와 같은 장점을 확인할 수 있었다. 또한, '실용적, 환경적 측면에서의 제약, 교수학적 중재 전략의 한계'라는 단점도 확인할 수 있었다. 싱크룸의 효과적인 활용을 위해서는 ZOOM과 같은 영상회의 플랫폼과 동시적 활용, 연주시 싱크룸에 내장되어 있는 메트로놈 사용, 싱크룸 활용에 필요한 오디오 인터페이스와 마이크 지원 등의 전략이 필요하다. 이러한 결과는 미래 상황 변화에 따른 온라인 음악 수업 활성화의 가능성을 제시한 것에 의의가 있다.

주제어: 온라인 음악 실기 수업, 레이턴시, 싱크룸 활용, 온라인 음악 수업 방안, 음악 교사

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I . Introduction

Due to COVID-19, the world has been experiencing an unprecedented educational environment since the beginning of 2020. One of the most significant changes is the shift from traditional in-person classes, where instructors and learners gather in the same physical space, to online remote classes where communication occurs through screens and microphones (Gye et al., 2020). Despite these changes, various solutions have been proposed to improve the quality of education through many studies and experiences accumulated. These solutions include the utilization of online platforms, development of educational content, and the sharing of online remote classes experience with peers. Consequently, new classes are being conducted through appropriate systems and innovative teaching methods that are specifically tailored to the new educational environment (Choi 2022; Choi & Cho 2020; Gye et al., 2020; Kim 2021a; Kim & Jeong 2021; Koh 2021; Kwon & Jung 2022; Park 2021). Music educators are actively developing and sharing various contents, teaching tools, and teaching models to address the challenges posed by this new context, and several studies have been conducted to overcome these difficulties (Norman 2021a; Norman 2021b; Norman 2022).

However, there are still many difficulties in conducting online music classes, especially in music education institutions that train professional musicians. Many music classes in these institutions rely on listening to the teacher's performance and following along. Several studies have analyzed the actual condition of remote music practice in these institutions, as they encounter greater difficulties than theory-oriented classes that mainly rely on instructors' lectures. This is since most music classes in professional music education institutions utilize a method called the apprenticeship learning method, wherein students learn songs by listening to and following performance.

Ahn (2020) and Lee and Kwon (2021) conducted a study on remote music education in music schools and discussed the status and problems of remote practicums in music education. Son (2021) and Kim (2021b) studied the status of remote practicum education in traditional Korean music by surveying learners and instructors with experience in remote lessons in secondary educational institutions specialized in Korean traditional music. Interestingly, regardless of differences in countries, educational institutions, and musical genres, the most frequently used platforms for remote music practicums are not specifically designed for music but are rather used for conversations or meetings (Biasutti, Antonini, & Schiavio 2021; Das, Bhuyan, & Shah 2020; Hash 2021). These platforms, which are intended for conversations, inevitably introduce latency, which may not be a significant issue in lecture-style classes but can impose limitations in music and singing classes.

Therefore, there is a need to use a platform with lower latency for online music classes.

SYNCROOM is a program developed by Yamaha that enables online music ensembles and available for free to anyone. It is specifically designed to automatically monitor and control the delay phenomenon, which is a problem commonly experienced with current programs used in remote classes. Hence, SYNCROOM can address the limitations of language focused platforms currently used in remote music classes.

The purpose of this study is to verify the practicality of using SYNCROOM in music education institutions to conduct remote music classes with reduced latency. The study aims to investigate and analyze the experiences of professional music teachers who have used SYNCROOM. Additionally, the study aims to promote the adoption of real-time online music classes using SYNCROOM based on the research findings.

The research questions are as follows:

First, what are the perceptions and experiences of using SYNCROOM for online practical music classes?

Second, what are the effective utilization methods of using SYNCROOM for online practical music classes?

II. Literature Review of Online Platform

1. Platforms used for online music class

Since 2020, various studies are being conducted to examine the status of online music classes in educational institutions that educate professional music (Ahn, 2020; Kim, 2021b; Son, 2021; Lee & Kwon, 2021). These studies differ in terms of research objectives and subjects; however, they provide insights into the platforms used in remote practicums, instructors' perceptions of these platforms, and various proposals generated from remote practicums. Therefore, these studies can help in the development of appropriate teaching plans for remote practicums.

An analysis of these studies showed that the most used platforms in remote practicums, regardless of subject types and regions where the classes are conducted, are video conferencing platforms such as Zoom (Ahn, 2020; Kim, 2021b; Lee & Kwon, 2021). Ahn (2020) found that Zoom is the preferred platform mandated by most universities, and some instructors utilize other platforms such as KakaoTalk, MS Teams, Facetime, and Skype due to accessibility issues.

Additionally, Lee and Kwon (2021) surveyed the platforms used by university instructors to teach music in remote classes. The results showed that 72.2% of the respondents used Zoom for remote classes, while 9.7% used Webex, 8.3% used MS Teams, and 4.2% used Google Classroom. Other platforms mentioned by respondents included Skype, Face talk, video calling, and others. Kim (2021b) surveyed instructors of Korean music practicums at secondary educational institutions specialized in Korean music to determine the platforms they use for Korean music major practicums. The results showed that Zoom was the most popular platform, accounting for 41% of all responses, which aligns with the results from Western music classes. Other mentioned platforms included Facetalk (21%), phone call (16%), FaceTime (10%), and Webex (2%). Additionally, some responses reported using KakaoTalk, which is currently the most used social networking system. These findings confirm the predominant usage of real-time video programs in online music classes.

Previous research results indicate that platforms that can be accessed through information and communication devices, such as remote computers and smart devices, are commonly used in online music classes. Among these platforms, Zoom, a video conferencing platform, is the most frequently utilized. Even in music practicums, platform primarily designed for meetings or conversation are used, rather than a music specific system.

2. Difficulties of real time online music class

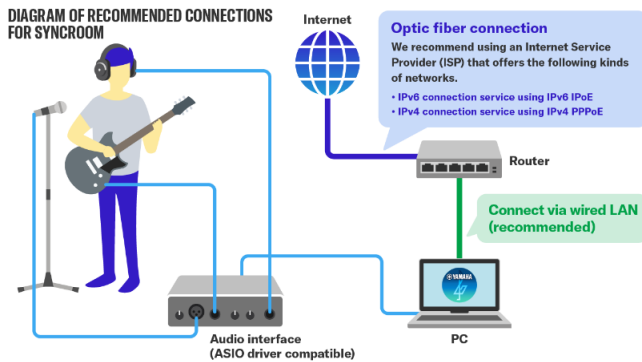
The biggest problem in real-time online music classes is latency. Latency causes difficulties in communication, sound transmission, and background noise. It also limits the conveyance of delicate motions and the ability to play music simultaneously. In major practicums, it is difficult to convey delicate musical expressions, and sustained tones may experience volume reduction or even complete disappearance, hindering effective delivery of the practicums. Different communication environments and devices lead to varying delivery speeds of music, resulting in a delay phenomenon that prevents simultaneous playing. Consequently, vocal classes requiring piano accompaniment and other classes that rely on accompaniment may not have accompaniment. Ensemble classes are conducted similarly to theory classes, part-specific classes, and one-on-one classes (Ahn, 2020; Kim, 2021b; Lee & Kwon, 2021).

The challenges of remote classes are not as significant in the case of theoretical and composition classes, which mainly involve instructor lectures, as there are for practicums (Ahn, 2020; Kim, 2021b). The current system for remote practicums may be suitable for classes based

on language-based communication and content, but it is not appropriate for classes requiring live performance. This difference in results can be attributed to the fact that the platforms primarily used in remote classes are not music-specific programs, but platforms designed for meetings and conversations. In classes such as lectures and conversations delivered through platforms like Zoom, delays may not significantly affect the teaching process. However, in music practicums involving playing, singing, and ensemble, if the performances are not properly synchronized, it becomes challenging to proceed with lessons. Moreover, since these platforms are designed to convey human speech, certain sounds, depending on the instrument or song's texture or volume, may be perceived as noise by the system. Automatic adjustments may lead to difficulties, such as volume adjustments or even elimination. Thus, it is necessary to use a platform with minimal or significantly reduced latency for online music classes.

3. Understanding SYNCROOM

SYNCROOM, an online ensemble program developed by Yamaha exclusively for music, effectively mitigates the delay phenomenon in performance by minimizing the delay that occurs during sound digital conversion. A study by Tsuji and Yamazaki (2021) demonstrated that Zoom recorded a delay of 140 ms in a wired environment and 161 ms in a wireless environment, Hangout recorded a delay of 100 ms in a wired environment and 133 ms in a wireless environment, while SYNCROOM recorded a delay of 15-25 ms in a wired environment and 30-70 ms in a wireless environment. Therefore, SYNCROOM appears to be a suitable platform for resolving the performance delay, which many instructors have identified as a major challenge in remote practicums. In addition, SYNCROOM is a dedicated music program that addresses issues related to noise and sound quality. It utilizes Yamaha's unique remote ensemble technology called "NETDUETTO" which enables seamless exchange of voice data without delay. SYNCROOM was developed based on a technology that establishes direct connections between users' terminals, bypassing the need for a specific server, thereby achieving bidirectional transmission and reception of audio data with minimal delay in music delivery. Additionally, it incorporates technology that continuously monitors the connection status to ensure minimal delay during network access (SYNCROOM website: <http://SYNCROOM.yamaha.com>). Although SYNCROOM can be download for free, a separate audio interface and microphone are needed to use it.



[Figure 1] SYNCROOM system (<http://SYNCROOM.yamaha.com>)

Once a room has been created on SYNCROOM for a performance, users have the option to open a public room where others can join and perform together. The room can be created at any time and remains open for up to five hours. A public room can accommodate a maximum of ten participants for communication and performance, and the performance is automatically saved as a .wav file. Since SYNCROOM utilizes a special audio interface and microphone, the recording quality is high. However, unlike Zoom, SYNCROOM does not support screen sharing. Nevertheless, users can communicate through their microphones and engage in chat discussions. One disadvantage of SYNCROOM is that it always requires an audio interface and microphone, and it lacks visualization capabilities. Nonetheless, as a music-specific program, SYNCROOM effectively addresses the issue of delay and overcomes the limitations of conventional platforms used in traditional remote music classes.

A study has been conducted on music activities using SYNCROOM. Park and Jung (2021) investigated the significant experiences of users of the remote music activity service using SYNCROOM and proposed ways to incorporate SYNCROOM into metaverse virtual spaces. Based on these studies, this research is to explore solutions to one of the biggest problems in online music performance classes, which is the latency issue. To do this music instructors will participate in music classes using SYNCROOM as both the instructors and learners, and interviews will be conducted to gather information about their perceptions and experiences. Through this investigation, the study aims to explore the experiences and effective utilization methods of using SYNCROOM for music performance classes. The findings will provide valuable insights and diverse perspectives on online music performance classes and can offer implications for future approaches to music education.

III. Method

1. Participants

The criteria for selecting participants in this study are as follows: (1) individuals who have a music major and have experience as a professional performer, (2) individuals who have experience teaching as a music practicum instructor, and (3) individuals who are familiar and proficient in using SYNCROOM and have the necessary connecting devices.

The recruitment of participants for this study utilized purposive sampling, which involves requesting research participation from individuals who meet the research criteria and who are within the researcher’s personal network. The participants in this study included three males and six females with an average age of 30 years. Their majors and educational careers are listed in Table 1. Only individuals who met the selection criteria, understood the objectives of this study, and participate voluntarily were included.

<Table 1> Participants information

Participant	Gender	Age	Field	Playing career	Educational career
A	M	42	Piri*	30 years	20 years
B	M	39	Guitar	7-year 11 month	7-year 11 month
C	F	35	Vocal	15 years	10 years
D	M	34	Guitar	14 years	5 years
E	F	34	Vocal	13 years	11 years
F	M	26	Piri	6-year 11 month	3 years
G	M	26	Composition	6-year 11 month	1 year
H	M	56	Percussion	30 years	33 years
I	M	26	Piri	6-year 11 month	8 months

*Piri : Korean traditional wind instrument

2. Procedure

1) Preliminary study

Before conducting the main study, a preliminary study was conducted with 4 participations. In the preliminary study, 1 pianist, 1 percussionist, 1 piri and 1 vocalist participated in online

music class utilizing SYNCROOM. The class included ensemble playing, singing, and listening to the accompaniment for 2 hours, followed by a 1-hour discussion about their experiences.

The results of the preliminary study indicated that compared to other platforms such as Zoom and Webex, SYNCROOM exhibited minimal latency between instruments, creating a sense of playing together and listening to real-time music. However, since SYNCROOM only transmits sound without a visual component, there was a difficulty in making music by relying on auditory cues without being able to see each other face-to face. Latency and delayed piano accompaniment were observed when an audio interface was not used. Based on the findings of preliminary study, the main study was conducted by structuring the online music class contents and ensuring alignment between the research question and components of the methodology.

2) The structure of online music class utilizing SYNCROOM and participants experiences

In this study, all participants were divided into two groups, and online music classes were conducted utilizing SYNCROOM with participants experiencing the roles of both the instructors and learners. The music classes utilizing SYNCROOM consisted of classes that required real-time musical communication, such as immediate musical feedback, singing, and instrument performance with accompaniment, choir or ensemble rehearsals, and ear training. The purpose was to determine whether SYNCROOM can be utilized for live musical communication between the instructors and learners or between learners, live performance, and teaching and learning.

Based on the findings from the preliminary study results, which revealed the difficulty of not being able to meet face-to-face. Therefore, this study supplemented the music classes by using both SYNCROOM and Zoom, allowing participants to see each other simultaneously.

3) Focus group interviews about experiences of online music class utilizing SYNCROOM

Online focus group interviews were conducted with participants who had experienced music classes using SYNCROOM. The interviews utilized semi-structured open-ended questions, and the following interview questions were asked:

<Table 2> Interview questions

Interview categories	Questions
Perceptions and experiences of using SYNCROOM for online practical music classes	What problems did you encounter during online classes using platforms other than SYNCROOM? How were your experiences of online music practicums utilizing SYNCROOM? What advantages and problems did you encounter when using SYNCROOM and Zoom at the same time
Effective utilization methods of using SYNCROOM for online practical music classes	How can we develop teaching plans for online music practicums utilizing SYNCROOM? How can pedagogical content be designed utilizing SYNCROOM?

4) Data collection

Group 1 participated in an online music class utilizing SYNCROOM for 45 minutes and 35 seconds, followed by focus group interview lasting 53 minutes and 24 seconds. Group 2 participated in an online music class utilizing SYNCROOM for 50 minutes, and their interview lasted for 44 minutes and 46 seconds. All classes and discussions were recorded with the participants’ consent. The recorded data was transcribed, and in cases where the discussion had ambiguous meaning, additional in-depth interviews were conducted to clarify the intended meaning. The additional interviews were conducted twice and lasted for 35 minutes and 42 minutes, respectively.

5) Data analysis

In this study, the collected data were analyzed through content analysis, which is a qualitative data analysis method that aims to derive valid inferences from research data in a repeatable manner (Weber, 1990). Content analysis is a systematic coding process that reveals patterns and themes in the content based on a comprehensive understanding of the given data. This study adopted the content analysis method and followed the procedures outlined by Do and Yi (2021) to analyze the data.

For analysis, an online free analysis tool called Taguette.com was utilized to upload transcribed materials, and a qualitative research method was applied. The data analysis process involved reading the collected data in text format and identifying the key content of the participants’ words, sentences, and paragraphs. Codes were generated to represent the positive and negative aspects of utilizing SYNCROOM for music classes, as well as suggestions for improvements and utilization

methods. These codes were grouped into primary categories and corresponding content for each category was classified. While reviewing the content of each primary category, common contexts were identified, leading to the reclassification or creation of sub-categories. Finally, comparisons were made between sentences and concepts within each sub-category to establish appropriate naming.

6) Reliability and validity

In this study, both member checks and triangulation were utilized to ensure the trustworthiness of the data analysis. Member checks involve sharing and explaining the research results with the participants to verify the accuracy of interpretation (Bird et al., 2016). The researcher continuously asked the participants about the meaning of data and contents analysis during data analysis process, which was interpreted by the researchers as verification of the results with participants. Additionally, triangulation, a method used to validate a topic or phenomenon by incorporating multiple sources of evidence, was employed to integrate various perspectives (Carter et al., 2014). Two researchers checked the data systematically, maintained focus, and constantly monitored and confirmed alignment between the data and the conceptual analysis and interpretation to achieve reliability, validity and rigor.

3. Ethical consideration

In terms of ethical consideration for the participants, the researcher explained the purpose of the study and the data collection presses to them. Participants were informed that their participation was voluntary and that they could decline to participate or withdraw from the study at any time. The participants' identities were protected by removing any significant aspects of their identity during data transcription, including their names. The findings of the study were presented using pseudonyms for the participants in the verbatim quotes to ensure their ethical protection. To ensure ethical protection for the participants in this study, the approval of G University's Institutional Review Board was obtained for the entire process, including participant recruitment and agreement to participate (IRB No. 1044396-202110-HR-217-01).

IV. Results

This study investigated ways to minimize latency in online music class utilizing SYNCROOM. For this purpose, 9 music instructors participated in online music class utilizing SYNCROOM as both instructors and learners. Their perceptions and experiences were surveyed, and the results were analyzed. The study identified the positive and negative aspects of utilizing SYNCROOM in music performance class and developed plans for its effective utilization.

1. Perceptions and experiences of using SYNCROOM for online practical music classes

Participants' perceptions and experiences of online practical music classes utilizing SYNCROOM were divided into positive and negative aspects. On the positive aspects, participants identified the possibility of real-time musical communication by online and sharing enjoyable musical experiences. Real-time musical communication was subcategorized into two aspects: the minimization of latency and clear sound delivery. This means that online classes using SYNCROOM minimize sound latency, allowing for seamless musical communication, and provide good sound quality that is delivered clearly. Sharing enjoyable musical experiences was subcategorized into the enjoyment of music activities and interest in participating in music activities using the system. This means that online music activities are enjoyable, and the use of system is engaging and interesting.

“If I play an instrument loudly on Zoom, it recognizes the sound as noise which can hardly be heard, but with SYNCROOM, the sound is delivered right away thanks to the short latency.” (A)

“The sound delivery is very clear when using SYNCROOM compared to other language-focused platforms. Because the latency is short technically, there is no feeling of alienation at all when it comes to sound delivery. Since there is less latency in the sound of the piano accompaniment, learners can play according to the instructor's piano accompaniment.” (B).

“During the folk music classes, I felt the charm of the melody, the vibration in the voice of the singer, the beat of the Jang-gu, and the sound of music.” (C)

<Table 3> Participants’ positive perceptions and experiences

Categories	Sub-categories (Themes)	Meaning
Possibility of real-time musical communication by online	Minimization of latency	The latency of sound is minimized online, which enables seamless musical communication.
	Clear sound delivery	The sound quality is good and delivered clearly.
Sharing enjoyable musical experiences	Enjoyment of music activities	Online music activities are enjoyable and fun.
	Interest in utilizing the system for music activities	Online music activities using the system are interesting.

On the negative aspects, participants identified practical and environmental disadvantages of using SYNCROOM, as well as pedagogical limitations in student mediation. The practical and environmental disadvantages of using SYNCROOM include occasional breaks in sound, difficulties in monitoring one’s own voice, constraints of internet environment, and difficulties in setting up equipment. This means occasional breaks in sound when multiple students are playing together, difficulty in monitoring one’s own instrument or voice, and the difficulties in setting up and equipping the internet environment. The limitations of student mediation were identified as difficulties establishing eye contact and non-musical communication, as well as challenges in promoting student engagement and medication. This means that due to the absence of a video transmission system, it is difficult to establish non-musical communication while maintaining eye contact with students through the screen, and it is challenging to promote and facilitate student participation in musical activities.

“When the entire ensemble plays together, sometimes there are breaks in the music and it becomes impossible to hear the sound. The flow can also be disrupted by breaks in the sound.” (D)

“I can only monitor my own voice when I sing physically. If a sound is coming from a specific direction, the instructor can follow the sound in that direction. However, one cannot determine the direction of a sound … When there is a sound breaks, it is difficult to discern which sound it is, which creates difficulties.” (G)

“The communicative environment is important. Sound can be heard well in a good communication environment, and it could not be heard well otherwise.” (C)

“When the internet connection is interrupted, it becomes difficult to hear the sound, and the latency increases.” (D, F)

“Misunderstandings can arise due to the inability to see facial expressions that are usually used to understand why a person is saying something. It could also be difficult to manage students as their faces cannot be seen.” (B, I)

“SYNCROOM is not a video sharing platform like Zoom, which allows you to see the user's face, but rather a platform where you can only hear each other's sounds. Therefore, it was awkward to communicate solely through sound without the ability to share video.” (F)

<Table 4> Participants’ negative perceptions and experiences

Categories	Sub-categories (Themes)	Meaning
Disadvantages of using SYNCROOM from practical and environmental perspectives	Occurrence of intermittent sound interruptions	Occasional breaks in sound when multiple students are playing together
	Difficulty in self-monitoring of sound	It is difficult to monitor one’s own instrument or voice.
	Limitations in internet environment and difficulty of equipment setup	The constraints of the internet environment and the difficulty in setting up and equipping the system were identified.
Limitations in mediating from a pedagogical perspective	Difficulty of maintaining eye contact and non-musical communication with students	The absence of a video transmission system through the screen makes it difficult to establish non-musical communication while maintaining eye contact with the students.
	Difficulty in promoting student engagement and mediation	It is challenging to encourage and mediate student participation in musical activities.

2. Effective utilization methods of using SYNCROOM for online practical music classes

Based on perceptions and experiences using SYNCROOM, the following are effective utilization methods. The suggestions are presented as follows, categorized into ways to promote student communication, support for audio connection and monitoring, plans to minimize latency and identify sounds, and technical problems and solutions.

1) Promoting student communication

Address the challenge of limited communication through the screen by simultaneously utilizing a live video platform such as Zoom. Also, encourage students to practice and familiarize

themselves with the music in advance to increase their active participation. By incorporating these strategies, educators can overcome the difficulties in encouraging and facilitating student participation, enhancing communication and engagement in online music classes. The following statements present aspects of utilizing video platforms, emphasizing individual practice and enabling student participation and control in online music classes.

“In classes that require videos, it is possible to complement by giving signals and feedback through Zoom.” (D)

“It requires individual practice and individual competence.” (E)

“It would be better to have students play together along with the instructor’s guidance or recorded accompaniment after each student completes their own practice.” (F)

“Student participation and control become possible when video platforms like Zoom and Webex are used alongside.” (H)

2) Support for audio connection and monitoring

To address difficulties in monitoring one’s own voice, occasional break-up in sound, and breaks in the musical flow, the following strategies can be employed. An accurate starting cue can be provided using a metronome within SYNCROOM. Additionally, consistent cues can be offered for monitoring sound throughout the classes. Accompaniment that integrates elements of rhythm, beat, melody, and chord can be provided to maintain a steady music flow. It is also beneficial to select songs with clearly identifiable structures instead of repetitive patterns. These strategies aim to enhance the online music class experience by providing accurate cues, maintain a consistent sound monitoring process, facilitating a steady musical flow through integrated accompaniment, and selecting songs with clear structures.

“When starting a music, it is beneficial to provide a starting cue using a metronome on the SYNCROOM platform. Keeping the metronome on throughout the performance makes it difficult to hear each other’s sound. Therefore, it is recommended to provide a starting cue only.” (H)

“When others produce different sounds, it becomes possible to identify one’s own sound by listening to those variations. Having different note levels and a strong rhythm can be helpful. It

was easier to sing when there was recorded accompaniment playing, incorporating not only the main melody but also cues like piano chords and rhythm.” (G)

“I played with a chord to test the music since it had the same sound, melody, and chord and I was able to hear a distinct sound, which made playing easier.” (E)

“The rhythmic pattern is simple, but if played repetitively, it becomes difficult to identify the incorrect parts and the entry points. It is necessary to consider selecting songs that allow for collective playing. When performing a song with repetitive patterns, it is recommended to consistently provide cues throughout the music.” (G, H)

3) Minimizing latency and identifying sounds

Intermittent sound interruptions may occur when multiple students participate, making it difficult to distinguish between instruments and between instruments and voices. To address this issue, the following strategies can be implemented. To minimize potential sound conflicts, it is recommended to reduce the number of students in each class. Additionally, mandating the use of a microphone and headset for all students ensures clear audio transmission. It is also important to confirm and adjust the microphone volumes among students to maintain a balanced sound level.

“It would better to have students play together along with the instructor’s company or recorded accompaniment after each student does their own practice.” (F)

“One should ensure a set-up where a microphone is used when playing an instrument, and voice can be heard along with the sound of piano playing.” (H)

“When starting a class, a test microphone volume needs to be done to ensure the level same of volume so that it is possible to know who is not playing correctly. Everyone can adjust the microphone. A headphone instead of a speaker should be used to listen to each other’s sound while playing.” (E)

4) Technical problems and solutions

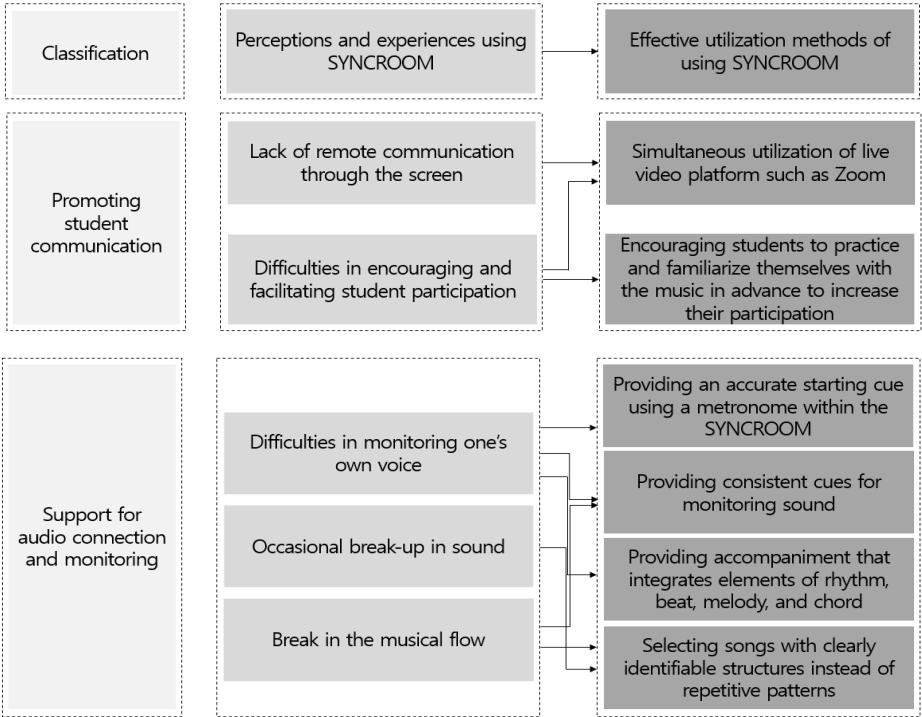
To address technical problems, the following strategies can be implemented. The teacher should encourage participation in an optimal internet environment and conduct prior checks to minimize intermittent sound interruptions. They should provide educational support to help students set

up and utilize their devices, addressing any difficulties in device setup. Additionally, the teacher should offer guidance and assistance to students in resolving limitations related to the internet environment. These strategies aim to enhance the overall technical experience and ensure smooth and uninterrupted online music classes.

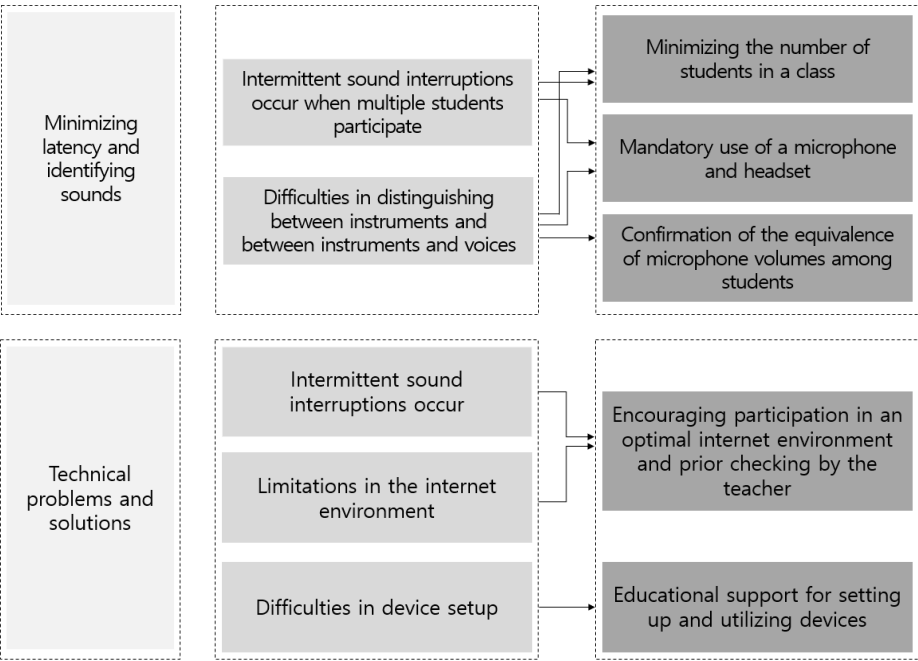
“The entire set of devices is important, and having sufficient training is also crucial.” (B, I)

“Since it requires professional devices such as an audio interface and microphone, the school should either provide support or offer rentals to students. It would be beneficial to provide the necessary instructions.” (D)

The following is a diagram illustrating effective strategies for utilizing SYNCROOM in online performance music classes, based on experiences from participants. This diagram showcases various ways in which SYNCROOM can be effectively utilized for different aspects of music education, providing a versatile and engaging platform for online practical music classes.



[Figure 2] Effective utilization methods of using SYNCROOM



[Figure 2] Continued

V. Discussion and Conclusion

This study explores technological strategies and plans to be applied to the educational field based on the experience of online practical music classes SYNCROOM. It presents problems with online music classes using platforms other than SYNCROOM, experience as an instructor and a learner in an online practicum utilizing SYNCROOM, utilization plan based on the experiential perception of advantages and problems of SYNCROOM. The results of this study are as follows: Experience as an instructor and a learner in an online practicum utilizing SYNCROOM were as follows. The latency of SYNCROOM is shorter than that of the other platforms. Therefore, in a music class, the latency phenomenon—a problem with conferencing platforms such as Zoom—is significantly reduced. With the reduction of latency, it becomes possible to play and sing along with the teacher’s accompaniment without inconvenience. Moreover, learners can play together, enabling high-quality online music practicums.

Especially, when SYNCROOM is used, music sounds become clearer and cleaner due to the

use of an audio interface and microphone. Unlike conference platforms, where music sounds may be perceived as noise and their volume reduced, SYNCROOM resolves this issue. With SYNCROOM, the problem of unclear and unclean sound delivery, as well as the recognition of music as noise, is reduced. This allows learners to accurately perceive the musical nuances in an online class.

Furthermore, it is possible to share enjoyable experiences equivalent to those of a real ensemble, even in an online setting. One of the important goals of a music class is to provide an enjoyable experience. However, experiencing aesthetic music in an online class can be challenging. Nevertheless, this study confirms that when SYNCROOM is used, it is possible to experience clear musical expressions and have an enjoyable experience through creative music activities and collaborative music-making. By using SYNCROOM in conjunction with video conferencing platforms such as Zoom, Skype, or Webex, it becomes possible not only to have a musical experience but also to communicate smoothly with learners. While SYNCROOM is a non-video platform, the combination of SYNCROOM with video platforms solves the communication and facilitation challenges. Although there may be differences in latency between the video platform and SYNCROOM, it does not hinder the progress of the class or communication.

Based on the experiential perception of the problems with SYNCROOM, the following utilization plan was proposed. In situations where multiple individuals participate in sound delivery, it can be challenging to distinguish between instruments and between instruments and voices due to increased likelihood of communication errors, resulting in latency. To address this problem, students participating in the class should use optimal communication conditions. Additionally, the use of microphones and headsets is necessary to ensure that the microphone volumes of the instructor and students are balanced. Monitoring one's own sound can be difficult during online music classes. The interruption of sound and musical flow highlights the need for support that connects and monitors the sound. Utilizing the metronome feature in SYNCROOM platforms can help in this regard, and the teacher should provide a starting cue. Participants found that strong beats were helpful in keeping track of the rhythm. They also mentioned that it was easier when playing different notes or chords rather than the same note repeatedly. To overcome these problems, it is recommended to select repertoire for classes that includes songs with various rhythms and chords instead of identical rhythms or repetitive tunes. This can provide a more engaging and dynamic musical experience for the participants.

The role of technological resources in musical learning has been increasingly explored in recent decades. Research has focused on the access and use of technological tools in classroom settings

(Rogers, 1997), their repercussions for teacher development (Hunt & Kirk, 1997), and self-assessment (Daniel, 2001). Several studies, including Kenny and McDaniel (2011) and Gall (2013) found that educators can encounter difficulties when implementing technologies in their teaching, particularly when considering poor institutional support and a lack of technical training. Similar issues also emerged in our study, where students report how technological issues may create demanding situations concerning mutual communication and feedback. To resolve such technical problems, instructors and students should conduct on line music classes in an optimal Internet communication environment. This supports the position of Andrea, Michele and Roberta (2021) that helpful opportunities about sources of music software and technology should be provided.

Currently, many music classes are taking online music classes using conferencing platforms such as Zoom and Webex. These platforms have problems in delivering music sound and sharing music experiences due to latency, problems in sound monitoring, and limitations in sound delivery. In order to solve these technical problems, instructors and students must strive for optimal On-line music lessons. To this end, useful opportunities should be provided for sources of appropriate music software and technology.

Through this study, it was confirmed that SYNCROOM can be a new platform for effectively conducting online music classes. It was found to be helpful in conducting online music classes that enable realistic musical experiences through SYNCROOM. However, there are still many challenges to overcome when it comes to using SYNCROOM such as communication, setting platform and network quality. Therefore, it is expected that more research on various teaching methods for effective classes using SYNCROOM and various teaching methods related to information and communication technology training of teachers will proceed in the future. Accordingly, the following suggestions are made for follow-up research.

First, it is necessary to study how to utilize the SYNCROOM in various classes. This entails exploring a wide range of applications for general music, professional private lessons, choir classes, and instrumental music classes. Secondly, research on the use of SYNCROOM between schools is needed. The advantage of SYNCROOM is the ability to perform together regardless of physical location. Therefore, it is important to investigate the feasibility and benefits of joint classes between schools using SYNCROOM. Lastly, there is a need to study how schools of different cultures can teach music together using SYNCROOM. This research will contribute to finding innovative ways to overcome the limitations of music classes and promote cross-cultural collaboration.

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