Journal of Contemporary Educational Research, 2025, Volume 9, Issue 4
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

Analysis of the Construction of Teacher-Student Interaction Mode in Piano Teaching in Normal Universities

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Abstract: In the modern higher education music curriculum system, the teacher-student interaction mode is a key factor affecting the effectiveness of piano teaching. However, the current teacher-student interaction mode in piano teaching still has limitations, such as one-way transmission and a lack of personalized feedback. Based on constructivist learning theory and social interaction theory, combined with information technology, this paper explores the optimization strategy of interaction mode in the piano teaching process of normal universities. This study adopts classroom observation and interview methods to analyze the impact of different interaction modes on students' piano learning effectiveness, learning engagement, and autonomous learning ability. The research results show that the constructivist interactive teaching mode supported by information technology can significantly enhance students' interest in learning and playing skills, optimize the classroom teaching atmosphere, and promote the improvement of their comprehensive literacy.

Keywords: Piano teaching; Interactive teaching mode; Constructivism; Information technology; Autonomous learning

Online publication: April 28, 2025

1. Introduction

With the continuous advancement of education system reform in China, piano teaching has become an important component of higher education and basic education systems. In recent years, more and more primary and secondary schools have incorporated piano teaching into the scope of quality education, while in higher education institutions, piano courses have gradually developed towards diversification, systematization, and innovation. At the same time, as society's emphasis on artistic literacy education continues to increase, people's demand for piano learning has shown a diversified and personalized trend. However, the traditional piano teaching mode still has certain limitations in teaching philosophy, teaching content, and teacher-student interaction mode, which makes it difficult to fully meet the current needs of learners at different levels and restricts the cultivation of piano education talents.

The traditional piano teaching mode usually adopts the method of one-way transmission by teachers, and students mainly play the role of passive recipients in the classroom. Although this mode ensures the systematicity and rigor of the teaching content to a certain extent, it also has obvious limitations, such as the lack of personalized feedback and limited teacher-student interaction, which restricts students' interest in learning and autonomous learning ability. In addition, in the context of the rapid development of the information society, modern teaching methods are becoming increasingly diversified, and piano teaching urgently needs to explore more efficient and interactive teaching modes to adapt to the current development needs of society and education.

With the rapid development of education informatization, modern piano teaching can rely on various information technologies, such as intelligent interactive systems, online teaching platforms, and virtual reality technology, to promote the innovation of teaching modes and make the learning process more flexible and efficient. The one-way transmission method in the traditional teaching mode is difficult to meet the growing personalized learning needs of students, while the interactive teaching mode emphasizes active communication between teachers and students, enhancing teaching effectiveness through various methods such as guidance, discussion, and practice.

In the process of piano teaching reform, it is crucial to construct a more interactive teacher-student learning mode. For example, by using situational teaching, cooperative learning, inquiry-based teaching, and other methods, teachers can stimulate students' interest in learning, improve the quality of teaching interaction, and enable students to master piano playing skills through participation, experience, and practice. At the same time, teachers should strengthen the observation and analysis of students' learning processes, providing timely and targeted guidance and feedback to improve students' learning effectiveness.

In addition, the interaction between teachers and students not only affects students' learning experiences but also directly relates to the cultivation of their music comprehension ability, creativity, and autonomous learning ability. By constructing an innovative teacher-student interaction mode, teachers can strengthen communication with students during the teaching process, timely understand their learning needs and difficulties, and provide targeted guidance and feedback. This not only helps to enhance the activity of classroom teaching but also enhances students' learning motivation, making them feel more engaged and belonging.

This study aims to explore how to optimize the teacher-student interaction mode in piano teaching based on constructivist learning theory and social interaction theory. Constructivism believes that learning is a process of students actively constructing knowledge, while social interaction theory emphasizes the promotion of learning effects through interactions between learners and their environment, teachers, and peers. Therefore, in the process of piano teaching, innovating the interaction mode can enhance students' interest in learning, strengthen their autonomous learning ability, and optimize classroom teaching effects.

2. Theoretical basis

2.1. Constructivist learning theory

Constructivist learning theory posits that knowledge acquisition occurs when learners engage in autonomous exploration, social interaction, and meaning construction within specific contexts [1]. Jean Piaget proposed that learning is a process where individuals continuously adjust their cognitive structures through assimilation and accommodation [2]. Assimilation refers to the process where learners filter or alter incoming stimuli, integrating them into existing schemas in their minds. Accommodation, on the other hand, involves learners adjusting their

internal structures to adapt to specific stimuli. When learners encounter new stimuli that cannot be assimilated into existing schemas, they modify or rebuild those schemas to adapt to the environment. The core of constructivism is student-centeredness, emphasizing students' active exploration, discovery of knowledge, and construction of meaning, rather than the traditional transmission of knowledge from the teacher's mind to the student's notebook. In piano teaching, constructivism underscores the importance of teachers creating authentic musical learning environments that guide students to construct their understanding of musical works through practice and reflection, rather than relying solely on teacher instruction.

Furthermore, the constructivist learning environment emphasizes four key elements [3]: context, collaboration, conversation, and meaning construction. Specifically, "context" requires that learning tasks should be close to students' practical experiences, such as providing performance demonstrations and musical context simulations in piano teaching. "Collaboration" emphasizes students deepening their understanding through interactive methods like cooperative playing and ensemble training. "Conversation" highlights the exchange of knowledge between teachers and students, as well as among students. "Meaning construction" refers to students forming a deep understanding of musical knowledge through performance, reflection, and feedback. Therefore, in piano teaching, teachers should encourage students' autonomous exploration and optimize teaching effectiveness through interactive learning.

2.2. Social interaction theory

Social interaction theory, a core component of social constructivism proposed by Lev Vygotsky [4], emphasizes that knowledge is not constructed individually but rather acquired gradually through language, culture, and collaboration in the process of social interaction [5]. Vygotsky's theory of the "Zone of Proximal Development" (ZPD) suggests that children have two levels of development: actual and potential. The actual level represents the child's ability to solve problems independently, while the potential level reflects the child's capacity to solve problems under the guidance of knowledgeable adults (teachers, parents) or when collaborating with more capable peers. The gap between these two levels constitutes the ZPD [6]. In piano teaching, this theory is primarily applied through the strategy of "scaffolding," where teachers provide a conceptual framework to support learners' understanding of knowledge. This framework breaks down complex learning tasks, facilitating a gradual deepening of learners' understanding through methods like demonstration performances, step-by-step guidance, and feedback.

Additionally, social interaction theory posits that the learning process involves the mutual transformation of subjective and objective knowledge [7]. In piano teaching, students' performance skills and musical understanding are continuously refined through interactions with teachers and peers. For instance, teacher-student interactions can help students externalize their personal musical understanding and optimize their cognitive structures through discussion, demonstration, and correction. Simultaneously, students revise and internalize knowledge through social feedback in contexts like ensemble playing, teacher-student dialogue, and stage performances, gradually forming stable cognitive patterns. Therefore, in piano teaching, teachers should foster interactive communication and create a cooperative learning atmosphere to promote higher-level musical understanding and skill development among students.

2.3. Application of information technology in music education

With the advancement of information technology, emerging teaching modes such as multimedia teaching, AI-assisted practice, and online interactive platforms have been gradually introduced into the field of music

education [8]. Both constructivism and social interaction theory emphasize learners' knowledge construction in dynamic and social environments, and information technology provides diversified interactive learning platforms. For example, smart piano applications like Simply Piano and Flowkey can offer real-time feedback to help students judge pitch and rhythm accuracy. Online teaching platforms like Zoom and Moodle enable remote teacher-student interactions, breaking through time and space limitations in teaching. By integrating constructivism, social interaction theory, and information technology, piano teaching can establish more personalized and interactive learning models, thereby enhancing learning effectiveness.

3. Methodological framework

3.1. Research design and participants

This study employed a mixed-methods approach, primarily utilizing classroom observation and interviews as the data collection techniques to explore the effectiveness of different interaction modes in piano instruction at higher education institutions [9]. The research focuses on students' classroom engagement, learning experiences, and teachers' feedback under various teaching models to optimize interactive patterns in piano education.

The study selects non-piano major students from the first and second years of the musicology department in a higher education institution as the research subjects. Participants must meet the following criteria: (1) Never studied piano or only have a basic foundation (such as mastering simple five-finger exercises); (2) Have not received systematic piano course training to ensure that the experimental results are not significantly influenced by existing skill levels.

A total of four students are recruited for this study and randomly divided into two groups. Each group consists of two members, and different teaching modes are adopted for comparative research. Group A follows the traditional one-on-one teaching model, where the teacher instructs each student separately. Group B participates in small group classes, where the teacher provides a diversified interactive learning platform based on constructivist and social interaction theories. Students engage in flipped classroom practices within their small groups and use smart piano applications for practice and feedback on note and rhythm accuracy after class.

3.2. Research methods

This study primarily adopts classroom observation and interview methods, combined with qualitative content analysis for data analysis, to evaluate the impact of different interaction modes on students' learning outcomes. (1) Classroom observation is used to record students' engagement, interaction, and teacher feedback under the two teaching modes. Observation includes: students' classroom participation (actively answering questions, participating in discussions, practice time investment), students' immediate feedback (question-asking, learning interest, emotional expression), and teachers' teaching strategies (lecturing methods, interaction forms, feedback approaches). A non-intrusive observation approach is employed using observation record sheets to document the entire class session. (2) Interviews are conducted to deeply explore teachers' and students' experiences and feedback on different interaction modes. Interview participants include piano teachers, focusing on teaching methods, student interaction, and the feasibility of AI technology, and students, understanding their learning experiences, difficulties, and suggestions under different teaching modes. Interview questions include: How do you view the impact of classroom interaction on piano learning? How do you think the feedback from the smart practice system helps your learning? Which classroom mode do you prefer and why? All interviews are recorded, transcribed into text, and analyzed for subsequent content analysis.

3.3. Research process

This four-week study compares the teaching effectiveness of small-group smart practice classes with the traditional one-on-one teaching model.

The research steps are as follows: Firstly, researchers conduct a pre-test to record students' basic piano proficiency levels. Group A students receive traditional one-on-one instruction, while Group B students utilize the small-group smart practice system. Weekly classroom observations are conducted to document the teaching effectiveness of different interaction modes. After the study, interviews are held to gather feedback from teachers and students. The research is then analyzed, and findings are summarized to propose suggestions for teaching optimization.

3.4. Data collection

Data sources for this study include classroom observation records, where observation notes are organized after each class to analyze student interaction, and interview transcripts, where key themes are summarized from teacher and student interviews.

4. Research results

4.1. Differences in student classroom participation

Group A (traditional one-on-one teaching model) exhibits lower classroom participation, with students primarily following teacher instructions and lacking autonomous learning and interaction. The teacher employs a step-by-step approach, breaking down and demonstrating elements such as the piece's background, rhythm, melody, and musical theory. However, due to the students' heavy reliance on teacher guidance, classroom interaction remains one-way, resulting in a mechanized learning process. Although students complete piano compositions after four weeks, the overall learning experience is passive. Classroom observations reveal both teachers and students feeling fatigued, and teachers express dissatisfaction with students' progress, believing learning outcomes can be further optimized.

In contrast, Group B (small group classes + smart practice system) demonstrates significantly higher classroom participation, with students showing strong autonomy and enthusiasm during the learning process. Utilizing constructivist and social interaction teaching strategies, the teacher guides students through group discussions, brainstorming sessions [10], alternating performances, and peer evaluations, enabling mutual learning. Additionally, students engage in independent practice using smart piano applications after class, quickly checking for wrong notes and adjusting their performances through system feedback, enhancing learning efficiency. Observations indicate that not only do Group B students complete piano compositions within four weeks, but the learning process is also relaxed and efficient, fostering a positive overall classroom atmosphere.

4.2. Feedback on student learning experience

In interviews, students in Group A generally found it difficult to recognize musical notation. Although they spent a lot of time practicing and ultimately completed the piano pieces, most students indicated that they would not continue piano practice in the future if it were not a course requirement. Additionally, students felt accustomed to the teacher-led interactive model, believing that this teaching method aligned with their previous learning experiences. However, some students expressed that the course progress was exhausting, and they lacked motivation for independent learning. Teachers also pointed out in interviews that they hoped to improve

the interactive model, encouraging students to participate more actively in learning rather than relying entirely on teacher instruction.

In contrast, Group B students gave high praise to the classroom interaction model, stating that group collaboration and the mutual evaluation mechanism helped them not only learn how to play the piano but also understand potential issues others might encounter from different perspectives. Students indicated that the group model made them more engaged in class, allowing them to constantly adjust their learning strategies through interaction. Furthermore, the instant feedback from the intelligent piano application enabled students to quickly identify errors during after-class practice, improving learning efficiency. Teachers were also satisfied with Group B's classroom performance, believing that students demonstrated higher learning interest and autonomy, resulting in a positive and energetic classroom atmosphere.

4.3. Teacher evaluation of teaching models

Teachers' evaluation of the traditional teaching model in Group A was conservative. They believed that although individualized guidance was meticulous, classroom efficiency was low, teacher energy input was high, and students were passive in the learning process, lacking motivation.

Regarding the combined model of group classroom and intelligent practice system in Group B, teachers noted a significant improvement in student autonomy and interaction, leading to a more vibrant classroom atmosphere. However, teachers also pointed out that while group learning encouraged autonomy, it still required appropriate guidance, as some students might reduce the quality of their practice due to inadequate self-management skills. Therefore, teachers suggested optimizing teacher guidance methods in future curriculum design, combining group collaboration with individualized instruction to enhance overall teaching effectiveness.

4.4. Classroom observation summary

Based on classroom observations and interview analysis, this study found that students in Group A (one-on-one traditional teaching) had lower classroom participation, relying mainly on teacher explanations. The learning process was mechanical, passively accepting teaching content. Although they completed the piano pieces, they lacked learning motivation. Students in Group B (group interaction + intelligent practice) had high classroom participation. With the assistance of group collaboration and the intelligent system, their learning experience was more positive, they had stronger autonomy, and they could quickly adapt to learning tasks while maintaining high practice interest.

Interview results indicated that while Group A students adapted to the traditional teaching model in class, they lacked interaction during the learning process and felt pressured during practice. Group B students were more willing to improve their learning effects through group discussions and mutual evaluations, believing that feedback from the intelligent system helped improve practice efficiency.

Teacher feedback showed that the interactive model in Group B helped cultivate students' independent learning abilities, while teaching in Group A was more demanding, and the learning experience for both teachers and students was relatively exhausting.

The application of the intelligent practice system helped improve students' practice efficiency, allowing them to quickly identify and correct playing errors, enhancing learning outcomes.

Teachers invested a lot of energy in the traditional one-on-one teaching model, while the flipped classroom model could reduce teachers' burdens and enhance students' independent learning abilities. However, it should be noted that some students still required appropriate teacher guidance during independent learning to ensure

the accuracy of their practice direction.

The results of this study indicate that introducing group interaction models and intelligent practice tools in piano teaching at higher education institutions can effectively improve students' classroom participation and learning experience.

5. Conclusion and insights

5.1. Theoretical interpretation and literature comparison of research findings

This study found that the group interaction model (Group B) significantly improved students' classroom participation and learning enthusiasm, which is consistent with the core viewpoint of social constructivism. Saleem *et al.* [11] pointed out that social constructivism emphasizes students' learning through collaboration, discussion, and knowledge exchange, rather than passively accepting knowledge from teachers. This theory believes that learners construct their own understanding through interaction with others [11]. In this study, students in Group B solved problems together under teacher guidance through group collaboration and mutual evaluation, and their learning effects were significantly better than those in the traditional one-on-one teaching model (Group A). This result supports social constructivism's viewpoint on interactive learning, which suggests that students can deepen their understanding of learning content and enhance their learning motivation in a collaborative environment.

Furthermore, Saleem *et al.* [11] emphasized that teachers play the role of guides in social constructivist classrooms, rather than unidirectional knowledge transmitters. Teacher interviews in this study also reflected this point—teachers in Group B's classrooms adopted more heuristic teaching strategies, guiding students to independently discover and solve problems, and conduct self-monitoring and feedback through intelligent piano applications. This teaching method improved students' independent learning abilities and made the classroom more lively and interesting.

Similarly, a research found that cooperative learning and personalized teaching strategies can effectively improve students' piano skills and practice habits in collective piano classrooms in the context of preschool education. Based on Vygotsky's sociocultural theory and Gardner's theory of multiple intelligences, this study emphasizes the positive impact of collective learning environments on music education [12]. The classroom design of Group B in this study drew on this theoretical framework, adopting a combination of group collaboration and teacher guidance to encourage students to evaluate, discuss, and reflect on each other's performance. This model not only enhanced learning interest but also enabled students to more actively construct musical knowledge under the guidance of teachers. This indicates that the collective interaction model can effectively promote learning effects in piano teaching, especially with the assistance of intelligent piano technology.

5.2. Practical significance of the research

By comparing the effects of different interaction models on students' learning outcomes, this study demonstrates that the group interaction model (Group B) has significant advantages in enhancing learning interest, classroom participation, and knowledge construction. The research results not only enrich the study of interactive teaching in the field of music education but also provide practical references for piano classroom teaching in higher education. Especially in higher normal universities, piano teaching is not only an important component of music education but also bears the core mission of cultivating future music teachers. Therefore, optimizing classroom interaction models is crucial for enhancing the teaching abilities of future teachers.

Additionally, the study found that the intelligent piano application played a positive role in Group B's classroom, helping students correct errors in a timely manner and improve practice efficiency [13]. This result suggests that the reasonable introduction of information technology in piano teaching can effectively enhance the learning experience, improve teaching quality, and provide strong support for the promotion of intelligent piano education in the future. Meanwhile, interview results also showed that teachers generally hope to improve classroom interaction models to enhance students' autonomy and participation. The conclusions of this study provide teachers with specific teaching suggestions, such as increasing group discussions, peer evaluations, and utilizing technological tools to aid practice, thereby optimizing teaching strategies and enhancing classroom teaching effects.

In the process of piano teaching reform, constructing a scientific, systematic, and standardized teacher-student interaction model is of great significance for improving the quality of piano teaching and promoting the comprehensive development of students' overall qualities. Future piano teaching should fully utilize the auxiliary role of information technology while innovating teaching concepts and optimizing teaching content, pushing piano education towards a more interactive and efficient direction to better meet the needs of modern education and cultivate piano talents with high-level performance skills and innovative thinking.

5.3. Main contributions of the study

5.3.1. Optimizing classroom interaction

Increasing student engagement, the study found that the group interaction model (Group B) can effectively enhance students' classroom participation. Therefore, in piano instruction, teachers should encourage students to engage in group discussions, collaborative performances, and mutual feedback, rather than relying solely on the traditional teacher-centered lecture format. By allowing students to construct knowledge through interaction, teachers can foster autonomous learning skills and enhance students' interest in learning.

5.3.2. Balancing personalized instruction with collaborative learning

Research indicates that collaborative learning promotes knowledge sharing, but some students may still require additional personalized guidance. When designing classroom activities, teachers can adopt a hybrid approach combining collaborative learning with individualized feedback. For instance, they can provide targeted instruction after group discussions to help students of different levels address their specific needs and achieve better learning outcomes.

5.3.3. Utilizing technology to enhance interactive teaching effects

Supported by technologies such as smart pianos and online learning platforms, teachers can integrate digital tools to enrich students' classroom experiences. For example, AI-assisted systems can provide instant feedback, and virtual piano software can offer a more intuitive understanding of musical structures. These tools not only enhance interactive experiences but also assist teachers in managing classroom instruction more efficiently.

5.3.4. Shifting the teacher's role from knowledge transmitter to learning facilitator

Traditional piano classrooms are primarily teacher-centered, but this study found that students can understand and grasp knowledge more effectively through independent exploration and peer interaction. Therefore, teachers should increasingly adopt the role of "learning facilitators," encouraging independent thinking, collaborative problem-solving, and providing guidance and support when necessary. This teaching approach can enhance students' critical thinking and creativity, benefiting them in their future musical pursuits.

5.4. Research limitations and future directions

Although this study explored the effects of different interaction models in piano instruction at higher education institutions and found that combining group flipped classrooms with smart practice systems effectively enhances student engagement and learning experiences, there are still limitations. Firstly, the sample size was small: The study only included four students from the first and second years of a music education program at a higher normal university, which may not comprehensively represent all non-piano major students. Future research can expand the sample size and include students from different universities, grades, and cultural backgrounds to enhance the study'' generalizability. Secondly, the research period was short: The four-week teaching experiment was limited in duration, making it difficult to observe long-term learning effects. For instance, while Group B students demonstrated high learning enthusiasm in the short term, it remains unclear whether they can maintain this high participation level in the long run. Additionally, whether the application of smart practice systems will have a sustained impact on students' self-directed learning habits requires further validation. Therefore, future studies can adopt a longitudinal research design to extend the observation period and investigate the long-term effects of different teaching models.

Furthermore, the evaluation criteria were limited: This study primarily assessed the effectiveness of teaching models through classroom observations and interviews, providing rich qualitative data but lacking objective quantitative measures (such as exam scores, practice duration, error rates, etc.)[14]. Future research can introduce more comprehensive quantitative assessment tools, such as piano performance scoring criteria, EEG, or eye-tracking technologies, to further explore students' cognitive load and learning effectiveness. Additionally, regarding the limitations of the smart practice system used in this study, it mainly provided instant feedback on pitch and rhythm but had limited guidance on advanced piano skills like expression, musicality, and touch techniques. Moreover, some students might overly rely on system feedback, neglecting independent reflection on musical expressiveness. Therefore, future research can explore more intelligent and multifaceted feedback mechanisms, integrating AI, machine learning, and teacher comments to better assist piano instruction with smart systems.

Disclosure statement

The author declares no conflict of interest.

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