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The Application of Mobile Blended Learning in Piano Instruction for Non-Piano Major Students at Guangdong University of Petrochemical Technology

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Abstract

Background and Aim: The study aims to evaluate the effectiveness of mobile blended learning (MBL) based on the Chaoxing application in the context of piano performance courses, particularly in enhancing the overall performance abilities of non-piano major students. The main objective is to determine the efficacy of MBL methods utilizing the Chaoxing application in improving the piano performance of non-piano major students and to investigate the students' perceptions of the mobile blended piano learning methods.

Materials and Methods: In this study, sixty non-piano major students from the Guangdong University of Petrochemical Technology participated in an eight-week experiment of mobile blended piano learning. Using paired-sample t-tests, the student's academic performance before and after the eight weeks was evaluated in terms of piano performance accuracy, technique, integrity, expression, and difficulty. Following the assessment, all participants received a questionnaire regarding their perceptions of mobile blended piano learning.

Results: The result revealed that employing mobile blended piano learning based on the Chaoxing application significantly enhanced students' performance in piano accuracy, technique, integrity, expression, and difficulty. Additionally, quantitative analysis from a questionnaire survey using the UTAUT model revealed that students widely perceived the Chaoxing application as easy to use, conducive to improving learning efficiency and grades, and expressed a strong willingness to use MBL.

Conclusion: The findings of the study support existing research, indicating that mobile blended piano learning can significantly enhance the piano performance abilities of non-piano major students, with high acceptance among students.

Keywords: Mobile Blended Learning; Piano Performance; Utaut Model; Chaoxing Application; Non-Piano Major Student

Introduction

In recent years, the confluence of China's burgeoning economy and heightened governmental emphasis on arts education has propelled piano instruction to the forefront of educational discourse (Smith, 2020). However, traditional approaches to piano pedagogy are encountering challenges in adapting to the digital era, prompting educators to explore innovative methodologies to enhance teaching effectiveness and student engagement, particularly within university contexts (Ning & Jia, 2021). Blended learning, a pedagogical approach that seamlessly integrates digital technologies with traditional face-to-face instruction, has emerged as a promising solution to address the evolving needs of contemporary learners (Hilliard, 2015; Faustino & Kaur, 2021).

The advent of digital, internet-based, and mobile learning has revolutionized piano education, offering learners a plethora of resources and interactive platforms to enrich their learning experiences (Wang et al., 2018). Particularly noteworthy is the emergence of mobile blended learning, which integrates mobile technologies into the blended learning paradigm, thereby enhancing accessibility and flexibility for learners (Liu & Shao, 2022). The COVID-19 pandemic accelerated the adoption of mobile learning as the primary mode of piano instruction, enabling students to pursue their musical aspirations remotely (Setiawan et al., 2021). However, despite its advantages, online teaching has presented challenges, including technological barriers and limitations in fostering meaningful interaction and communication (Hepşen, 2022).

Recognizing these challenges, there has been a shift towards mobile blended learning models, which combine the strengths of traditional face-to-face instruction with the accessibility and convenience of mobile technologies. By leveraging mobile devices such as smartphones and tablets, mobile blended learning offers learners unprecedented flexibility and personalized learning experiences

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(Vera & Shpak, 2021). Moreover, mobile blended learning has the potential to enhance student engagement and motivation by providing immersive and interactive learning environments that cater to individual learning styles and preferences (Jefferson, 2021).

This study seeks to investigate the efficacy of mobile blended learning in enhancing piano performance among non-piano major students at the School of Arts, Guangdong University of Petrochemical Technology. Specifically, the research aims to assess the impact of integrating mobile technologies into blended learning approaches on student outcomes such as performance accuracy, technical proficiency, and overall musical expression. By conducting pre-test and post-test evaluations and administering the UTAUT model questionnaire to gauge student perceptions, the study aims to provide valuable insights into the effectiveness of mobile blended learning in piano education.

In conclusion, mobile blended learning represents a promising frontier in piano education, offering a dynamic and adaptive approach to instruction that capitalizes on the affordances of mobile technologies. By integrating mobile devices into blended learning environments, educators can create engaging and interactive learning experiences that empower students to achieve their musical goals. This research endeavor holds the potential to inform educational practices and contribute to the ongoing evolution of piano pedagogy in the digital age.

Objectives

1. To determine the differences between students' piano performance before and after the mobile blended learning method has been applied to non-piano major students at the School of Arts, Guangdong University of Petrochemical Technology.
2. To examine the perspectives of non-piano major students regarding the use of mobile blended learning methods in piano studying.

Literature review

In the literature review, the researcher presents a comprehensive review of the literature on the topic of this study by integrating the theoretical foundations and previous relevant research in music education and mobile blended learning fields. The second section provides specific information about the population, while the third section explores the relationship between the population and the topic. The fourth section covers the theoretical framework and previous literature. The theoretical framework of the study encompasses various relevant theories and concepts to support the design, data analysis, and conclusion derivation of the research, including constructivist theory, connectivist theory, the Unified Theory of Acceptance and Use of Technology (UTAUT), and piano performance teaching and evaluation theory. The goal of the literature review is to provide a comprehensive overview of the theories, concepts, and research findings related to the research topic, which are divided into several subsections.

Mobile blended learning theory

Blended learning, as defined by Rasheed et al. (2020), was an educational approach that merged traditional face-to-face instruction with online learning components, aimed to optimize the learning process, foster student engagement, and improve learning outcomes.

According to Güzer and Caner (2014), initially emerging in the late 1990s and early 2000s, blended learning addressed the limitations of traditional instruction by incorporating online resources to support face-to-face teaching. As technology advanced, blended learning evolved to encompass more diverse and personalized forms. This educational approach emphasized the importance of integration, flexibility, and interactivity in blended learning, laying the foundation for subsequent research in this field.

Research conducted by Bralić and Divjak (2018), Vasbieva et al. (2016), and Albiladi and Alshareef (2019) demonstrated the efficacy of blended learning in enhancing academic performance, knowledge acquisition, and student satisfaction across various educational contexts. Moreover, studies by Ramírez-Donoso et al. (2023) and Kacetl and Semradova (2020) highlighted the positive impact of blended learning on student engagement, autonomy, and collaborative learning experiences.

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As explored by Alamri et al. (2021), subsequent stages of the blended learning approach study focused on optimization, leveraging learning analytics and emerging educational models to enhance outcomes. Recent research by Phakamach and Panjarattanakorn (2024) introduced a blended learning management digital platform on Entrepreneurship and Ventures in Education, showing promising results in enhancing graduate learning experiences.

The evolution of blended learning led to the emergence of mobile blended learning (MBL), as delineated by Klímová and Pražák (2019). MBL leveraged mobile devices, such as smartphones and tablets, to deliver learning content and facilitate interactive activities, providing learners with flexible, accessible, personalized, and convenient interactive learning experiences. Mobile blended learning (MBL) extends the benefits of blended learning.

Alshurideh et al. (2019) pointed out that mobile learning platforms played a crucial role in supporting MBL initiatives, offering learners access to educational resources, communication tools, and progress-tracking features.

Evaluation studies by Klímová and Pražák (2019) demonstrated the positive impact of MBL on student learning outcomes, motivation, and satisfaction. At the same time, they emphasized the importance of systematic planning and instructional design to ensure the success of MBL initiatives. According to Ustun(2019), despite the benefits of MBL, challenges such as device compatibility and technological competency exist. Suartama et al. (2019) also point out that further research was needed to elucidate the benefits and challenges of MBL, addressing instructional design, teacher training, and course management.

As highlighted by Pan (2020) and Zhu et al. (2020), in the realm of piano instruction, blended learning gained traction in recent years, particularly accelerated by the COVID-19 pandemic. Zhao & Cleesuntorn (2022), and Yang (2023) evaluated its effectiveness using various methods, assessing outcomes such as engagement, self-directed learning, and motivation.

Notably, Yang (2023) conducted a comprehensive study on the effectiveness of a blended learning model incorporating a mobile application in piano instruction. This study investigated the impact of a blended learning model incorporating a mobile application on piano learning outcomes and satisfaction, underscoring the potential of this approach to enhance piano learning outcomes and student satisfaction.

In conclusion, the MBL approach offered promising avenues for fostering student-centered learning experiences and optimizing educational outcomes. However, in piano teaching, limited research explored the application of the MBL approach, representing a significant research gap. Future research should explore best practices, effectiveness evaluation, and instructional innovations in integrating MBL into piano teaching, exploring the nuanced challenges and opportunities presented by integrating MBL into piano education. The theory of mobile blended learning guided the teaching approach adopted in this study.

Theory of Constructivism

Constructivist theory, as expounded by Dennick (2016), posited that learning is a continuous process grounded in existing knowledge, emphasizing the active engagement of learners in constructing new understandings. Efgivia et al. (2021) further emphasized that constructivism views learning as an active process where individuals construct knowledge based on prior experiences, highlighting the significance of social interactions and the process of meaning-making.

According to Triantafyllou (2022), in educational contexts, constructivist approaches emphasize problem-solving and inquiry-based activities that enable learners to collaboratively construct knowledge in dynamic environments. Teachers played a crucial role in facilitating this process, creating learner-centered environments aimed at fostering critical thinking and experiential learning.

Alismaiel et al. (2022) applied constructivist theory to investigate the impact of social media use on collaborative learning, highlighting its positive effects on student engagement and academic performance.

In the realm of piano teaching, Guo (2017) and Acquah (2022) underscored the applicability of constructivist principles. Guo (2017) examined challenges in piano instruction within higher education institutions, proposing solutions grounded in constructivist teaching methods. Acquah (2022) explored

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approaches to enhancing keyboard skill instruction, rooted in constructivist theory principles, and highlighted the importance of active engagement, social interaction, and knowledge construction in piano instruction. By encouraging students to actively participate in the learning process and engage in collaborative activities, teachers fostered musical understanding and creative expression.

In conclusion, constructivist theory offers a valuable framework for both general education and piano instruction. By embracing constructivist principles, piano teachers could create enriching learning environments that stimulated students' curiosity and fostered their musical development. In this study, constructivist theory elucidated how students actively constructed and developed piano performance ability in piano courses through the use of mobile blended learning methods (based on the Chaoxing application).

Theory of Connectivism

Connectivism, a learning theory introduced by Siemens (2005) and Downes (2008) in the early 21st century, represented a significant shift in educational paradigms, particularly in the digital age. This theory posited that learning was not solely an individual process but was intricately connected to and influenced by the networks and resources available in the digital world.

The advent of Web 2.0 technologies, as highlighted by Hendricks (2019), brought transformative effects to learning and teaching, enabling learners to engage in activities irrespective of time or location as long as they were connected to the internet. Connectivism is built upon the learner-centered constructivist learning model, emphasizing the significance of external networks and social media platforms in the construction of new knowledge. Learning, in the connectivism perspective, extended beyond cognitive and individualistic activities to become collaborative endeavors unconstrained by traditional boundaries.

Boyraz & Ocak (2021) further elucidated that connectivism sought to elucidate learning within the digital environment, where learners formed networks with peers and digital sources such as Wikis, blogs, and data clouds. It represented a novel theory for 21st-century education, tightly intertwined with technological advancements.

Connectivism's relevance to adult learning theory was underscored by Corbett & Spinello (2020), who suggested that it aligned well with the characteristics and needs of adult learners. This perspective was supported by Connolly & Wicks (2023), whose research on part-time higher education students explored learning approaches characterized by connectivism theory. Their findings shed light on the potential impact of connectivism perspectives on the use of virtual learning platforms in contemporary educational contexts.

Kilag et al. (2023) offered empirical evidence of the efficacy of connectivism-based instruction in enhancing student learning outcomes. Through a quasi-experimental study in two private high schools in the Philippines, they demonstrated that integrating connectivism theory into blended learning environments positively impacted student engagement and learning outcomes.

In conclusion, connectivism represented a significant departure from traditional learning theories, emphasizing the interconnected nature of learning in the digital age. Connectivism theory suggests that learning is a networked process, emphasizing that learners acquire knowledge through connections and interactions. Its application extended to various educational contexts, offering valuable insights into the design and implementation of learning environments conducive to 21st-century learning. In this study, mobile blended learning facilitated a richer and more flexible learning approach for students by connecting them through network platforms and resources. Connectivism theory explains how students enhance their piano performance ability by connecting with others through resources and interactions within the Chaoxing application.

The Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT), proposed by Venkatesh et al. (2003), served as a comprehensive framework for understanding and predicting individuals' acceptance and usage behavior toward new technologies. It amalgamated and extended various established technology acceptance models, including the Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), and Innovation Diffusion Theory (IDT).

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According to Venkatesh et al. (2003), the UTAUT model identified four critical factors influencing the decision to adopt and utilize new technology: perceived usefulness, perceived ease of use, facilitating conditions, and behavioral intention. Additionally, the demographic profile, encompassing attributes like age, gender, and experience, was considered integral to understanding the research sample's composition and characteristics.

Further refinement and expansion of the UTAUT model by scholars such as Simeonova (2014) and Sarfaraz (2017) led to the inclusion of five core variables:

Performance Expectancy: This variable assessed the extent to which individuals anticipated that using the new technology would enhance their performance and efficiency.

Effort Expectancy: It evaluated individuals' expectations regarding the ease or difficulty of using the new technology.

Social Influence: This factor gauged the perceived influence of others' attitudes and expectations on individuals' decision to adopt the new technology.

Facilitating Conditions: It measures individuals' perception of the availability of resources and support when using the new technology.

Behavioral Intention: This variable reflected individuals' willingness and determination to use the new technology.

The UTAUT model found widespread application in research concerning technology acceptance and usage, including educational technology. Through the quantification and analysis of these variables, researchers could assess the likelihood and determinants of individuals' adoption and utilization of new technology in various contexts (Simeonova, 2014; Sarfaraz, 2017).

In conclusion, the UTAUT theory was utilized to elucidate individuals' behavior toward adopting new technologies. The UTAUT model provided a robust framework for comprehending the complexities of technology acceptance and usage behaviors. Its incorporation of demographic factors and core variables offered valuable insights for researchers and practitioners seeking to facilitate the successful integration of new technologies in diverse settings. In this study, the UTAUT model was employed to quantitatively analyze students' acceptance levels and willingness to use the Chaoxing application, aiming to comprehend students' attitudes and acceptance toward mobile blended learning methods.

Piano Performance Evaluation

Mi (2018) and Yuan (2016) underscored the pivotal role of piano performance evaluation in evaluating pianists' technical proficiency and musical expression, providing valuable insights into their progress and development. This evaluation encompassed diverse aspects, including technical requirements, artistic expression, and overall musical understanding.

As proposed by Morijiri & Welch (2022) and Hunt & Snook (2016), common evaluation methods in piano performance assessment included performance recording and observational assessments. Performance recording facilitated the playback and evaluation of students' performances, while observational assessments entailed direct observation of their performances and techniques.

To ensure standardized and equitable evaluation, Wesolowski (2012) emphasized the use of evaluation rubrics and scoring sheets, providing clear criteria for assessing students' progress and mastery. These rubrics encompassed various indicators such as technical accuracy, musical expression, timbre control, and artistic perception.

Critical components of piano performance evaluation, as outlined by Li (1994) and Zhang (2009), included five variables: Performance Accuracy, Technical Skills, Music Integrity, Artistic Expression, and Work Difficulty. Performance Accuracy entailed the precision of pitch, rhythm, and expression, while Technical Skills encompassed the speed, strength, and sensitivity of finger movements. Music Integrity focused on conveying music as a complete artistic form, emphasizing fluency and coherence in performance. Artistic Expression involves infusing musical works with emotions and personal style, showcasing interpretation and understanding of musical content. Work Difficulty refers to the technical and artistic challenges presented by the performed musical pieces.

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These variables were crucial for evaluating students' performance level and musical expression in piano examinations, as emphasized by Álvarez-Díaz et al. (2021) and Hunt & Snook (2016). They provided comprehensive guidelines for assessing students' technical skills, intonation, tone quality, expressiveness, and stage performance.

In summary, piano performance evaluation significantly contributed to nurturing students' musical development and proficiency. By employing standardized evaluation methods and considering essential variables, educators could effectively assess students' progress and guide their improvement in piano education. In this study, guided by theories of piano performance evaluation, researchers designed a quasi-experimental study using paired-sample t-tests to compare the differences in piano performance before and after the implementation of mobile blended learning conditions among non-piano major students. Piano performance grading criteria served as the measurement tool for assessing piano performance scores. Based on its five variables, the researcher formulated five hypotheses aimed at determining the effectiveness of the mobile blended learning method used in this study in enhancing piano performance ability among non-piano major students.

Synthesizing the above theories, the objective of this study was to assess the effectiveness of mobile blended learning methods based on the Chaoxing application in enhancing piano performance skills among non-piano major students and to investigate students' perception and acceptance of this method. These theoretical frameworks provided theoretical support for the study, aiding researchers in better experiment design, data analysis, and conclusion drawing, thus revealing the potential advantages of mobile blended learning in improving student academic performance and attitudes.

Conceptual Framework

In this section, the researchers aimed to provide an overview of the variables and their interrelationships that affect student performance. The research examined the impact of a mobile blended learning approach based on the Chaoxing application on the academic performance of non-piano major students in piano courses, as well as students' perceptions of this learning method.

The mobile blended learning approach is crucial for enhancing the piano performance abilities of non-piano major students. This study employs a quasi-experimental design to assess the influence of the mobile blended learning approach based on the Chaoxing application on students' piano performance, including five dimensions: accuracy, technicality, completeness, expressiveness, and difficulty.

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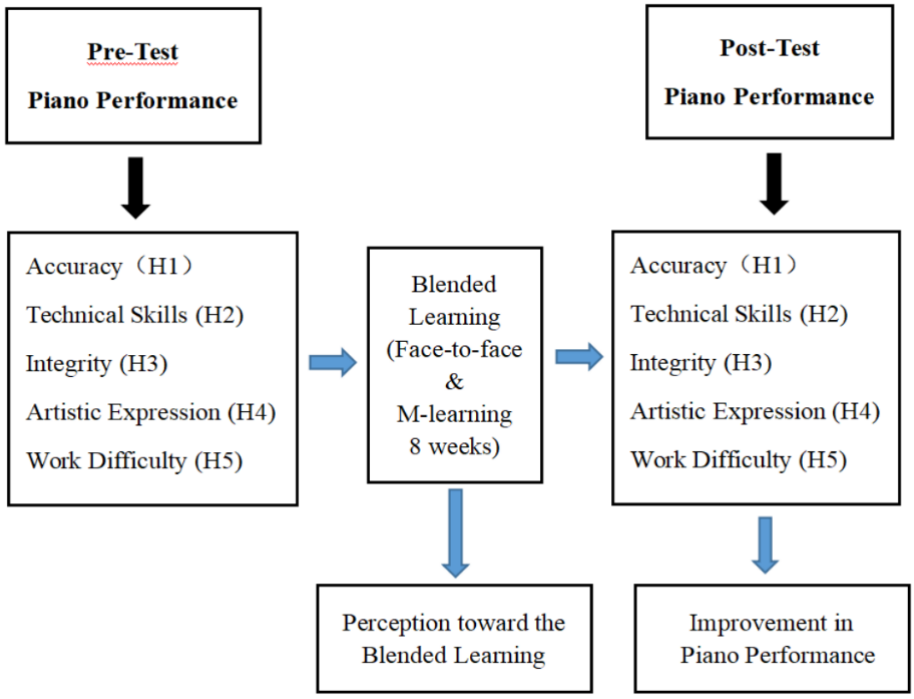

Figure 1 The framework of the effectiveness of the mobile blended learning approach for improving the piano performance

Hypotheses

Based on the literature review, and the conceptual framework, the hypotheses have been developed as follows.

H_a1: There is a difference in the accuracy of piano performance before and after students learn piano using the MBL approach.

H_a2: There is a difference in the technical skills of piano performance before and after students learn piano using the MBL approach.

H_a3: There is a difference in the musical integrity of piano performance before and after students learn piano using the MBL approach.

H_a4: There is a difference in the artistic expression of piano performance before and after students using the MBL approach.

H_a5: There is a difference in the work difficulty of piano performance before and after students use the MBL approach.

Methodology

This study adopts a quasi-experimental quantitative research method to measure whether non-piano major students at the Art College of Guangdong University of Petrochemical Technology can improve their piano performance level through the designated mobile blended learning approach. The quasi-experiment uses pretest and posttest methods to investigate piano performance ability.

The quasi-experiment selects a total of 60 non-piano major students from the Art College of Guangdong University of Petrochemical Technology. None of the participants have previously participated in similar experiments. Before the experiment, participants undergo on-site piano tests evaluated by three piano teachers from the Art College of Guangdong University of Petrochemical Technology, utilizing the "Evaluation Criteria for Piano Performance Courses at the Art College of Guangdong University of Petrochemical Technology." These criteria encompass five variables: accuracy, technique, completeness, musicality, and level of difficulty of the piece, each scored out of 20 points for a total score out of 100.

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The 60 students engage in an 8-week blended learning approach following a predetermined curriculum plan. Upon completion of the experiment, all students undergo a post-test, mirroring the format of the pretest.

To ensure data accuracy, participating students must meet specific criteria, including prior training on the mobile blended learning approach and abstaining from alternative learning methods during the study period.

Following the post-test, all participants received a questionnaire regarding their perceptions of mobile blended piano learning.

The survey procedure involves distributing questionnaires to participants using the Wen Juan Xing online survey platform. Clear instructions accompany the questionnaire, emphasizing the importance of accurate and honest responses. Reminders and follow-up communication are implemented to maximize the response rate, and a specific data collection deadline is set.

Inferential statistics, such as paired samples t-tests, are utilized to analyze the collected data from quasi-experimental to determine the differences between students' piano performance before and after the mobile blended learning method has been applied for non-piano major students. The hypotheses testing focused on variables including accuracy, technique, musicality, and repertoire difficulty.

Descriptive statistics was used for the analysis of questionnaire data and employed to provide an overall summary of the questionnaire data.

In summary, the research methodology provided a practicable instructional intervention to examine the effect of mobile blended piano learning on improving the piano performance ability of non-piano major students. The process integrated ethical considerations, validity and reliability, and appropriate statistical analysis to ensure a complete research process.

Results

This research provides a comprehensive analysis of the research findings, including detailed inferential statistics and hypothesis testing. The focus is on determining whether the mobile blended piano learning method has an impact on students' piano performance compared to traditional learning methods. These components elucidate the analytical methods used to derive significant insights from the dataset and clearly explain the quantitative attributes under study. Together, these components form the foundation of the comprehensive analysis of the research results.

Inferential Statistics: Hypothesis Testing

In this study, hypothesis testing is crucial as researchers attempt to measure whether non-piano-major students can improve their piano performance levels through specified mobile blended learning methods, particularly in enhancing overall performance skills. This evaluation aims to analyze the effectiveness of mobile blended learning within the context of piano performance courses.

Hypothesis Testing

In this subsection, the objective is to determine how effective the mobile blended learning (MLB) approach is in improving the comprehensive performance of non-piano major students at the School of Arts, Guangdong University of Petrochemical Technology. The researcher considered the impact of using the MBL approach in piano instruction on variables related to performance accuracy, technical skills, music integrity, artistic expression, and work difficulty. The researcher used a paired T-test to analyze the scores pre-test and post-test.

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Table 1 *Paired sample T-test of the Average Pre-test Scores and Post-test Scores of Accuracy*

	Paired Differences					t	df	Sig. (2-tailed)
	Mean differences	SD	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 Pre-test Accuracy - Post-test Accuracy	-1.513	1.836	.237	-1.988	-1.039	-6.386	59	.000

The t-test results showed that there was a statistically significant difference between pre-test and post-test scores on the Accuracy; t (59) = -6.386, p =.000. Therefore, the null hypothesis is rejected.

Table 2 *Paired sample T-test of the Average Pre-test Scores and Post-test Scores of Technique*

	Paired Differences					t	df	Sig. (2-tailed)
	Mean differences	SD	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 Pre-test Technique - Post-test Technique	-3.037	1.746	.225	-3.488	-2.586	-13.471	59	.000

The t-test results showed that there was a statistically significant difference between pre-test and post-test scores on Technique; t (59) = -13.471, p =.000. Therefore, the null hypothesis is rejected.

Table 3 *Paired sample T-test of the Average Pre-test Scores and Post-test Scores of Integrity*

	Paired Differences					t	df	Sig. (2-tailed)
	Mean differences	SD	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 Pre-test Integrity - Post-test Integrity	3.443	2.070	.267	-3.987	-2.909	-12.887	59	.000

The t-test results showed that there was a statistically significant difference between pre-test and post-test scores on Integrity; t (59) = -12.887, p =.000. Therefore, the null hypothesis is rejected.

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Table 4 *Paired sample T-test of the Average Pre-test Scores and Post-test Scores of Expression*

	Paired Differences					t	df	Sig. (2-tailed)
	Mean differences	SD	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 Pre-test Expression - Post-test Expression	-4.123	2.002	.258	-4.640	-3.606	-15.956	59	.000

The t-test results showed that there was a statistically significant difference between pre-test and post-test scores on Expression; t (59) = -15.956, p =.000. Therefore, the null hypothesis is rejected.

Table 5 *Paired sample T-test of the Average Pre-test Scores and Post-test Scores of Difficulty*

	Paired Differences					t	df	Sig. (2-tailed)
	Mean differences	SD	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 Pre-test Difficulty - Post-test Difficulty	-2.410	1.160	.150	-2.710	-2.110	-16.093	59	.000

The t-test results showed that there was a statistically significant difference between pre-test and post-test scores on Difficulty; t (59) = -16.093, p =.000. Therefore, the null hypothesis is rejected.

Table 6 *Summary of Hypothesis testing and results*

Hypotheses	**Statement**	**p-Value**	**Result**
$H_0$1	There is no difference in the accuracy of piano performance before and after students learn piano using the MBL approach.	p =.000	Rejected
$H_0$2	There is no difference in the technical skills of piano performance before and after students learn piano using the MBL approach.	p =.000	Rejected
$H_0$3	There is no difference in the musical integrity of piano performance before and after students learn piano using the MBL approach.	p =.000	Rejected
H_{04}	There is no difference in the artistic expression of piano performance before and after students using the MBL approach.	p =.000	Rejected
H_{05}	H0There is no difference in the work difficulty of piano performance before and after students use the MBL approach.	p =.000	Rejected

The above-paired t-test results showed that the post-test means of mobile blended learning were higher than the pre-test means in the accuracy, technique, musicality, and repertoire difficulty of the piano performance course, and the significance level of each indicator is less than 0.05. Therefore, the null hypotheses are rejected. The mobile blended learning approach with the Chaoxing application is an effective teaching method to improve students' piano performance.

Students' perceptions of mobile blended piano learning

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The researchers investigated non-piano major students' perceptions of mobile blended piano learning through questionnaires. The Unified Theory of Acceptance and Use of Technology (UTAUT) model was used to conduct a quantitative analysis of student's performance expectations, effort expectations, social influence, facilitating conditions, and behavioral intentions when using Chaoxing applications, evaluating the likelihood and influencing factors of students continuing to adopt and use mobile blended learning technologies in piano learning.

The results of the study showed that the 60 participating students' perceptions of the performance expectations of the technology Chaoxing application used in mobile blended learning, with an overall mean of 4.32， it is highly affirmed that using the Chaoxing application in piano learning can improve the performance and efficiency. For effort expectations of using the Chaoxing application, the mean value was 4.33, they unanimously believe that the Chaoxing application is easy to use. For perceptions about the social influence of using the Chaoxing application, the mean value was 4.29， they all agreed that others (classmates, teachers, universities, people who can influence them) have a great influence on their attitudes and expectations about using Chaoxing applications in piano lessons. For perceptions about facilitating conditions of using the Chaoxing application, the mean value was 4.31, they strongly agreed that using the Chaoxing application for piano learning can ensure the availability of external environmental conditions, resources, and technical support (average score of 4.31). The average mean score of the behavioral intention of students to use the Chaoxing application for mobile blended piano learning was 4.36， it can be concluded that students have a strong behavioral intention to adopt the Chaoxing application for mobile blended piano learning.

Table 7 *Summary of the Mean Values Regarding the Perceptions*

	Variables	Mean	Standard Deviation	Interpretation
1	Performance Expectations	4.32	.509	Strongly Agree
2	Effort Expectations	4.33	.516	Strongly Agree
3	Social Influence	4.29	.481	Strongly Agree
4	Facilitating Conditions	4.31	.524	Strongly Agree
5	Behavioral Intentions	4.36	.533	Strongly Agree

Conclusion

The existing research content provides convincing evidence that the research results of the quasi-experimental quantitative study indicate a significant improvement in piano performance among students using mobile blended learning. Following this method, there were statistically significant differences between pre-test and post-test academic scores ($p < 0.05$), suggesting the method's significant statistical significance in enhancing piano performance among non-piano major students. Specifically, students made significant progress in accuracy, technique, integrity, expression, and difficulty. Further data analysis reveals that after adopting the Chaoxing application for mobile blended learning, the five basic variables of accuracy, technique, integrity, expression, and difficulty in piano comprehensive performance among non-piano major students significantly improved, compared to traditional learning methods, exhibiting marked enhancements.

Additionally, through a questionnaire survey, it was evident that students had a high acceptance of mobile blended learning methods. In the quantitative analysis using the Unified Theory of Acceptance and Use of Technology (UTAUT) model, students demonstrated strong agreement regarding their performance expectations, effort expectations, social influence, facilitating conditions, and behavioral intentions in using the Chaoxing application. The average analysis results show mean values of 4.32, 4.33, 4.29, 4.31, and 4.36 for students' performance expectations, effort expectations, social influence, facilitating conditions, and behavioral intentions, respectively. They generally perceived mobile applications as easy to use and believed they could improve learning efficiency and performance. Furthermore, students perceived the attitudes and expectations of their surroundings as significantly influential in their adoption of mobile blended learning. These results indicate students'

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strong willingness to continue using mobile blended learning and are likely to continue using this technology in future learning endeavors.

In conclusion, the research findings suggest that mobile blended learning methods have a significant effect on improving piano performance among non-piano major students. Students also demonstrated positive attitudes and intentions toward this learning method.

Discussion

The purpose of this quasi-experimental quantitative study is to examine the effectiveness of mobile blended learning in piano performance, based on the integration of the Chaoxing application with traditional teaching methods. Through pre-test and post-test experiments, the research results indicate a significant improvement in piano performance among non-piano major students in the mobile blended learning environment. This improvement encompasses aspects such as accuracy, technicality, integrity, expression, and difficulty. Such findings underscore the potential advantages of mobile blended learning in music education, providing students with a richer and more flexible learning approach, consequently enhancing their learning outcomes.

The researchers surveyed to investigate the perception of non-piano major students regarding mobile blended learning in piano performance. Using the Unified Theory of Acceptance and Use of Technology (UTAUT) model, they quantitatively analyzed students' performance expectations, effort expectations, social influence, facilitating conditions, and behavioral intentions when using the Chaoxing application. The findings indicate a high level of acceptance among students towards mobile blended learning, with a widespread belief in the ease of use of mobile applications and their potential to enhance learning efficiency and performance. Furthermore, students acknowledge the significant influence of their surrounding environment on their adoption of mobile blended learning, highlighting the importance of social support in shaping student learning behavior. These factors collectively contribute to students' acceptance and active adoption of mobile blended learning, leading to improved learning experiences and outcomes. Lastly, the quantitative analysis of behavioral intentions reveals a strong inclination among students to continue using the Chaoxing application for mobile blended piano learning, indicating their willingness to persist with this learning approach and the likelihood of sustained use of this technology in future learning endeavors.

Therefore, further exploration and implementation of mobile blended learning in the field of education is necessary. It is recommended to apply these research findings to practical teaching. Additionally, future research could further expand sample sizes, conduct long-term tracking studies, and delve deeper into the application effects and influencing factors of mobile blended learning in different disciplinary fields.

Recommendations

Implementation of Findings in Diverse Educational Settings

To maximize the practical application of the identified effective mobile blended learning methods in this research, it is crucial to integrate them into piano performance courses across various educational institutions. By implementing the research findings into real-world teaching scenarios, we can unlock the full potential of the study, fostering advancements in teaching methodologies, resource development, and educator proficiency in mobile blended piano instruction. This application of research outcomes will not only enhance the efficacy and quality of piano education but also enrich students' learning experiences and growth prospects.

Longitudinal Studies and Diversification of Sample Groups

Given the time constraints of the current study and its focus on a specific student demographic, it is recommended to conduct longitudinal investigations to observe the sustained effects of mobile blended learning over time. Additionally, future research should aim to diversify the sample groups by including students from various educational backgrounds, institutions, and academic disciplines. By expanding the participant pool, we can enhance the representativeness and generalizability of the

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research findings, providing a more comprehensive understanding of the long-term impact of mobile blended learning across different student populations.

Comprehensive and Detailed Research Exploration

Future studies in similar domains should pursue more comprehensive and in-depth analyses. This entails:

Delving into the intricacies of the learning process: Conducting thorough examinations of students' learning behaviors and strategies within mobile blended learning environments to discern their influence on learning outcomes and offer tailored pedagogical recommendations.

Exploring alternative mobile applications: Experiment with a variety of mobile applications or platforms for blended learning and compare their effects on student performance and engagement, as well as evaluate the strengths and limitations of each application.

Considering instructional design factors: Investigating the role of instructional design and implementation in mobile blended learning settings, exploring how teaching strategies impact student learning outcomes, and providing educators with more effective instructional guidance.

Exploring interdisciplinary applications: Extending the application of mobile blended learning methodologies to other academic disciplines, examining their adaptability and effectiveness in diverse educational contexts, and broadening the scope of research inquiries.

By embracing these recommendations, future research endeavors can comprehensively explore the application effects and influencing factors of mobile blended learning in piano education, thereby offering valuable insights and practical guidance for educational practitioners and policymakers.

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