

August – 2025

# Virtual Concerts in Learning Oboe-Played Chinese Folk Music: Impact on Performance Proficiency, Perceived Aesthetic Qualities, and Students' Motivation

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## Abstract

This study compares the effectiveness of video communication technologies and group chats in virtual reality (VR) as platforms for practising musical skills among students. Additionally, it examines the capacity to convey aesthetic characteristics of musical performance through these two forms of remote communication and the influence of these technologies on student motivation. The research involved 106 senior students from two higher educational institutions in China. Zoom and VRChat served as the instructional platforms for the two experimental groups. The findings did not reveal significant differences in performance mastery. Specifically, the perception of task value demonstrated the most substantial increase, scoring 5.65 compared to 4.81 out of a possible 7; all three pairs of values exhibited significant differences between the groups based on the results of the student's *t*-test. Furthermore, a significantly higher sense of immersion and quality of aesthetic experience was observed within the VR group, scoring 4.81 compared to 3.70 out of a possible 5 in the videoconferencing group. Additionally, VR's greater capability to convey characteristic emotional nuances of music was confirmed by the fact that within the VR group, two out of six distinctive features of Chinese folk music (lyrical, highly artistic aspects and intonation subtlety) were more pronounced than in the videoconferencing group. These results indicate the potential of VR technology to enhance the quality of aesthetic experience as well as the motivation for learning among students in music education, including those studying wind instruments.

*Keywords:* intonation subtlety, musical values, performance expressiveness, sound sharpness, upper register

## Introduction

The instruction of musical instrument playing constitutes a significant component of education capable not only of preparing individuals for professional endeavors in music but also of enhancing the quality of life, fostering a sense of creative self-realization, and promoting emotional development. However, music education is one of the most challenging disciplines, as it necessitates the simultaneous development of fine motor skills, auditory acuity, and the concurrent processing of various forms of information (Adamyan, 2018). Due to the absence of rapid progress, a considerable number of students may lose motivation and prematurely discontinue their studies. Conversely, the integration of digital technologies in education can streamline the learning process, rendering it more engaging and motivating for students. Such technologies encompass the use of mobile applications, remote communication technologies, and specialized software capable of providing prompts or feedback in real time. Currently, the majority of research is devoted to the development of various technologies for piano instruction, with comparatively fewer studies focusing on string instruments and notably scant attention directed toward wind instruments (Apaydınlı, 2023). Meanwhile, instruction in wind instrument playing may pose the greatest challenge and prove less intuitive for students due to the nature of sound production (Hallam et al., 2020).

Due to its intricate design, the oboe is one of the most challenging wind instruments to master. The most common challenges include mis-fingering, poor blowing skills, and incorrect assembly (Han, 2023). Using a double reed to create the sound gives it a unique and subtle quality (Bowen et al., 2019). The tiny opening in the reed allows the musician to breathe in a way that sustains the sound, creating a continuous melody (Zhang & Lam, 2022). During deep or prolonged breathing, inhaling through the nose can cause the cheeks to expand as they hold more air (Li, 2022). The oboe can be used in traditional and contemporary music, which is connected to the potential for expanding the realm of sound (Bucur, 2019). In solo performances and as a solo instrument in orchestras, the oboe can enhance the expressive presentation of folk music (Tang, 2020). This instrument has a wide range of sounds, distinguished by including notes from the small octave (B flat) to the 3rd octave (A). The air passage creates the soprano sound produced by the oboe through a conical tube and the use of valves with a double reed (Miller, 2013). A sharp timbre characterizes the upper register sound of the oboe. The nasal sound of the oboe is also distinctive (Paquier et al., 2016).

When selecting approaches for performing melodies on the oboe, it is essential to preserve the uniqueness of the musical compositions, which is particularly significant for folk music. The distinctiveness of Chinese folk music is maintained through the pentatonic scale and the presence of a soft timbre (Xiao, 2025). The emotional component in its interpretation plays a crucial role, which should be reflected in the articulation of musical nuances and the expressiveness of musical experiences (Lee & Mazzola, 2025).

Changing circumstances in the modern world have spurred a noticeable shift towards remote learning across various educational domains, including music. However, this shift often occurs out of necessity, lacking adequate preparation and thorough analysis to select the best methodologies. Consequently, teachers, students, and parents report a decline in students' theoretical knowledge and practical skills (Zhang, 2024). Equally significant is the adverse impact on the mental well-being of both teachers and students, manifesting in feelings of social isolation and a lack of live interaction (Tivendale, 2022). An intriguing question also arises regarding the influence of remote communication on the aesthetic perception of music. Audiences often perceive live concerts as a distinct and emotionally immersive

experience, whereas digital communication or playback reproduction requires more effort to achieve a comparable effect (Merrill et al., 2023). At the same time, digital technologies in education have an impact on student motivation, which ensures a deeper level of learning. As a result, students strive to develop a unique performance style, which encourages them to overcome challenges (Chen, 2025). Continuous improvement of knowledge fosters confidence in musical interpretation and contributes to creative growth.

Although networked music has become prevalent in education and professional music creation and performance, its implementation is still associated with technical limitations, such as latency issues (Wilson, 2023). These problems contribute to additional frustration in an already complex process of music creation and may pose a significant threat to motivation for students still acquiring skills. Furthermore, if the transmission of aesthetic qualities of musical performance through virtual environments is incomplete, it may devalue students' efforts and diminish the perceived utility of their education. Therefore, further research is necessary to determine which forms of organizing remote music training and concerts are optimal.

## Literature Review

### Characteristics of Chinese Folk Music

Chinese folk music is known for its lyrical, highly creative elements, often added as lyrical windings — a style that involves graceful, flowing ornamentation and expressive pitch bends — and which would be measured in the beauty of a distinctive performing style. Sound improvisation on the oboe can be heard in the instrument's rhythm, windings, and symbolism. The ability to perform and play the oboe proficiently is linked to highly artistic characteristics. Intonation subtlety is valued in Chinese music because it is related to the performer's emotional investment in the music. Folk melodies can be performed vocally while accompanied by an instrument, allowing pitch manipulation and enhancing speech intonation nuances. The visibility of the musical is influenced by the prominence of high-pitched sounds, which have spiritual importance in China. This method can be seen in a flexible performance that includes a variety of sound layers. Chinese spirituality is imparted through a system of embedded tones and use of a pentatonic scale which have a distinctive sound when performed on the oboe.

The oboe's sound arises from vibrations in the column in the instrument's barrel. Combining long and short notes allows for creating sharp sounds, which can lead to novel virtuosic possibilities. The musical piece's artistic theme is revealed through the rhythm expression speed. Sound speed changes are evident in the aesthetics of performance, which are associated with folk music's peculiarities.

### Playing the Oboe: Features of Sound and Learning to Play

The oboe sound's unique characteristics, which resemble those of the human voice, are related to sound expressiveness (Li & Zhang, 2022). Controlling the acoustic balance will produce an aesthetically pleasing sound for oboe melodies. It is possible for musicians to exercise self-control during rehearsals. The oboe playing technique is interconnected by knowledge of the oboe's unique timbre, the relationship between cultural preservation and musical perception, and the degree of hearing development (Wang et al., 2022). With the aid of carefully chosen music, the oboe can amplify the

emotionality of literary folk pieces. This strategy encourages the appreciation of folk materials' aesthetic qualities based on their emotional resonance and technical inspiration (Pong, 2020).

Several studies have been devoted to the development of mobile applications aimed at assisting in learning to play wind instruments. Specifically, the Fingering and Tuning Charts application allows users to select one of 10 different wind instruments. Its functionality includes displaying a moving musical staff that indicates the next notes, a visual representation of how a note should be played on the instrument, and some visual explanations of music theory. However, the application does not provide real-time feedback and is primarily intended for initial familiarization with playing principles (Priyadarshani, 2021). There are also applications designed to assist beginners in tuning their instruments by providing graphical representations of pitch (Peterson Tuners, 2023). The application examined in the study by Pamidi (2018) offers slightly broader functionality, allowing real-time analysis of student performance, providing feedback on the accuracy of note intonation, and presenting fingering and tuning information graphically. Another application, Suiview, recognizes and displays intensity, pitch, and timbre in real time as graphical representations (Watanabe et al., 2023). However, the functionality and user interface of such applications are often somewhat limited in enhancing the student's learning experience (Watanabe et al., 2023).

A popular trend in the development and research within music education is the use of augmented and virtual reality (VR). These technologies enable the creation of fully virtual representations of instruments, with "playing" facilitated through human motion tracking technologies. Examples of such applications include Music Room and Soundstage VR (Gao & Li, 2024). Their advantages may include increased student engagement and a reduction in performance anxiety through appropriate simulations. However, a current limitation of the technology lies in its suitability for simulating musical instruments played through hand movements. The specific nature of wind instruments complicates their realization as virtual interactive objects (Serafin et al., 2017). Furthermore, digital sound simulation of wind instruments is more complex due to their physical characteristics. Nevertheless, this issue may soon be addressed as researchers develop devices capable of using information about the intensity of airflow from human breathing to interact with virtual environments (Tatzgern et al., 2022). Additionally, playing a musical instrument in VR can be facilitated through the use of a specially designed substitute for a real instrument, known as a digital musical instrument, a physical instrument constructed specifically for interaction with VR. These instruments can be adapted for learning various real instruments (Costa et al., 2019).

The development of software products capable of serving as guides for students in understanding the theory and practice of playing wind instruments, such as the oboe, is complex, and the role of the instructor in this process remains indispensable. However, it is equally important to organize high-quality remote learning experiences, increase student motivation, and foster social interaction. The use of VR is often considered in organizing virtual training sessions and concerts, wherein motion and facial expression recognition technologies allow for the creation of corresponding avatars in virtual space whose movements mirror those of the real participants (Chen, 2022). This technology creates a sense of the presence of performers in the same venue. Yet, they play on real physical instruments rather than virtual ones, with the instrument's representation in VR serving merely as a graphical reproduction. Immersive technologies are proposed for developing communication skills among performers during group performances (Orman et al., 2017; Yan & Xia, 2024). Further refinement of these technologies may enhance the distance learning by increasing social interaction and better preparing students for real musical performances.

## Problem Statement

VR technology is relatively new to contemporary education and is still underused. Challenges include the need for additional resources, time for prior familiarization with the technology, and insufficient understanding among instructors of the effectiveness of such technologies (García Gil et al., 2022). The aim of this study was to investigate further the impact of using remote communication technologies with VR for organizing distance concerts on the performance quality of music students, their motivation for learning, and their subjective aesthetic perception of music compared to videoconferencing technologies.

The research objectives were to

- develop an educational program that includes regular mini-concerts for practicing students' technical and expressive skills, organized using videoconferencing and VR technologies, and
- identify and compare the performance outcomes achieved by students who practiced using videoconferencing and VR technologies.

## Methodology

### Sample

Participants in the study included 106 future musicians. One of the conditions for participating in the research was the achievement of oboe theoretical playing skills sufficient for performing musical compositions from beginning to end, which was necessary for participation in the mini-concerts. Therefore, for the study, graduates of senior courses—4th and 5th year students from Lishui University, Nanjing Arts Institute, and senior classes of music schools in Lishui and Nanjing—were selected. The sample consisted of students with varying levels of oboe performance skills: below average (15%), average (23%), sufficient (35%), and high (27%). This allowed for a stratified approach to sampling based on the presence of different levels of practical skills. All students had completed a theoretical course in oboe performance but lacked sufficient practical skills. The assessment of practical skills was conducted based on the evaluation of academic results and additional verification of oboe performance skills in accordance with the research program. Adobe Audition software (Version 1.6.4) was used for acoustic analysis. This program enabled the use of various tools for sound analysis (e.g., phase analyzer, spectral analysis), which allowed for the evaluation of the accuracy and purity of instrumental interpretation of melodies. This made it possible to select students with varying levels of practical skills. Participants were randomly assigned to two groups, with the first group participating in virtual concerts using videoconferencing technology (videoconference group) and the second group using VR technology (VR group). Each group comprised 53 participants. Four instructors, two from each participating institution, all with 10 to 15 years of experience in teaching the oboe, were invited to evaluate the students' performances.

### Research Design

The research spanned a period of 5 months and was integrated into the existing educational process at the two participating institutions. In addition to the standard curriculum adopted by the institutions, which included the study of music theory and group and individual practical sessions, students

participated monthly in virtual mini-concerts involving a total of 15 to 25 students from different academic groups and instructors who assessed the performances. Students from the videoconference group participated in conferences organized using the Zoom platform, while students from the VR group used the VRChat virtual reality platform.

The Zoom platform offers advanced capabilities for engaging participants in videoconferences. Joining the videoconference was facilitated through the generation of an identifier, which allowed for the pre-scheduling of the conference and provided participants with an opportunity to prepare in advance. This ensured collaborative interaction among all participants and was designed to facilitate responses to surveys regarding the quality of performances. The high image quality was aimed at enabling the visibility of necessary elements of the demonstration, including the presented melodies. The Zoom platform enabled collaborative musical interaction with students, focusing on the accuracy of the performed sounds. The use of recordings from conducted videoconferences and interactive whiteboards provided timely access to essential musical information.

The platform VRChat was chosen for its extensive customization capabilities. This platform allows each participant to create their avatar based on Unity SDK technology, and interactivity occurs through eye- and body-tracking mechanisms. The range of choices encompasses both the external appearance of the avatar and the features of its movements and animations. Additionally, the platform enables the construction of custom virtual worlds, adjusting the appearance of the environment in which the virtual embodiments of participants will interact.

For the implementation of this research, the virtual environment and avatars were created with the assistance of two staff members from each educational institution who had experience in three-dimensional modeling and voluntarily assisted in the research. They developed a virtual three-dimensional concert hall and also aided students in creating their avatars. Students could choose the characteristics of their avatars themselves; however, a condition was that their appearance should correspond to the circumstances of a musical concert and should not contain sharply contrasting elements to the external environment.

To conduct sessions in VR, Meta Oculus Quest 2 VR glasses were used. The technological process of working with the VRChat platform involved the creation of a virtual space tailored for a specific group to perform oboe melodies. This included configuring the platform according to the genres of music being studied and providing virtual practical approaches to oboe performance. Interaction through avatars was implemented based on the platform's technical capabilities, using natural approaches to performance. Interaction among students also occurred through 3D models of sheet music and musical diagrams, enabling their performance through animation. Virtual reality allows for the creation of necessary settings to improve instrumental playing techniques. This is achievable through gamification elements, which motivate students to achieve higher results during concert-level instrumental interpretation. The technical capabilities of VRChat are also expanded, allowing for the use of regular computers with a VR headset connection. The creation of avatars is possible based on predefined text or animation parameters. Interaction between avatars occurs through virtual buttons, musical instruments, and other elements.

Students from both groups participated in virtual concerts from their own homes, and the necessary instruments were provided by the educational institutions. Considering the limited amount of VR equipment, concerts in the VR group were held on different days with a 1 to 2 day displacement.

The initial participation for students in both groups was characterized by discomfort and a lack of skills in using the platforms despite being familiar with their theoretical features. The group of students who initially used the Zoom platform interacted more confidently with instructors and other participants, as the simple functionality did not require additional actions. The use of the VRChat platform before the creation of avatars was characterized by students' lack of confidence in learning the designated functionality and performing the required actions.

However, the first lessons revealed an increase in the confidence of students using VRChat and a decrease in confidence among students using Zoom. This was related to the clarity of sound provided by the first platform and the distortion of sound that occurred during the use of Zoom. This resulted in more positive assessments regarding the use of VRChat. Additionally, psychological indicators among students were considered, as these could have influenced the quality of the concerts. The assessment was linked to the determination of self-efficacy, as physical classrooms allow students to be directly under the teacher's supervision and focus on the educational atmosphere, whereas home-based lessons require additional self-discipline. The assessment of self-efficacy before and after the study among students in both groups was conducted using the method of Schwarzer and Jerusalem, adapted by Romek (Scholz et al., 2002). The results showed that the use of Zoom before the study indicated a self-efficacy level of 28 points among students, corresponding to an average level; after the study, the score was 31 points, still corresponding to an average level. The use of the VRChat platform before the study reflected a self-efficacy level of 27 points, corresponding to a low level; after the study, the score increased to 38 points, corresponding to a high level.

During the virtual concerts, students took turns performing solo renditions of musical adaptations of Chinese folk songs on the oboe. The final concert served as an assessment of the effectiveness of the educational interventions employed. Instructors evaluated each student's performance based on the accuracy of musical elements, instrument mastery, and artistic expressiveness. Additionally, upon completing the final concert, students were required to complete three questionnaires. The first aimed to evaluate the overall aesthetic experience of the concert, the second was aimed at determining the level of educational motivation, and the third expanded the data on the quality of aesthetic characteristics conveyed through digital environments, assessing to what extent students in each group were able to perceive the distinctive features of Chinese folk music. The questionnaires were provided in the form of online surveys on the Airtable platform.

## Measurements

Instructors evaluated the quality of students' musical performances at the end of the experimental period based on three parameters: accuracy of musical elements (pitch sequence, rhythm, and pitch), mastery of musical instrument control, and artistic expressiveness. Each parameter was assessed on a scale of 1 to 5, guided by criteria provided by the assessment rubric presented in the study (Ciorba & Smith, 2009). To determine the final score for each participant for each of the three parameters, the average of the scores assigned independently by the four instructors was calculated.

The Value Components section of the Motivated Strategies for Learning Questionnaire (Pintrich & De Groot, 1990) was used to assess the level of academic motivation. These components included: intrinsic goal orientation, which pertains to internal reasons why a student engages in a task, such as a challenge, interest, and skill acquisition; extrinsic goal orientation, reflecting the level of motivation by external indicators, such as grades or rewards; and task value, which reflects the student's perception of the usefulness and value of the task. Each component consisted of several statements, rated on a Likert

scale from 1 to 7, with the final score for each scale determined as the average value. The assessment of performance mastery involved two approaches with a weekly frequency, which allowed for the collection of longitudinal results.

To compare the quality of students' aesthetic experience in perceiving music in a VR environment, a questionnaire on the sense of absorption was employed based on statements developed by Vroegh (2018). The questionnaire included the following statements:

1. I felt completely absorbed in the music.
2. Time passed quickly.
3. I did not notice the surrounding environment.
4. I forgot that I was at a concert.
5. I was completely focused on the music.
6. My thoughts wandered.
7. I was completely bored.

Each of these statements was rated from 1 to 5 on a Likert scale, with the last two statements using an inverted scale. The final score was computed as the mean of the ratings across all statements. This test was chosen to focus on feelings of engagement and absorption in the musical presentation. Metrics from this test would be able to effectively reflect the emotional atmosphere transmission of the musical presentation in digital environments, which might suffer the most due to the limited capabilities of certain technologies.

I developed a questionnaire to assess the quality of conveying the aesthetic characteristics of Chinese folk music. For its development, I initially analyzed 200 folk music compositions using a comparison method to determine the expressiveness parameters. This analysis identified several distinctive and prominent elements. These included the following:

- lyrical, highly artistic aspects
- intonation subtlety
- the high-pitched sound, significant for Chinese spirituality
- sound reproduction uniqueness
- the rhythm expression speed

The quality of transmitting the aesthetic aspects of music during the performances was assessed by independent experts. This involved the participation of four instructors who teach the performance of folk music on various instruments (oboe, pipa, piano, etc.), each with a minimum of 10 to 15 years of experience. The instructors were able to evaluate not only the elements of expressiveness but also the

ways in which additional nuances were conveyed. These nuances were related to the ease of interpreting these indicators and the possibility of reflecting symbolic Chinese elements.

The connection between these elements is essential for manifesting the characteristic features of Chinese folk music. The link to these indicators of intonational subtlety is based on conveying the delicacy of emotional performance, reflecting the depth of expression. The significance of high-pitched sounds for Chinese spirituality should be based on elevated performance, using symbolic high sounds interconnected with meditation. The uniqueness of sound reproduction is characterized by conveying subtle nuances that influence the overall tone of the performance. The speed of rhythm expression implies the use of expressive movements that impact emotional intensity, aligning with cultural symbolism and interpretative nuances. The level of transmission of these parameters depends on the multilayered nature of the performance and the ability to convey the internal experiences of the performer.

The questionnaire regarding the assessment of the possibility of conveying aesthetic aspects of music is presented in the Appendix. The questions are related to student perception of individual aesthetic aspects of Chinese music in the performances of their own groups.

Students were asked to rate on a scale of 1 to 5 how much they perceived these characteristics while listening to performances by their peers at the educational mini-concert organized using one of the distance communication technologies.

### **Statistical Processing**

For the convenience of data collection and initial processing, Airtable software (Version 1.6.4) was used, which enables the creation of electronic spreadsheets. For statistical data processing, including the calculation of the independent samples *t*-test, IBM SPSS Statistics (Version 1.6.4) was employed. Calculations were based on the inclusion of normal distribution between the groups.

### **Ethical Issues**

Participants in the study were engaged on a voluntary basis and were informed about the option of withdrawing their participation at any time without any negative consequences. The data collected were anonymized for the purpose of analysis and were not used for any other purposes. Additionally, all borrowed materials reference relevant literature sources (COPE, 2025).

### **Limitations**

This study exclusively used the VRChat platform, and the developed virtual environment resembled a typical concert hall during a performance of classical music. Many other VR platforms, specifically designed for music concerts, offer various vivid special effects, which may elicit a completely different experience and affect the quality of musical performances. This research focused on VR as a communication environment and aimed to create a more realistic experience rather than employing gamification or enhancing entertainment effects. Also, limitations apply to studying the performance of folk music on the oboe; performances of contemporary music genres were not included. However, the limitations are not obvious, as this article reveals the relationship between technical and aesthetic parameters of musical performance and parameters that affect folk music's expressiveness.

## Results

During the fifth and final mini-concert, instructors assessed the two groups of students for (a) mastery of musical pieces based on criteria including accuracy of musical elements (score accuracy, musical notation, rhythm, and pitch), (b) proficiency in instrument control, and (c) artistic expressiveness. The results are presented in Table 1.

**Table 1**

*Results of the Assessment of Student Performances in the VR Group and Videoconferencing Group*

Performance parameter	VR			Videoconferencing			<i>t</i>
	Score	<i>M</i>	<i>SD</i>	Score	<i>M</i>	<i>SD</i>	
Proficiency with and accuracy of musical elements, including pitch, rhythm, and score accuracy	5.9	4.13	0.76	6.0	4.22	0.80	1.654*
Ability to control his or her instrument with musical intent	6.4	3.51	0.65	6.2	3.47	0.76	1.585*
Ability to be expressive with regard to inflection and style	6.8	3.88	1.11	6.5	3.75	1.09	1.442*

*Note.* The assessment was based on the evaluation rubric found in “Measurement of Instrumental and Vocal Undergraduate Performance Juries Using a Multidimensional Assessment Rubric,” by C. R. Ciorba and N. Y. Smith, 2009, *Journal of Research in Music Education*, 57(1), p. 9 (<https://doi.org/10.1177/0022429409333405>). VR = virtual reality.

\* $p < .05$ .

There was no significant difference between the groups, although the accuracy of musical elements was slightly lower in the VR group. Since the *t*-test did not reveal significant differences, this slight reduction may be attributed to the randomness and inaccuracy of some assessments or to the fact that students may not have sufficiently adapted to the new technology. As the VRChat platform was being used for practicing and demonstrating already-acquired skills rather than for initial skill acquisition, the lack of significant difference may indicate that both platforms equally facilitated the students’ ability to realize their skills without many impediments.

A lower level of accuracy in the interpretation of musical elements, although not significant, was observed in the use of VRChat, resulting from students being distracted by additional functional features. Students indicated that this affected their initial concentration to some extent. The ability of the students to control their instruments with musical intent was higher when using VRChat, as it maintained an enhanced level of interaction with all participants in the learning process. The performance of melodies occurred in a more natural atmosphere, which enabled students to achieve high results. This allowed for the integration of possible virtual cues with playing techniques. For the same reason, expressiveness in the manifestation of intonation and musical style was achieved. Respondents noted that the flexibility of the virtual settings also had an impact, as it allowed for adjustments to the performance in accordance with the proposed musical works.

Upon completing the final mini-concert, students completed a questionnaire on learning motivation. Table 2 presents the results.

**Table 2**

*Results From a Questionnaire on Learning Motivation Comparing the VR Group and Videoconferencing Group*

Learning motivation parameter	VR		Videoconferencing		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Intrinsic goal orientation	5.49	1.21	4.89	1.13	2.753*
Extrinsic goal orientation	5.58	1.17	5.01	1.05	2.267*
Task value	5.65	1.03	4.81	1.21	2.978*

*Note.* The learning motivation strategies were drawn from “Motivational and Self-Regulated Learning Components of Classroom Academic Performance,” by P. R. Pintrich and E. V. De Groot, 1990, *Journal of Educational Psychology*, 82(1), p. 33-40 (<https://doi.org/10.1037/0022-0663.82.1.33>). VR = virtual reality. \**p* < .05.

Motivation indicators across all three components were higher in the VR group compared to the videoconferencing group. The most significant positive difference in the VR group was observed regarding task value, signifying the perception by students of the usefulness and importance, and their interest in the content of their learning.

Intrinsic goal orientation was based on responses to questions related to the willingness of students to voluntarily exert more effort in learning activities for a specific internalized goal. The internal goal orientation among students in the VR group was higher, and motivation was expressed through the unconventional use of approaches to instrumental interpretation. That motivated students to work more precisely on the artistic elements of Chinese music and to develop confidence in conveying Chinese folk music’s values. This motivation arose among students from the original listening experience of compositions, ensuring the perception of sound purity through VR. The pedagogical aspect of this motivation was reflected in the individualized approach to teaching, which was evident in the possibility of progressive learning.

Extrinsic goal orientation denoted motivation associated with approval from elders and parents, and competitive feelings between peers. These allowed the learning process to be perceived as more meaningful and enabled the achievement of new musical goals. External motivation is typically manifested in the increased confidence of students and the connection between dedication to learning and the attainment of a corresponding level of practical skills. It is also reflected in a student’s ability to achieve educational goals and in the exchange of musical experiences with other students.

The final aspect of this study involved determining students’ subjective perceptions of the aesthetic experience during the virtual mini-concerts. See Table 3.

**Table 3**

*Results From a Questionnaire on the Quality of the Aesthetic Experience Comparing the VR Group and Videoconferencing Group of Students*

Quality of the aesthetic experience	VR		Videoconferencing		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Absorption and positive emotional experience	4.81	1.07	3.70	1.15	2.112*

*Note.* Students ranked the quality of the experience on a scale of 1 to 5. The questionnaire was based on statements found in “The Pleasures of Getting Into the Music: Absorption, and Its Role in the Aesthetic Appreciation of Music,” by T. P. Vroegh, 2018, doctoral dissertation, Johann Wolfgang Goethe-Universität (<https://publikationen.uni-frankfurt.de/frontdoor/index/index/docId/47549>). VR = virtual reality.

\**p* < .05.

The students’ experience of absorption and positive emotional perception of the performance was significantly higher in the VR group. When examining students’ responses to individual questionnaire items, the greatest difference between the groups was observed in the ratings of three statements: (a) “I felt completely absorbed in the music” (4.70 in the VR group compared to 3.21 in the videoconferencing group); (b) “I did not notice the surrounding environment” (4.87 compared to 3.05); and, (c) “My thoughts wandered” (4.67 compared to 3.52, using an inverted scale).

The final part of the study involved an analysis of how effectively the two different digital environments facilitated the conveyance of characteristic aesthetic features of Chinese folk music using the oboe. In the preliminary phase of the research, I identified the specific expressiveness parameters of Chinese folk music.

These expressive parameters were presented to the students in the form of a questionnaire. The results of students assessing the effectiveness of two digital environments in conveying the characteristic features of Chinese folk music are presented in Table 4.

**Table 4**

*Students’ Views on the Effectiveness of Conveying the Aesthetic Features of Chinese Folk Music in Two Digital Environments—VR and Videoconferencing*

Aesthetic feature of Chinese Folk Music	VR		Videoconferencing		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Lyrical, highly artistic aspects	4.58	0.94	4.22	1.02	2.012*
Intonation subtlety	4.71	1.02	4.35	1.13	2.109*
High-pitched sound significance for Chinese spirituality	3.72	1.13	3.55	1.24	1.714
Sound reproduction uniqueness	2.98	1.26	3.17	1.31	1.512
Rhythm expression speed	3.55	1.32	3.38	1.21	1.615

*Note.* VR = virtual reality.

\**p* < .05.

Participants in the VR group demonstrated a significantly higher level of recognition of the melodies performed by peers in such characteristic features of Chinese folk music as lyrical, highly artistic aspects and intonation subtlety. Although there were no significant differences between the groups in recognizing the rest of the characteristic features, the overall tendency towards better recognition of

these features in musical pieces in the VR environment once again speaks to the effectiveness of this digital environment in conveying the aesthetic characteristics of musical performances.

The subtlety of intonation takes precedence over other parameters, as it is closely related to the emotionality of the instrumental interpretation, conveying personal experiences. This criterion influences the potential for altering approaches to performance, which is manifested in the creation of additional nuances.

The prominence of lyrical, highly artistic aspects over other indicators is linked to the transformation of the primary sound and the ability to use additional melodic embellishments. This expressive parameter is associated with partial modifications of the melody, allowing for the use of unconventional approaches to its interpretation.

The relationship between pitch sounds and Chinese spirituality is linked to musical traditions, which allow for the performance of inherent sounds and orientation towards multi-layered sounds. The student's understanding of the principles of conveying the pentatonic scale component of music enables them to reflect a high degree of spiritual depth in their performance. The speed of rhythm expression is also associated with the relationship between pitch sounds and Chinese spirituality, as it holds particular significance in Chinese music. During the instrumental interpretation, the respondents were able to achieve harmony in alternating sounds and intervallic performance, which influenced the expressiveness of the sound.

The originality of reproduced sounds parameter had a lower level of expression, as students were required to possess more professional skills in melody interpretation. Some difficulties were observed in combining long and short notes, which was reflected in the virtuosity of respondents from both groups.

## Discussion

This study is not the first to examine the effectiveness of VR technologies for organizing remote communication in the education of future musicians. Specifically, several studies have explored the effectiveness of applying this technology in the training of future conductors. Improvements in nonverbal communication through eye contact, body posture, and gestures have been identified. In this case, the technology increased the amount of potential training time, overcoming the time constraints of face-to-face sessions (Orman et al., 2017). However, the sense of social presence may vary, depending on the ability of the virtual environment to simultaneously accommodate multiple streams of information from the real world, such as facial expressions, movements, and environmental features (Van Kerrebroeck et al., 2021). In one study aimed at testing a VR platform specially developed to support interaction among professional musicians, open interviews with participants demonstrated the platform's potential to foster creative activity. It is worth noting that researchers implemented appropriate audio and visual tools to facilitate music creation (Ppali et al., 2022). Another study investigated the effectiveness of using VR in training future vocalists (Doganyigit & Islim, 2021).

The reviewed studies were based on the analysis of the overall impact of VR effectiveness. In my study, however, an assessment was conducted on the mastery of oboe melody performance using VR and videoconferencing. Although the results show only slight differences, they provide an opportunity to

evaluate the advantages of VR in education. This is related to the ability to achieve more precise sound processing, which allows for the consideration of cultural and aesthetic aspects of Chinese folk music.

Studies examining the effectiveness of distance communication in music education have often yielded ambiguous results. For instance, a study comparing the effectiveness of face-to-face and online music composition education using the sonata form found that the quality of compositions was higher in the group using the online platforms Playground Sessions and Soundation Studio. The former provides diverse educational materials, communication opportunities, and assessment, whereas the latter focuses on technical aspects of music creation, such as audio editing and beat addition (Han, 2023). Meanwhile, another study investigating the effectiveness of face-to-face and blended learning in gobo playing revealed a decrease in practical and theoretical knowledge among students in the blended form compared to face-to-face. However, the results only reflected the subjective perception of skill levels by students and teachers (Zhang, 2024). Similar results were obtained in a study examining the effectiveness of distance learning in choral singing; however, in that case, students' perception was slightly more positive in terms of the convenience of such a format (Li, 2024).

The current study complements the findings of previous research by providing an assessment of whether VR technology is more effective for training future oboe players than conventional videoconferencing. Despite the absence of a noticeable difference in the quality of acquired skills, the virtual environment contributed to an increase in the quality of aesthetic perception of music during performances and motivation for engagement, which is a significant advantage. Motivation plays a crucial role in the continuous improvement of students' skills and allows for the regulation of their desire to acquire new knowledge. A prominent advantage of virtual technologies is their ability to create an individualized learning environment and adjust the pace and duration of working on specific musical parameters.

Additionally, a somewhat greater effectiveness of the virtual environment in conveying folk music's lyrical and aesthetic characteristics was demonstrated. The evolution of folk music compositions can be linked to regional shifts impacting contemporary music. A change in playing tempo, connected to a change in intonation and modern forms, allows a performance to be more harmonious. It was found that the right way to breathe and changes in sound pitch and volume affect how expressive a performance is (Xu, 2022). The wind instrument's characteristics mean that it should produce an expressive sound (Li & Yuan, 2023).

Folk music has a unique style, evoking light, dark, rich, and vibrant emotions. The interplay of different rhythms in folk compositions is another feature that contributes to their expressive power (Yantian et al., 2021). The study of the characteristics of traditional Chinese music allowed us to conclude that it is primarily composed in pentatonic scales, has monophonic sound, and contains a significant amount of percussion. Traditional music is an excellent tool for expressing a wide range of feelings, and one song can encompass serenity, complexity, mystery, and calmness (Chai, 2022). Folk music is distinguished by a special musical charm that shows in the performance aesthetics. Since different melodic windings have varying effects on the scale system and tonal-harmonic structures, using them contributes to performance authenticity (Chai, 2022).

Augmented reality technology that allows learning to play classic musical instruments, such as the oboe, can be used to maintain national cultural art. It is known that the aesthetic qualities of musical composition performance are based not only on a musical technique but also on the ability to add extra

musical windings. It has been proven that using augmented reality technologies helps people learn more about their culture and traditions and gets students more interested in learning new things (Hong & Wu, 2022).

Using an oboe is a great way to convey the metaphorical tone of musical works. The oboe contributes bright tones, creates varied harmonies, and helps maintain the pentatonic scale, which is characteristic of folk music. The oboe is a musical instrument that allows the user to concentrate on sound waves and add attenuation or saturation effects that enhance the musician's freedom of expression. The sharpness produced by the sound intensity of the instrument appears in the sound dynamics (Larson, 2020).

Despite the debate surrounding the equivalence of live and virtual music in conveying subtle aesthetic elements, in this study, the levels of recognition of characteristic features of Chinese folk music were quite high, and there was a tendency towards improvement observed in the group participating in mini-concerts using VR. The use of virtual technologies enables a more precise adherence to the sequence of task execution and eliminates extraneous sounds, ensuring an accurate perception of melodies. Consequently, it allows for a deeper analysis of musical works, which impacts the quality of subsequent performances. Additionally, the virtual space provides an expanded set of tools for sound correction, in contrast to traditional teaching methods.

## Conclusions

This study aimed to compare the effectiveness of using videoconferencing and VR technologies in teaching oboe playing, particularly in organizing remote mini-concerts aimed at practicing the technical and expressive skills of students. The oboe is a challenging instrument to teach, particularly when fully translated into a distance format. Due to its inherent complexity, there is a risk of losing its effectiveness. However, incorporating elements of distance learning can complement and enrich traditional teaching methods. This approach allows for increased practice opportunities, which entail more organizational complexities in face-to-face settings and pose higher risks in the event of infectious disease outbreaks. The capabilities of the technology employed play a crucial role in this context.

In this study, no differences were observed in the technical and expressive characteristics of students' performances between groups regularly participating in mini-concerts using videoconferencing and VR technologies. However, higher levels of academic motivation were noted in the VR group according to the Value Components section of the Motivated Strategies for Learning Questionnaire. Specifically, the perception of task value scored 5.65 compared to 4.81 out of 7 possible points, intrinsic goal orientation scored 5.49 compared to 4.89, and extrinsic goal orientation scored 5.58 compared to 5.01; all three pairs of values showed significant differences between the groups. Motivation among students using VR was linked to the provision of immersive presence through avatars. This facilitated closer interaction between students, promoting the development of practical oboe-playing skills. Sensory integration enabled a more comprehensive understanding of performance approaches using experimental learning methods, allowing for the identification of a clear connection between the performance of musical elements.

Additionally, a significantly higher sense of immersion and quality of aesthetic experience was reported in the VR group, scoring 4.81 compared to 3.70 out of 5 possible points in the videoconferencing group.

The use of VR provided a greater sense of immersion, which was related to the quality of transmitted sounds and the elimination of surrounding noises from the real environment. Furthermore, VR demonstrated a greater ability to convey characteristic emotional nuances of music. In the VR group, 2 out of 6 characteristic features of Chinese folk music were more pronounced compared to the videoconferencing group. The findings showed that lyrical highly artistic aspects, intonation subtlety, the high-pitched sound significant in Chinese spirituality, sound reproduction uniqueness, and the rhythm expression speed are the expressiveness parameters in Chinese folk music. After adding melodic windings typically associated with lyrical motifs, it was found that highly artistic lyrical aspects emerged. Intonation subtlety is intertwined with changes in pitch; the high-pitched sound, significant for Chinese spirituality, also promotes awareness of the pentatonic scale. The sharpness of the sound and the contrast between long and short notes are two indicators of a unique sound. Finally, the rhythm expression speed helps to convey the performance artistry.

Based on this study, the VR environment has the potential to provide better levels of immersion and perception of aesthetic value among students, which may, in turn, be one of the reasons for the simultaneous increase in their motivation.

## **Funding, Conflict of Interest, and Ethical Compliance**

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors declare that there are no conflicts of interest related to this work. Data supporting the findings of this study are available from the corresponding author upon reasonable request.

The study was conducted in accordance with the ethical standards of the World Medical Association's *Declaration of Helsinki*. Ethical approval was obtained from the local ethics committee of Xinyang Normal University (Protocol No. 4993, dated February 2, 2023).

All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by YZ. The first draft of the manuscript was written by YZ, and all authors reviewed and approved the final manuscript.

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## Appendix

### Survey: “Evaluation of the Possibility of Conveying Aesthetic Aspects of Chinese Folk Music Through the Platforms Used in Education

- Is it possible to perceive musical nuances during the performance of instrumental compositions?
- Does the perception of cultural nuances occur based on listening to melodies performed by students from your group?
- Does the perception of artistic nuances occur based on listening to melodies performed by students from your group?
- While listening to melodies performed on the oboe by students from your group, do you perceive lyrical motifs?
- Does the perception of intonational subtlety occur as a result of listening to melodies performed by students from your group?
- Is the spiritual component of the music perceived during the listening of melodies performed by students from your group?
- Is the high-pitched sound clearly expressed during the listening of melodies?
- Is it possible to trace unique sound characteristics while listening to melodies performed by students from your group?
- Is it possible to perceive the speed of rhythmic changes during the listening of musical works?
- Does the perception of oboe melodies, as heard through the platforms, leave a positive impression?
- Does the perception of oboe melodies, as heard through the platforms, leave a negative impression?

