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The Efficacy of Blended Learning via Video Conferencing for Piano Instruction: A Case Study at Yunnan University

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Abstract

Background and Aim: Piano practice has adopted video conferencing platforms like DingTalk due to the increasing integration of digital tools in music education. However, their impact on students' performance and learning experience remains underexplored. This study examines the effectiveness of DingTalk-assisted piano practice for non-piano major students at Yunnan University, focusing on memorization ability, playing skills, musical expression, and music style.

Materials and Methods: A 12-week quasi-experimental study was conducted with 60 undergraduate musicology students. The treatment group (n = 30) practiced remotely via DingTalk, while the traditional group (n = 30) followed traditional methods. Data were collected through pre-tests, post-tests, and a post-intervention Likert-scale questionnaire on satisfaction, engagement, and perceived learning. Paired t-tests and ANCOVA were used for analysis.

Results: DingTalk-based practice significantly improved memorization ability ($d = 0.87$, $p < 0.001$) and technical skills ($d = 0.91$, $p < 0.001$). Engagement and satisfaction scores were also higher in the treatment group. However, improvements in musical expression were modest ($d = 0.42$, $p = 0.029$), and no significant effect was found on music style interpretation ($p = 0.926$).

Conclusion: Video conferencing enhances technical proficiency and engagement in piano learning, but its impact on musical expression is moderate, and no significant improvement is observed in music style interpretation. Additional interactive feedback may be needed to support expressive development. These findings highlight the potential of blended learning models that integrate digital tools with traditional instruction for a more comprehensive music education approach.

Keywords: DingTalk; Blended Learning; Piano Practice

Introduction

China's higher education expansion has significantly diversified university music programs, with 11 conservatories, 11 art colleges, 143 normal universities, and over 1,400 universities offering music education (Law & Ho, 2011). While conservatories focus on elite performance training, comprehensive universities emphasize foundational music education, interdisciplinary learning, and accessibility (Zhu & Su, 2018). Recent educational reforms encourage the integration of scientific and artistic perspectives, expanding curricula to include musicology, ethnomusicology, and music technology (Li, 2023). Despite these advancements, piano education in comprehensive universities faces three major challenges:

1. Misaligned Assessment Standards – Many institutions apply music conservatory-level grading criteria that do not align with students' broader educational objectives, creating a mismatch between evaluation and learning outcomes (Tan, 2018).

2. Outdated Teaching Methods – Traditional one-on-one, performance-driven instruction is impractical for university students with diverse learning needs and limited practice time, reducing its effectiveness in non-specialist contexts (Paulk, 2013).

3. Limited Technology Integration – While digital tools can enhance engagement, self-directed learning, and accessibility, their application in university piano instruction remains insufficient (Ma & Ma, 2023).

These challenges underscore the need for innovative instructional models, particularly blended learning approaches. Prior research on technology-assisted music education has demonstrated its potential benefits. Studies by Hansen et al. (2013) and Portowitz et al. (2014) indicate that digital platforms can

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enhance musical expression, memory retention, and playing skills, leading to improved engagement and performance outcomes.

To address these challenges, this study explores the use of DingTalk for blended piano practice at Yunnan University, a comprehensive university with interdisciplinary teaching advantages, examining its impact on learning engagement, technical proficiency, and musical development. DingTalk was chosen due to its accessibility, real-time feedback capabilities, resource-sharing functions, and cost-effectiveness, making it particularly suitable for large-scale university instruction. Unlike traditional video conferencing tools, DingTalk integrates interactive learning features such as structured feedback mechanisms, cloud-based practice logs, and AI-assisted assessment tools, offering a more dynamic and flexible learning environment (Sun et al., 2023).

By evaluating the effectiveness of DingTalk in a blended learning context, this study seeks to provide empirical insights into the modernization of university-level piano education and inform future curriculum reforms. Moreover, the findings may serve as a model for integrating digital platforms into broader music education practices, bridging the gap between traditional and technology-enhanced instruction.

This study explores how musicology students at Yunnan University develop technical proficiency, musical perception, and theoretical understanding through DingTalk-assisted piano practice. Using a quasi-experimental design, it examines the effectiveness of blended learning in addressing instructional challenges at comprehensive universities. By combining online and offline engagement, the research provides insights into learning experiences, instructional strategies, and student satisfaction with digital tools.

Research Objectives

1. To determine the difference in piano performance between the pre-test and post-test for students in the treatment group using DingTalk.
2. To examine the difference in piano performance between the treatment group using DingTalk and the traditional group not using DingTalk.
3. To identify the non-piano majors' students' satisfaction, engagement, and perceived learning towards DingTalk conference use in piano practice.

Literature review

Theoretical Frameworks Related to the Research

This study is grounded in three key theoretical perspectives: praxial philosophy of music education, blended learning theory, and constructivism. These frameworks collectively provide a comprehensive lens for examining technology-assisted piano education, particularly within the context of DingTalk-supported learning environments. While previous studies have explored these theories independently, their integration into a unified framework for digital piano instruction remains underdeveloped.

Praxial Philosophy of Music Education

David J. Elliott's praxial philosophy (Szego, 2005) emphasizes music as an active and experiential process, moving beyond traditional aesthetic or theoretical perspectives. It highlights the cultural, social, and personal dimensions of music-making, advocating for real-world engagement in performance and interpretation (de Villiers, 2021). Unlike conservatory-based approaches that emphasize technical mastery, the praxial perspective encourages students to integrate performance, critical thinking, and musical interpretation (Elliott, 1995). Blended learning aligns with this philosophy by bridging theory and practice, providing interactive, flexible instruction beyond conventional classroom settings. However, existing literature lacks a critical analysis of how digital tools like DingTalk specifically support praxial learning principles. This study addresses this gap by examining how DingTalk-assisted instruction fosters engagement, collaboration, and real-world musical experiences in piano education.

Blended Learning Theory

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Blended learning (BL) integrates face-to-face instruction with digital technologies, enhancing accessibility and student engagement (Graham, 2006a). Garrison and Kanuka (2004) define it as the intentional integration of physical and online learning experiences. Research suggests that 35% of higher education institutions offer blended courses, with 12% of distance learning enrollments utilizing blended formats (Dziuban et al., 2018). In music education, BL facilitates self-regulated learning, instructor feedback, and technical skill development through digital platforms (Barzilai & Blau, 2014). Recent studies on technology-enhanced music learning emphasize the importance of asynchronous practice opportunities and real-time feedback(Wang et al., 2021). However, current research has not sufficiently explored how enterprise communication tools like DingTalk support BL in piano education. This study contributes to filling this gap by analyzing the pedagogical affordances of DingTalk in facilitating blended piano instruction.

Constructivism

Constructivism asserts that learners actively construct knowledge based on prior experiences and critical engagement with new information (Kosnik et al., 2018). Educators serve as facilitators, guiding students through problem-solving, critical thinking, and independent learning (Hausfather, 2001). In piano education, constructivist approaches enable students to develop personalized interpretations of music, reinforcing creativity and self-directed practice (Richardson, 1999). Blended learning naturally aligns with constructivist principles by allowing students to adapt techniques, receive feedback, and refine performance in a student-centered, flexible environment (Milovanov & Tervaniemi, 2011). However, there remains a lack of research on how digital communication platforms like DingTalk promote constructivist learning in music education. This study investigates how DingTalk enables students to collaboratively engage, reflect on their progress, and receive contextualized feedback, thus enhancing constructivist learning experiences in piano education.

Technology-Enhanced Music Learning and DingTalk

Technology-enhanced music learning (TEML) has gained prominence in recent years, with digital tools significantly transforming music instruction. Platforms such as Zoom, Moodle, and Smart Music have been studied extensively in online and hybrid learning contexts (Partti & Karlsen, 2010). However, research on enterprise communication tools like DingTalk in music education remains scarce.

DingTalk, launched by Alibaba Group in 2015, is a collaborative platform widely adopted in China for education and business communication (Zhang et al., 2023). Unlike traditional Learning Management Systems (LMS), DingTalk offers instant messaging, cloud-based file sharing, real-time video conferencing, and interactive learning features, making it a versatile tool for blended music instruction. Since the onset of the COVID-19 pandemic, DingTalk has become increasingly popular among music educators for online instruction (Hou & Yu, 2023).

Despite its growing adoption, there is limited empirical research on how DingTalk supports piano education within a praxial, blended, and constructivist framework. This study aims to address this gap by examining the impact of DingTalk-assisted piano practice on student engagement, technical proficiency, and musical interpretation, contributing to the modernization of piano instruction in higher education.

Conceptual Framework

The conceptual framework of this study is illustrated in Figure 1, which outlines the relationship between video conferencing-based piano instruction and key learning outcomes. By integrating pre- and post-assessments with student surveys, this study provides empirical evidence on the efficacy of blended teaching models in piano education.

Methodology

Research Treatment

The quasi-experimental study was conducted over 12 weeks, structured into four distinct phases

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Stage 1: Preparation (Weeks 1–2)

In the initial stage, the instructor established an online learning environment to support structured piano practice sessions. Students were required to install and familiarize themselves with the DingTalk application, including its camera and speaker controls, to ensure a seamless experience. Participation in the study was voluntary, and students were fully briefed on the research objectives and procedures before providing informed consent. Those who agreed to participate completed a pre-test, marking the commencement of the experimental process.

Stage 2: Intervention (Weeks 3–10)

During this eight-week intervention phase, the treatment group attended every Friday from 7:00 to 9:00 PM. Teachers and students engage in a 120-minute online piano practice session via DingTalk video conference, fostering structured learning and interaction. The session includes three phases: Discussion (0-15 min): Students share insights on a selected piece and watch master performances, enhancing musical understanding. Independent Practice (15-90 min): Students practice individually while teachers provide real-time feedback via video feeds and chat. Performance & Reflection (90-120 min): 2-3 students perform, share challenges, and discuss strategies, promoting collaboration and confidence. Before each session, students submit practice goals on DingTalk, ensuring accountability and structured progress. This approach enhances self-directed practice, teacher guidance, and peer learning.

Stage 3: Post-Test (Week 11)

Following the intervention phase, both the treatment and control groups completed a post-test to evaluate their piano performance. The post-test results were used to assess the effectiveness of the experimental conditions in improving students' technical proficiency and overall musical expression.

Stage 4: Questionnaire Survey (Week 12)

In the final stage, a questionnaire survey was administered to the treatment group to evaluate their perceptions of video conferencing as a tool for piano practice. The survey examined changes in students' engagement, satisfaction, and learning perceived beyond performance-based assessments, offering additional insights into the pedagogical implications of blended learning in music education.

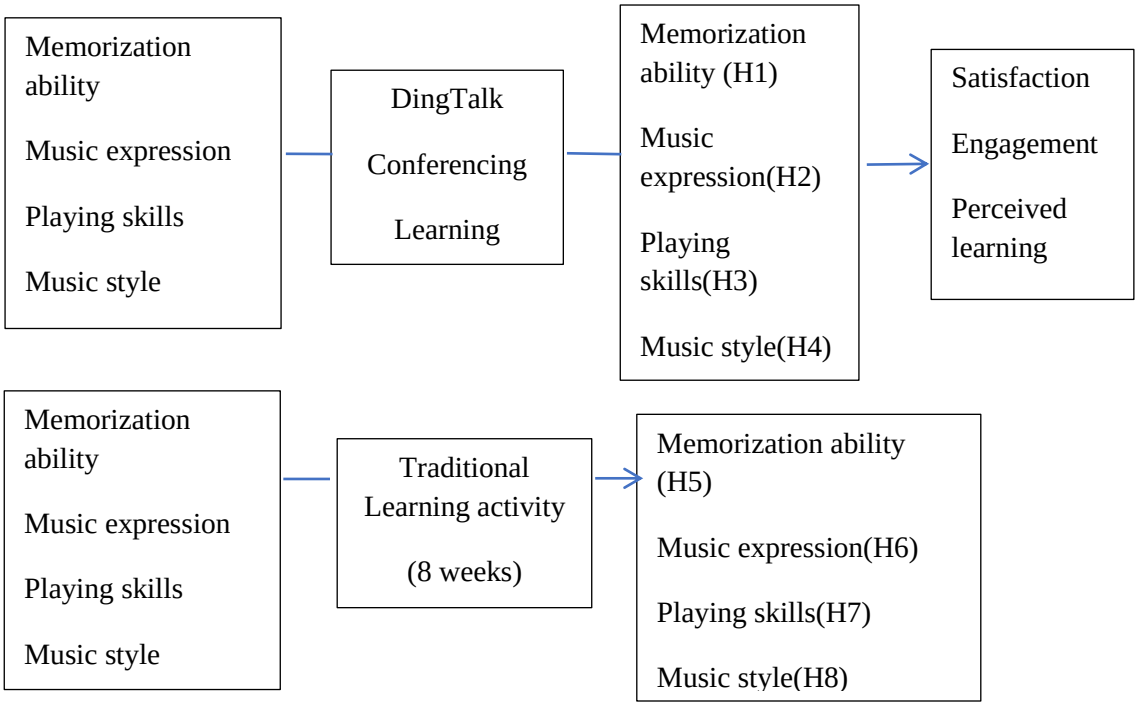

Figure 1 Conceptual Framework

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Population and sample

The population under investigation encompasses undergraduate students hailing from the Department of Music at Yunnan University. The 60 students in the sample are all sophomores, juniors, and seniors majoring in musicology. All had completed at least one year of mandatory piano instruction as part of their curriculum, despite not being piano majors.

The participants exhibit four key characteristics that make them suitable for this study: They come from diverse geographical and cultural backgrounds, which may influence their musical perception and learning approaches. Their piano proficiency levels vary significantly, as they enter university with different levels of prior training.

They have strong academic abilities but inconsistent performance skills, making them an ideal group to assess the effectiveness of video conferencing in structured piano practice. As digital natives, they are accustomed to online learning, which makes them well-suited for exploring the impact of video conferencing technology in music education.

To examine the impact of DingTalk-assisted piano practice, the participants were randomly assigned to two groups (Treatment group n = 30), which practiced using DingTalk video conferencing for structured piano sessions. The Control group (n = 30) followed traditional practice methods based on class assignments and periodic teacher feedback. Both groups participated in a 12-week quasi-experimental study, involving pre-tests, post-tests, and a survey to evaluate learning outcomes, engagement, and satisfaction.

In order to ensure the reliability and validity of the samples as far as possible, the researchers will conduct purposeful sampling after comprehensive measurement of expert opinions, piano examination standards, students' achievements, and learning attitudes.

Research instruments

The instruments of this research are performance tests and a questionnaire to collect data. The performance test consisted of pre- and post-test results of the two groups, which were used to observe whether the piano performance of the students changed after practicing the piano using DingTalk video conferencing. The questionnaire is aimed at the experimental group of students to investigate their satisfaction, engagement, and perceived learning degree after using DingTalk video conference to practice the piano.

The performance test follows the piano exam grading standards of the Music Department at Yunnan University's College of Art and Design. Students must perform two complete pieces on stage with appropriate attire and etiquette, ensuring the difficulty matches their skill level. The evaluation consists of four dimensions: memorization ability (30%), playing skills (30%), music expression (20%), and music style (20%), with a total score of 100. Performance is categorized into Excellent (90-100), Good (80-89), Average (70-79), Pass (60-69), and Fail (0-59). Excellent: Flawless memorization, smooth execution, rich tonal variation, and expressive interpretation. Good: Mostly accurate, fluid performance with slight errors, good technique, and musical expression. Average: Some mistakes, limited tonal variation, and basic expressive elements. Pass: Frequent errors, unclear phrasing, and weak technical control. Fail: Incomplete memorization, interrupted performance, and lack of expressiveness. The test comprehensively assesses students' piano performance skills, ensuring their technical ability, expressiveness, and stylistic understanding are effectively measured.

This study employed a Likert-scale questionnaire to collect quantitative data on students' satisfaction, engagement, and perceived learning after participating in DingTalk-assisted piano practice. The questionnaire consisted of 18 statements, measured on a 5-point Likert scale: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly Disagree (1). The results were analyzed using mean scores and standard deviation (SD), with interpretation ranges following (Barua, 2013):1.00–1.80: Strongly Disagree, 1.81–2.60: Disagree, 2.61–3.40: Neutral, 3.41–4.20: Agree, 4.21–5.00: Strongly Agree.

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The questionnaire items were adapted from established research sources: Students' satisfaction (Li & Phongsatha, 2022), (Mandasari & Wahyudin, 2021), and Student engagement (Gray & DiLoreto, 2016), and Perceived learning(Barzilai & Blau, 2014).

To ensure accuracy, an English associate professor translated the questionnaire into Chinese, and a master's student back-translated it into English. Comparison of both versions confirmed its reliability.

Reliability and Validity

The Item-Objective Congruence (IOC) test was conducted to establish content validity. Three music education experts reviewed the questionnaire for alignment with the study's objectives, ensuring its construct validity. Based on their evaluations, minor modifications were made to improve clarity and relevance.

Before the main study, a pilot test was conducted with 20 music students who had experience using DingTalk for learning but had not previously used it for piano practice. This pilot test aimed to identify potential issues in the questionnaire design and refine it accordingly. The responses were analyzed using Cronbach's Alpha to measure internal consistency reliability, with the following results (Table 2):

Table 1 Results of Cronbach's Alpha of the research instruments

Variable	Number of Items	Cronbach's Alpha
Students' satisfaction	8	0.776
Engagement	5	0.706
Perceived learning	5	0.695

According to (Hair Jr et al., 2010), a Cronbach's Alpha ≥ 0.7 indicates good reliability. The perceived learning dimension scored 0.695, slightly below the threshold, likely due to its multidimensional structure. However, content analysis confirmed its theoretical validity, allowing the study to proceed with further statistical analysis.

After refining the questionnaire, the formal survey was administered at the end of the quasi-experiment. Students completed it in class within 10–15 minutes, ensuring a controlled environment for data collection. The validated instrument provided reliable insights into students' experiences with DingTalk-assisted piano learning.

Data Analysis

This study employed descriptive statistics to summarize students' satisfaction, engagement, and perceived learning outcomes from DingTalk-assisted piano instruction. Additionally, paired sample t-tests were conducted to assess within-group differences before and after the intervention, while ANCOVA was used to compare post-test differences between the treatment and control groups. These analyses provide insights into the effectiveness of DingTalk in facilitating piano learning within a blended educational framework.

Descriptive Statistics: Students' Satisfaction, Engagement, and Perceived Learning

Tables 2-4 summarize students' satisfaction, engagement, and perceived learning outcomes. These descriptive statistics provide an initial overview of how students experienced and responded to DingTalk-assisted learning.

Students' Satisfaction with DingTalk

Table 2 Students' satisfaction with learning on DingTalk

Item Statements	Mean	SD	Interpretation
1. My piano practice efficiency has improved after using DingTalk video conference.	3.97	0.89	Agree
2. I am trained to have critical thinking in conducting DingTalk video conferences.	3.70	0.91	Agree

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Item Statements	Mean	SD	Interpretation
3. The content and materials presented in the video via DingTalk are clear.	3.80	0.99	Agree
4. The object of practice in the video is clear.	4.10	0.96	Agree
5. Multimedia and technology contribute more to the success of learning.	4.03	0.99	Agree
6. DingTalk video conference provides an interesting model of learning.	4.07	0.94	Agree
7. It is easy to practice piano with DingTalk video conference	3.43	1.07	Neutral
8. I enjoy practicing piano using DingTalk video conference after piano class.	3.30	1.12	Neutral
Total	**3.80**	**0.98**	**Agree**

Table 2 presents students' satisfaction ratings with DingTalk-assisted piano learning. The overall satisfaction score was 3.80, indicating that most students agreed that DingTalk contributed positively to their learning. The highest-rated aspects included clarity of practice objectives (4.10) and engagement in learning (4.07). Ease of use (3.43) and enjoyment of after-class practice (3.30) received neutral feedback, suggesting that some students faced challenges in seamlessly integrating DingTalk into their piano practice routines. This suggests that while DingTalk is an effective learning tool, further improvements in user-friendliness and motivation strategies may be needed.

Students' Engagement in DingTalk-Supported Learning

Table 3 Students' engagement in learning towards Ding Talk

Item Statements	Mean	SD	Interpretation
1. I frequently interacted with my instructor for this course.	4.10	0.80	Agree
2. I discussed what I learned in the course outside of class.	4.10	0.75	Agree
3. I completed my piano practice as assigned during the course.	4.17	0.69	Agree
4. I participated in synchronous and/or asynchronous chat sessions during the course with Ding Talk video conference.	4.10	0.71	Agree
5. I was actively engaged in the activities required in the course.	4.23	0.67	Agree
Total	**4.14**	**0.61**	**Agree**

Table 3 presents student engagement levels. Students strongly agreed that they were actively engaged (4.23) and completed assigned practice (4.17). Interaction with instructors and participation in Ding Talk synchronous/asynchronous sessions were rated positively (4.10 each), suggesting that Ding Talk effectively facilitated teacher-student interaction and collaborative learning. These findings support the hypothesis that Ding Talk fosters an interactive and participatory learning environment, enhancing student engagement in blended music education.

Students' Perceived Learning Outcomes

Table 4 Students' perceived learning towards DingTalk

Item Statements	Mean	SD	Interpretation
1. Online with DingTalk video conference for piano	3.83	0.83	Agree

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Item Statements	Mean	SD	Interpretation
practice is an excellent medium for social interaction.			
2. I felt comfortable practicing through the DingTalk video conference.	3.70	0.75	Agree
3. I felt comfortable sharing my piano playing in this course.	3.70	0.91	Agree
4. The instructor created a feeling of an online community.	4.40	0.62	Strongly Agree
5. I felt comfortable participating in course discussions.	4.03	0.80	Agree
Total	**3.90**	**0.78**	**Agree**

Table 4 presents students' perceived learning with supportive aspects of DingTalk. The overall perceived learning score was 3.90, indicating a generally positive experience. The highest-rated aspect was the instructor's role in fostering an online learning community (4.40), suggesting that effective teaching strategies on DingTalk contributed to a sense of belonging and motivation. Comfort in practicing and sharing performances (3.70) was rated moderately, implying that some students might still feel hesitant about online learning formats. These results indicate that while DingTalk facilitates a structured learning experience, additional pedagogical support may be needed to further improve students' confidence in online practice and performance sharing.

The piano performance between the pre-test and post-test

Paired Sample T-Tests

Tables 5-8 summarize the results of paired t-tests, assessing within-group differences in piano performance.

Hypothesis 1:

$H_0$1: There is no difference in memorization ability in the treatment group without DingTalk video conference in pre-test and with DingTalk video conference in post-test.

H_a1: There is a difference in memorization ability in the treatment group without DingTalk video conference in pre-test and with DingTalk video conference in post-test.

Table 5 Paired Sample T-Test of memorization ability

			Statistic	d f	p	Mean difference	Cohen's d
pre-test	post-test	Student's t	-11.4	29.0	<.001	-6.53	-2.08

Note: H_a: μ (Measurement 1 - Measurement 2) ≠ 0

Table 5 Description that the paired sample t-test yielded a p-value of <.001, indicating a statistically significant improvement between pre-test and post-test scores. The post-test mean was 6.53 points higher, with a Cohen's d of -2.08, signifying a very large effect size. This result leads to rejecting the null hypothesis, confirming that DingTalk video conferencing significantly enhanced students' memorization ability. These findings lead to the rejection of the null hypothesis, confirming that DingTalk video conferencing had a substantial positive impact on students' memorization ability.

Hypothesis 2:

$H_0$2: There is no difference in the playing skills in the treatment group without DingTalk video conference in pre-test and with DingTalk video conference in post-test.

H_a2: There is a difference in the playing skills in the treatment group without DingTalk video conference in pre-test and with DingTalk video conference in post-test.

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Table 6 Paired Sample T-Test of playing skills

			Statistic	df	P	Mean Difference	Cohen's d
pre-test	post-test	Student's	-11.7	29.0	<.001	-3.07	-2.13

Note: H_a: μ (Measurement 1 - Measurement 2) ≠ 0

Table 6 shows a significant improvement in piano playing skills, as indicated by the paired sample t-test (t = -11.7, p < .001) with a mean difference of -3.07. The large effect size (Cohen's d = 2.13) confirms a substantial positive impact of DingTalk video conferencing. Consequently, the null hypothesis is rejected, confirming a significant difference in students' playing skills before and after using DingTalk.Therefore, the null hypothesis is rejected, confirming that students' playing skills significantly improved after using DingTalk for practice.

Hypothesis 3:

$H_0$3: There is no difference in the music expression in the treatment group without DingTalk video conference in pre-test and with DingTalk video conference in post-test.

Ha3: There is a difference in the music expression in the treatment group without DingTalk video conference in pre-test and with DingTalk video conference in post-test.

Table 7 Paired Sample T-Test of music expression

		Statistic	df	P	Mean Difference	(Cohen's d)
pre-test	Student's t	-2.30	29.0	0.029	-3.07	-0.420

Note: H_a: μ (Measurement 1 - Measurement 2) ≠ 0

Table 7 shows a statistically significant improvement in musical expression, as indicated by the paired t-test (t = -2.30, p = 0.029) with a mean increase of 3.07 points. The moderate to small effect size (Cohen's d = -0.420) suggests a meaningful but modest impact of the intervention. Consequently, the null hypothesis is rejected, confirming a significant difference in musical expression before and after using DingTalk video conferencing. These findings lead to the rejection of the null hypothesis, confirming that DingTalk video conferencing contributed to a meaningful, albeit modest, improvement in musical expression.

Hypothesis 4:

$H_0$4: There is no difference in the music style in the treatment group without DingTalk video conference in pre-test and with DingTalk video conference in post-test.

H_a4: There is a difference in the music style in the treatment group without DingTalk video conference in pre-test and with DingTalk video conference in post-test.

Table 8 Paired Sample T-Test of music style

			Statistic	df	P	Mean Difference	(Cohen's d)
pre-test	post-test	Student's	0.0933	29.0	0.926	0.0333	0.0170

Note: H_a: μ (Measurement 1 - Measurement 2) ≠ 0

Table 8 presents the results of the paired sample t-test, showing a non-significant difference in music style between pre-test and post-test (t = 0.0933, df = 29, p = 0.926). The effect size (Cohen's d = 0.017) is negligible, confirming that the intervention had no measurable impact on students' music style.

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Consequently, it suggests that DingTalk video conferencing had no measurable impact on students' musical style. Consequently, the null hypothesis is not rejected.

ANCOVA Results

Tables 9-12 present the ANCOVA results for Hypotheses 5-8, comparing post-test differences between the treatment and control groups.

Hypothesis 5:

$H_0$5: There is no difference in memorization ability between the treatment group and the traditional group.

H_a5: There is a difference in memorization ability between the treatment group and the traditional group.

Table 9 ANCOVA - Memorization ability (Post-test)

	Sum of Squares	df	Mean Square	F	p	η^2
Memorization ability (Pre-test)	7.78	1	7.78	2.17	0.146	0.016
Group	263.62	1	263.62	73.53	<.001	0.554
Residuals	204.35	57	3.59			

Table 9 presents the ANCOVA results for memorization ability, comparing the treatment and traditional groups. Pre-test differences were non-significant ($p = 0.146$, $\eta^2 = 0.016$), explaining only 1.6% of the variance. However, post-test results revealed a significant main effect of group ($F = 73.53$, $p < 0.001$, $\eta^2 = 0.554$), indicating that 55.4% of the variance in memorization ability was attributable to the intervention. This effect size ($\eta^2 = 0.554$) suggests a large practical significance, confirming that DingTalk video conferencing substantially enhanced students' memorization ability compared to traditional instruction. Consequently, the null hypothesis is rejected, supporting the conclusion that the treatment group outperformed the control group in post-test memorization scores.

Hypothesis 6:

$H_0$6: There is no difference in piano playing skills between the treatment group and the control group.

H_a6: There is a difference in piano playing skills between the treatment group and the control group.

Table 10 ANCOVA -Piano Playing Skills (Post-test)

	Sum of Squares	df	Mean Square	F	p	η^2
Piano Playing Skills (Pre-test)	131.4	1	131.41	63.5	<.001	0.238
Group	78.0	1	77.98	37.7	<.001	0.401
Residuals	117.9	57	2.07			

Table 10presents the ANCOVA results for piano playing skills, showing significant effects for both pre-test scores ($F = 63.5$, $p < 0.001$, $\eta^2 = 0.238$) and group assignment ($F = 37.7$, $p < 0.001$, $\eta^2 = 0.401$). The group effect ($\eta^2 = 0.401$) indicates that 40.1% of the variance in piano playing skills was explained by the intervention, suggesting a substantial impact of DingTalk-assisted learning. These results lead to the

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rejection of the null hypothesis, confirming that the treatment group demonstrated significantly greater improvement in piano playing skills compared to the traditional group.

Hypothesis7:

$H_0$7: There is no difference in the musical expression between the treatment group and the control group.

H_a7: There is a difference in the musical expression between the treatment group and the control group.

Table 11 ANCOVA - Music expression (Post-test)

	Sum of Squares	df	Mean Square	F	p	η^2
Music expression (Pre-test)	56.24	1	56.24	46.11	<.001	0.430
Group	5.18	1	5.18	4.24	0.044	0.040
Residuals	69.52	57	1.22			

Table 11 presents the ANCOVA results for musical expression, showing significant effects for both pre-test scores ($F = 46.11$, $p < 0.001$, $\eta^2 = 0.430$) and group assignment ($F = 4.24$, $p = 0.044$, $\eta^2 = 0.040$). The pre-test scores accounted for 43.0% of the variance, indicating a strong prior influence on post-test results. Meanwhile, the group effect ($\eta^2 = 0.040$) accounted for only 4.0% of the variance, suggesting a statistically significant but small practical effect of the DingTalk intervention. These results lead to the rejection of the null hypothesis, confirming that the treatment group demonstrated a statistically significant but small improvement in musical expression compared to the traditional group.

Hypothesis 8:

$H_0$8: There is no difference in the musical style between the treatment group and the control group.

H_a8: There is a difference in the musical style between the treatment group and the control group.

Table 12 ANCOVA - Music style (Post-test)

	Sum of Squares	df	Mean Square	F	p	η^2
Musical style(Pre-test)	14.21	1	14.21	8.439	0.005	0.127
Group	1.33	1	1.33	0.778	0.379	0.012
Residuals	95.96	57	1.68			

Table 12 presents the ANCOVA results for musical style, showing that pre-test scores had a significant effect on post-test outcomes ($F = 8.439$, $p = 0.005$, $\eta^2 = 0.127$), explaining 12.7% of the variance. However, group assignment had no significant effect ($F = 0.778$, $p = 0.379$, $\eta^2 = 0.012$), accounting for only 1.2% of the variance, suggesting that the intervention had a negligible impact on musical style. These results provide support for the null hypothesis, indicating that DingTalk video conferencing had no significant effect on musical style in the treatment group compared to the control group.

Conclusion

Hypothesis testing revealed significant improvements in memorization ability, playing skills, and musical expression for the treatment group, while no effect was found for musical style.

Hypotheses 1, 2, and 3 were rejected, confirming large effect sizes for memorization ability ($d = -2.08$) and playing skills ($d = -2.13$), demonstrating that DingTalk-assisted practice enhanced students' technical proficiency and retention skills. Musical expression also improved ($d = -0.42$), though with a

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smaller effect size, suggesting that interpretative depth may require in-person guidance. Null hypothesis 4 was not rejected, indicating no significant difference in musical style, reinforcing the idea that stylistic development depends more on artistic mentorship than structured online learning.

Similarly, null hypotheses 5, 6, and 7 were rejected, confirming that the treatment group significantly outperformed the control group in memorization ability, playing skills, and musical expression. However, null hypothesis 8 was not rejected, indicating no difference in musical style scores between the groups. These results highlight that while DingTalk enhances technical skill acquisition, it may not fully support stylistic refinement and interpretative growth, which require direct mentorship and artistic coaching.

These findings align with blended learning theories, emphasizing that structured digital tools effectively reinforce technical skills (Graham, 2006b). However, the small effect size for musical expression ($\eta^2 = 0.040$) and negligible impact on musical style ($\eta^2 = 0.012$) suggest that artistic expression and stylistic individuality in piano performance require additional face-to-face feedback (Elliott, 1994).

Discussion

This study explored the integration of DingTalk in piano education for non-piano majors at Yunnan University, assessing its impact on performance, engagement, and learning satisfaction. The findings indicate significant improvements in memorization ability, playing skills, and musical expression, aligning with previous research on the benefits of digital learning in music education(Bauer & Dammers, 2016). Students attributed their progress to the platform's clarity and interactivity, reinforcing its role in fostering structured practice and engagement(Wise et al., 2011).

However, while musical expression improved, changes in musical style remained statistically insignificant. This suggests that while digital tools enhance technical proficiency, they may not fully support nuanced stylistic interpretation, a challenge noted in prior studies (Hebert, 2008). These findings highlight the need for deeper cultural immersion and personalized instruction alongside technological integration.

Demographic analysis showed that students with prior piano experience adapted well to DingTalk. They appreciated its structured format but noted limitations in sustaining long-term practice. The teacher's role emerged as a critical factor, emphasizing that technology should complement, not replace, instructor-led guidance (Wang, 2024). While most hypotheses were supported, the findings suggest that individual learning differences, baseline proficiency, and adaptability to digital tools must be considered in blended learning approaches.

This study underscores the value of integrating digital tools with traditional piano pedagogy to enhance technical proficiency and engagement. While DingTalk proved effective for structured learning, its limitations in fostering stylistic interpretation suggest that a balanced approach, combining digital instruction with personalized feedback, is essential. Future research should explore hybrid models that optimize both technical and artistic development, with longitudinal studies providing deeper insights into the long-term impact of blended learning in music education.

Recommendations

Based on the study findings, the following recommendations are proposed to enhance piano education in comprehensive universities and promote interdisciplinary integration within music education.

Firstly, leveraging advanced technologies such as virtual reality (VR), artificial intelligence (AI), and online interactive platforms can facilitate deeper interdisciplinary fusion among musicology, anthropology, and psychology (Lin & Chen, 2024). VR, for example, can provide immersive cultural experiences, enabling students to engage with diverse musical traditions and performances in virtual environments. This approach enriches the curriculum by broadening students' perspectives beyond technical skills, fostering an understanding of music's psychological, cultural, and societal impacts (Rong et al., 2022).

Secondly, implementing an interdisciplinary educational model can make music education more accessible by developing well-rounded musicians who can extend aesthetic education beyond academia to the broader community. This approach encourages students to not only refine their piano performance skills but also to apply musical knowledge in real-world contexts, fostering broader public appreciation of music and aesthetics. Additionally, integrating cross-disciplinary elements such as philosophy, sociology, and digital media can enhance students' ability to contextualize music within historical and cultural frameworks,

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preparing them for diverse career pathways in the arts and education (Ho, 2010). Lastly, evaluation methods should evolve to become more comprehensive and multidimensional. Beyond traditional piano exams, incorporating online and offline performances, creativity-based assessments, and peer evaluations can provide a richer understanding of students' progress (Hebert, 2009). Performance-based assessments showcase students' technical and expressive abilities, while peer assessments foster interactive learning and reflective practices. This holistic approach enables educators to gain deeper insights into students' learning journeys, thereby improving teaching strategies and fostering more meaningful educational outcomes.

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