

## Retraction

# Retracted: Feasibility Analysis of Intelligent Piano in Piano Teaching

### Scientific Programming

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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- [1] Y. Ma, "Feasibility Analysis of Intelligent Piano in Piano Teaching," *Scientific Programming*, vol. 2022, Article ID 5010428, 8 pages, 2022.

## Research Article

# Feasibility Analysis of Intelligent Piano in Piano Teaching

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With the rapid development of artificial intelligence, big data, blockchain, and other technologies, the impact of intelligent environment on the development of education has become more and more profound. Other developed countries have realized that education reform is urgent in the intelligent environment. So as to seize the major strategic opportunity of artificial intelligence development, my country has optimized the teaching content, teaching methods, and teaching methods of traditional piano teaching on the basis of respecting the traditional piano teaching concept. Upgrade to achieve the innovation of the relationship between teaching and learning in piano education in normal schools, and create a new situation for piano teaching in normal schools. Based on the current situation of piano education for musicology majors in normal schools, this paper takes the intelligent piano as the research object, compares the advantages and disadvantages of the application of smart pianos and traditional pianos in the environment of normal schools, combines the intelligent technology provided by smart pianos, and explores the application of technology to pianos in normal normal schools. The path of teaching reflects the value and use value of intelligent piano in piano teaching in normal schools and explores the value of intelligent piano teaching.

## 1. Introduction

The rapid development of information technology has promoted the development handle of educational informatization and the modernization of educational means. Taking the rapid development of the Internet as the horizontal axis, artificial intelligence, personal customization, and network communication as the vertical axis, the high and steady upward curve has been recognized by more researchers, and even mentioned the “fourth industrial revolution,” which is the “smart age.” Emerging technologies have penetrated all aspects of life, and have gradually occupied an irreplaceable position in the field of learning. Relying on the benefits brought by new science and technology and the Internet, whether teaching or receiving education will reduce the constraints brought by tradition and gradually become an intelligent education system. In the field of music education, intelligent teaching has also become the general trend [1–3]. In the traditional “one-to-one” teaching, teachers mainly impart knowledge to students in an oral way, and a good teacher-student relationship is built between students and teachers. Normal school students’

piano learning is mainly based on repertoire skills and is relatively lacking in autonomous learning and classified learning. At the same time, the demonstrations in the piano classes in normal schools are mainly based on the teacher’s personal demonstration, and the students learn the repertoire by imitating the teacher as the main learning method. In this way, although students can learn more intuitively about the teacher’s playing skills, they lack their own creativity. After graduation, the students trained under the piano education in normal schools are mainly faced with primary and secondary schools, which requires that the piano education and training in normal schools should meet the requirements of normal schools and meet the actual job needs of students. The rapid development of information technology in the 21st century has promoted the development of educational informatization and the modernization of educational means. With the gradual deepening of education reform, the piano education in normal schools has gradually shifted from “examination-oriented education” to “quality education,” which requires piano teaching in normal schools to reposition the teaching according to the new needs of cultivating compound music education talents

[4–6]. Therefore, the intelligent piano teaching in colleges and universities under the information technology came into being. It is a new type of teaching with more integration, interaction and creativity. It allows students to form a more comprehensive understanding of music art in the process of piano learning, the systematic acquisition of professional skills adapted to actual work needs [7].

How to speed up the strength and progress of the integration of piano teaching and information technology in normal schools has become an important research topic. Therefore, this paper will focus on the application of intelligent piano in colleges and universities supported by information technology, through in-depth analysis of the evolution of intelligent piano, comparison with traditional piano teaching, and its unique intelligent technology, so as to explore a new type of piano. The new piano course teaching mode provides a certain reference for the future intelligent piano teaching [8–10]. This paper mainly conducts a practical and theoretical exploration of the application of intelligent pianos supported by information technology in the piano classrooms of musicology majors and piano performances in normal high schools, hoping to arouse more musicians, learners, and researchers to the intelligent for the emphasis on the piano. It provides a reference for improving the autonomy, creativity, and practicality of piano learning in normal teachers. And by carrying out piano course teaching research, adding modern technology to the process of piano course teaching, optimizing the resources and teaching process of piano teaching in normal schools, providing a new idea and method for the reform of normal school education, and providing theories for the innovation research of piano education in normal schools' support.

## 2. Research Status of Intelligent Piano in Piano Teaching Methods at Home and abroad

In the foreign literature, I have only found two descriptions and researches on smart pianos, and there is no relevant research on the combination of smart pianos and music teaching in normal colleges. Among them, “IntelligentPianoAndSystem” analyzes the piano keyboard from the keys, the indicator module, the first data communication module, the key detection module, the MIDI data processing module, the MIDI synthesizer, the audio encoder, the audio amplifier, and the speaker, to show that the smart piano can be realized for the functions of personnel identification, correction, scoring, sound quality replacement, composition, etc., and heighten the efficiency of piano learning. Another article “Intelligent Tutor System For Piano Learning” introduces the invention of the “Piano Learning” intelligent tutor system, which is designed for the piano learners, especially for piano practice after class, and guides piano teachers to effectively teach through intelligent operation methods and processes, guide students how to heighten their piano skills more effectively through this system.

There has been some research on the application of smart pianos in piano education in Chinese normal schools. Relatively large part scholars have thought about the

feasibility of combining smart pianos with music education in normal schools from multitudinous perspectives and put forward some ideas at the same time. Chen pointed out that the emergence of smart pianos is caused by various aspects such as science and technology, human needs, and the market, and it is an inevitable combination of old and new. Whether its practicality, its own performance, or its influence and acceptance, it provides an important foundation for research and development. However, the emergence of new things must have a process that is well known to the public, as well as its own selling point compared with traditional pianos, and problems such as the inability of propaganda to accurately locate the target group make smart pianos unable to accurately impress consumers and market sentiment [11]. Yu and Peng believes that the smart piano is now a very important part of the learning field, and its proportion in the market is increasing year by year, which is attributed to him and his influence. Its own characteristic is to use new science and technology on the existing performance of traditional piano, reorganize some internal structures, update use functions, and at the same time integrate some successful scientific research results into it; rational use is a powerful addition to modern music education. One way [12]: Lian integration of science and technology into music teaching itself is a way to heighten autonomy, interactivity, and points of interest, which invisibly reduces a lot of resistance for students in the process of learning music again in a passive position. For him to break through the traditional teaching mode and adopt this kind of teaching mode with more resource integration ability, interaction ability with students, and individualized creativity ability, it is a reform plan for cultivating personalized, innovative, and technological talents in the 21st century music department. It is also the development direction of music education in the future [13]. Zhan and Wu are using questionnaires to conduct sampling surveys to understand the situation of piano teaching based on the quality development of college students in multitudinous regions. The piano teaching method has become an important part of the new quality education. The data shows that it has certain reference for future education and is worth further exploration. The research shows the current development direction of quality education in colleges and universities through this set of data, so as to view the problem in an all-round way and solve the problem in the rapidly advancing education [14].

In the related research on the implementation of children's music education using emerging technology as an investigation method, Mo and Li talked about the comparison between modern and past teaching models, and shortcomings such as knowledge structure lines no longer exist. Nonlinear network structure, diversification of presentation forms has become the characteristic of education in this era [15]. Wei pointed out that modern society is in the environment of the Internet and emerging technologies. The influence of technological development has penetrated into all aspects of study and life, and intelligent communication equipment has also made a significant contribution to this. The development of the smart piano and its introduction

into the market is also due to its own performance, which can bring more teaching benefits and more scientifically formulate a more suitable knowledge system for multitudinous student groups and higher practicability. It has been continuously studied as a direction, and explore Rauscher et al. [16]. In the related research on the use of emerging technologies as an investigation approach, Zhang proposed to make good use of the advantages and characteristics of Internet music software, and integrate it into the teaching of harmony in normal schools. This method makes better use of the accuracy of computers, is more convenient for students to learn, and maximizes the characteristics of harmony. At the same time, it integrates theory and teaching into teaching, and the teaching efficiency is significantly improved compared to before. It also broadens the thinking of students, increases creativity, makes teaching more intelligent and modern, and has a significant impact on my country's music education [17]. In the age of the Internet, Yan et al. have also combined piano teaching with it, using multitudinous educational cloud, database, and other approaches to research and explore the application scheme of cloud computing in the curriculum and constantly develop a form more suitable for modern education. Courses that are more suitable for students' age and comprehension ability enable educated people to better grasp knowledge, and the drawbacks of traditional teaching have been significantly improved [18]. Tubo is a piano concerto digital performance training system based on a set of computer music production tools and the ROM function of digital pianos. It is an orchestra software that develops and produces ten piano concertos. The live performance of the piano and the orchestra is an old performance mode, while the digital orchestra is to make the orchestra part of the piano concerto into audio through music production software and use it in students' daily practice, so as to strengthen the students' understanding of the piano concerto. The ability to perform in this genre helps students gain a more comprehensive understanding of the essence of Western music culture. The smart piano can be applied to the music education of the normal school with reference to the digital orchestra model of the concerto, as an auxiliary tool for the music learning of the normal school [19, 20].

To sum up, from the data I collected, there has been some research on the application of smart pianos in piano education in Chinese normal schools, but there is a lack of attempts to explore specific measures to achieve innovation in piano teaching in normal schools. Theory cannot be connected with practice and cannot really heighten the current situation of piano teaching in normal colleges. Therefore, the intelligent technology of intelligent piano is added, the teaching and learning modules are developed according to the characteristics of piano teaching in normal schools, the intelligent piano teaching in normal schools supported by information technology is established, and the implementation is carried out to improve the current situation of slack in music education in normal schools; make full use of the school. The existing intelligent piano equipment and the hardware facilities to be improved will provide theoretical support for building a modern platform

for piano teaching innovation in normal colleges, which is the important research purpose and significance of this paper.

### 3. Research on Functional Modules of “Smart Piano”

The “smart piano” system has rich learning resources, and its huge resource library provides a reliable guarantee for the “smart piano” teaching activities. The resource library can provide information technology support for teachers to formulate teaching plans and teaching plans. At the same time, students need to use the information in the resource library for after-class preview, practice, review, and assessment [21, 22]. As shown in Figure 1, the resource library expands on the basis of traditional piano teaching materials, digitizes music scores, teaching materials, and articles, and provides information retrieval functions for students and teachers to facilitate teachers and students to access resources.

*3.1. Recognition of Playing, Practice with Lights, Intelligent Error Correction.* In the existing teaching system, intelligence and multimedia have become very common. Not only has multimedia teaching been widely used in primary and secondary school classrooms, but also in music colleges, teaching and information technology are generally integrated, which is a kind of sublimation from blackboard to whiteboard for the development of education [23–25]. Teachers need to improve the traditional teaching methods in piano courses, keep pace with the times, and make full use of the Internet and “smart piano” terminals to make up for relatively large part defects in traditional teaching. In the past, the piano course was one-on-one teaching with teachers and students, and then students practiced for a week after class. This handle was repeated until the work was completed. For students in higher normal schools, this method is inefficient, and there are not enough teacher resources to realize the whole handle of traditional teaching. Therefore, using the “smart piano” system can solve the problem of teachers, and at the same time improve the fun and efficiency of learning, reduce the learning pressure of piano courses, free up more time for the learning of other courses, and effectively improve the comprehensive quality of students. The core of the “smart piano” is the teaching guidance module, which is divided into two parts: computer guidance and teacher guidance. Among them, computer guidance is the advantage of “smart piano” over traditional teaching methods. The “intelligent piano” connects teachers and students with the network, completes human-computer interaction at the same time, and completes teaching and learning under the dual action of computer and network.

The “smart piano” presents the electronic music score to the students through the display screen. In the initial learning stage, the students can play the audio of the work first, and mark the progress of the audio on the music score in real time, so that students with weak notation ability can follow the music mentally. By listening to the music scores, students have a preliminary and overall understanding of the

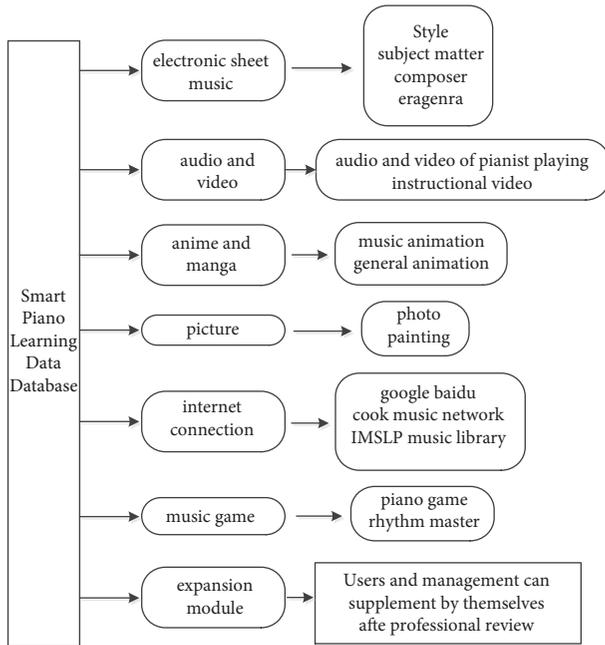


FIGURE 1: Expansion diagram of intelligent piano learning data.

work. Students can adjust the playback speed according to their own abilities and habits, and listen to the individual stages of the work repeatedly.

**3.2. Gradient Teaching Method.** The gradient teaching module is designed to evaluate students' learning progress and performance level, then provide guidance for the formulation of learning plans, match students data with individual models, and provide students with appropriate learning content based on their learning needs, as shown in Figure 2 shown.

**3.2.1. Primary Assessment.** When students use the "smart piano" for the first time to learn, they need to test and evaluate their actual performance ability and music knowledge. Students with a good foundation can directly choose the difficulty of the test, judge the performance level through the computer's evaluation of speed, accuracy, and artistic processing, and finally formulate a corresponding learning plan according to the performance level. Students with poor or zero foundation can skip the test and just fill in the questionnaire, input their preferences and expected learning progress to the computer, and then the computer will directly formulate a learning plan based on the data model.

**3.2.2. Intermediate Assessment.** The purpose of the intermediate assessment is to investigate the students' learning status and to test the students' learning progress and learning stage achievements, so as to fill in the gaps and prepare for future learning. The intermediate assessment consists of three parts, one of which is self-assessment. The self-evaluation system aims to improve students' self-

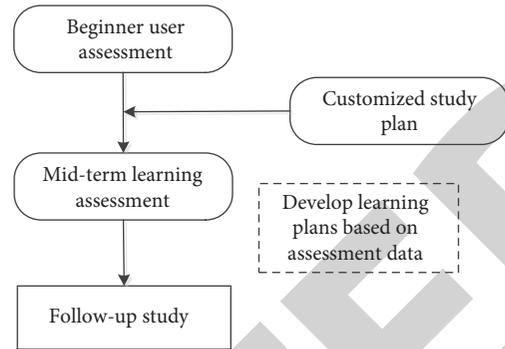


FIGURE 2: Gradient teaching flow chart.

learning ability, so that they can have a clear understanding of their own level, and can accurately guide their students when they go to teaching positions in the future. Self-evaluation includes self-satisfaction, scores, and learning difficulties. The second is computer evaluation. The computer scores the basic elements of performance according to the sensor data and makes a preliminary judgment on the students' performance level. The third is teacher evaluation and student mutual evaluation. Students upload their performance videos to the Smart Piano cloud platform, and teachers and classmates will score and fill in relevant comments. Finally, the computer comprehensively evaluates the three parts to give concrete results.

**3.2.3. Study Schedule.** The computer formulates a corresponding learning progress table according to the data filled in by the individual and the test results, which mainly includes two elements, one is the student's performance level, and the other is the student's artistic accomplishment and repertoire preference. The performance level data is obtained from the combination of the computer's primary assessment and the teacher's assessment. According to the final score, the difficulty matching repertoire is selected as the learning target. Learn step by step towards deeper levels of difficulty. The data on artistic accomplishment and repertoire preferences are obtained from questionnaires filled out by the students, and corresponding questions will be arranged in the questionnaires. At the same time, according to the data mining of the search engine, the computer will summarize the students' preferences. Finally, based on the above information, a learning schedule is formulated.

## 4. Analysis of the Functional Modules of Intelligent Piano in Piano Teaching in Normal Schools

**4.1. Intelligent Piano Solo Teaching.** The teaching process using the smart piano as a platform is mainly divided into three stages, namely, self-study, online guidance, and face-to-face teaching. The sixth week is face-to-face with teachers. The computer adjusts the teaching progress in real time according to the learning situation and detection data and gives full play to the teaching advantages of the intelligent piano.

*4.1.1. Learning Points and Difficulties.* Preliminarily master the style and characteristics of the work, understand the writing background of the work, accurately play the notes and musical terms in the work, and complete the basic elements of music, especially pitch, dynamics, and fingering. At the same time, combining network and multimedia means in piano teaching to assist students in learning music-related knowledge, improve students' artistic accomplishment in an all-round way, deepen their understanding of music works, and cultivate more sensitive hearing. Solo works are often difficult to perform, and works of different composers and styles need to be played with relative skills. Therefore, mastering scientific and reasonable practice methods and overcoming difficulties in performance skills is the top priority.

*4.1.2. Self-Study Stage.* After the teacher assigns the task, the students first watch the relevant performance videos and asynchronous online classes, and read the relevant text materials. In this way, we can understand the relevant background information of the work and have a preliminary understanding of the overall overview of the work. Then, under the guidance of electronic scores and computers, students will be familiar with the fingerings and notes of the works by performing reading and primary exercises. For the more difficult skills in the works, such as fast running, interval jumping, and two-tone running, first try to practice at a slow speed by yourself to explore the tricks of playing. If it cannot be solved, the online class or face-to-face class will be guided by the teacher. When it can be played completely, the qualification rate of basic musical elements such as pitch and rhythm is detected by the computer. Then adjust the study plan and guide students to practice in a targeted manner.

*4.1.3. Online and Face-to-Face Teaching.* In online classes and face-to-face classes, teachers first listen to students' complete performances of the whole piece, and explain the performance methods and practice methods of difficult skills in the class, and at the same time teach students how to understand music and process works. After the teacher's guidance, the students perform the whole song completely, and the computer and the teacher jointly give a comprehensive score to test the learning results. The computer stores the comprehensive score in a database for use in subsequent study planning.

*4.2. Analysis of Intelligent Piano Teaching Design.* The teaching handle using the smart piano as a platform is mainly divided into three stages, namely, self-study, online guidance, and face-to-face teaching. The sixth week is face-to-face with teachers. The computer adjusts the teaching progress in real time according to the learning situation and detection data and gives full play to the teaching advantages of the intelligent piano. As a graduate student of a normal university, I have been allowed to carry out teaching practice in the school, and the practice object is the first-year

undergraduate students of the school. I have verified whether it is feasible to apply the intelligent piano to the piano teaching of the normal school.

Design 1: The traditional piano is integrated into the teaching of intelligent piano, and the piano solo is used as a teaching case. According to the comparison between the intelligent feedback of the smart piano and the feedback of the artificial teacher as the experimental data, the experiment is a six-week system teaching cycle of the smart piano, and the feedback of the artificial teacher to make a summary and analysis of the progress and quality of the course. The first and second weeks take the form of intelligent piano group lessons, the third and fourth weeks take the form of intelligent piano individual lessons, and the fifth and sixth weeks take the form of traditional piano individual lessons. The teaching selects "Chopin's Ballade in G Minor" as the case repertoire. Starting from the first week, various aspects of teaching are gradually carried out. Based on the students' adaptability, basic piano skills, and the playing complexity of "Chopin's Ballade in G Minor" as the premise, the teaching will be carried out. The process adopts the normal step-by-step and complementary teaching methods, analyzes the students' weekly feedback and draws conclusions, and finally evaluates the students' completion, thus reflecting the advantages of the new intelligent teaching model, as shown in Table 1.

Design 2: Taking piano solo teaching as an example, the religion arrangement is carried out in the form of traditional piano individual lessons. Six weeks are used as a systematic religion cycle. Based on the combination of the artificial teacher feedback and the intelligent feedback of the smart piano in the sixth week as the experimental tracking data, the weekly class situation is summarized and analyzed. Weeks 1 to 6 take traditional piano individual lessons. Taking the example of "Chopin's Ballade in G Minor" as a case, the religion is carried out from the first week to the sixth week, and the combination of students' acceptance ability, basic piano ability, and the difficulty level of "Chopin's Ballade in G Minor" is as follows: in the light of the data obtained from students' feedback every week, the students' completion degree is finally checked, as shown in Table 2.

Through design analysis and comparison with the same religion content, different class forms and religion methods, from the data of teaching practice and the data and feedback of the summary table, a new teaching mode was adopted in the six-week class schedule. This is a piano religion mode of "main + assistant," "human + instrument," and "complementary." This approach further mobilizes the enthusiasm of students and increases their participation in the classroom. It combines the religion advantages of artificial intelligence and intelligence to make up for the shortcomings of traditional piano religion. This "human + device," "complementary," and "remote" piano religion mode is more able to

TABLE 1: The combination of intelligent piano and traditional piano teaching-take Chopin's Ballade in G Minor as an example.

Teaching time (week)	Class form	Teaching content	Teaching method	Student recognition	Teaching feedback	Student completion
First	Intelligent piano group class	Creative background	(1) Play the original audio (2) Introduce the creative background (3) Introduce the content of the track	Excellent	Have an intuitive perception of the work	85%
Second	Intelligent piano group class	Music analysis	(1) Form analysis (2) Thematic analysis (3) Harmonic gaps to familiarize students with	Generally	Raise awareness and performance with smart media	75%
Third	Intelligent piano individual lessons	Melody and rhythm	(1) Play recording intelligent error correction melody (2) Intelligent error correction rhythm (3) Analyze the cause of the problem	Excellent	Novel teaching methods improved melody and rhythm problems	90%
Fourth	Intelligent piano individual lessons	Emoticons	(1) Play the recording, (2) Add emoji to playing	Generally	More mechanized and Constrains musical performance	65%
Fifth	Intelligent piano individual lessons	Performance skills	(1) Point out repertoire skills (2) Preliminary practice	Excellent	Into the teaching of performance skills is more efficient	90%
Sixth	Traditional piano individual lessons	Performance skills	(1) Point out repertoire skills (2) Track summary	Excellent	Improves the ability of works and the delicacy of performance	90%

TABLE 2: Traditional piano solo teaching-take Chopin's Ballade in G Minor as an example.

Teaching time (week)	Class form	Teaching content	Teaching method	Student recognition	Teaching feedback	Student completion
First	Traditional piano individual lessons	Creative Background	(1) The teacher plays the selected excerpts (2) Oral introduction of the creative background and the connotation of the repertoire	Bad	The impression of the work is limited and forgotten quickly	55%
Second	Traditional piano individual lessons	Music analysis	(1) Form analysis (2) Thematic analysis (3) Harmonic gaps to familiarize students with	Bad	Inconvenient in instructional media	55%
Third	Traditional piano individual lessons	Melody and rhythm	(1) Play the recorded manual error correction melody (2) Manual error correction rhythm (3) Analyze the cause of the problem	Good	Novel teaching methods improved melody and rhythm problems	80%
Fourth	Traditional piano individual lessons	Emoticons	(1) Play the recording, (2) Add emoji to playing	Generally	Constrains students' imagination and expressiveness of music	65%
Fifth	Traditional piano individual lessons	Performance skills	(1) Point out repertoire skills (2) Preliminary practice	Generally	Playing skills are less affected by preteaching	70%
Sixth	Traditional piano individual lessons	Performance skills	(1) Point out repertoire skills (2) Track summary	Generally	Playing skills are less affected by preteaching	70%

mobilize the enthusiasm of students. The percentage of students' completion in this religion mode reaches 90%, while the traditional religion method reaches only 70%. The emergence of this model is an attempt to update the religion concept in the light of the inheritance of the traditional religion model, combined with the intelligent technology of the smart piano.

## 5. Conclusion and Outlook

**5.1. Summary.** Comparing different class forms and teaching methods, it can be seen that the teaching mode combining intelligent piano and traditional piano teaching has certain feasibility and promotion. Existing piano teaching can try to add "smart piano" teaching into it. The piano lessons under the "smart piano" application adopt two types of lessons: individual lessons and group lessons, and the combination of traditional individual lessons is no longer mechanized and simplified. This new teaching form mainly relies on intelligent technology. Through intelligent technology, the knowledge that needs to be taught to students in the form of oral and text can be taught to students with pictures and audio. This mode is more intuitive and can mobilize students. The facial features meet the students' auditory and visual requirements. Compared with the traditional teaching mode, this has stricter requirements on students' learning quality, broadens the path for students to acquire knowledge, and improves teaching efficiency and quality.

**5.2. Prospect.** The piano teaching mode of "human+instrument." The "person" here refers specifically to the teachers and students participating in the music class. Since the piano major itself has its own particularity, it is an active output and an active acceptance of such a teaching method. In the classroom, teachers need to use methods such as playing demonstrations, music appreciation, and verbal communication to help students heighten their professional abilities from the perspective of creative background, music analysis, and performance skills. "Device" refers to the use of smart pianos in the classroom. It has functions such as intelligent recognition of rhythm and pitch, switching between multiple versions of smart scores, audio, and video, etc., which undoubtedly provides practical teaching for the improvement of teaching quality.

### Data Availability

The dataset can be accessed upon request.

### Conflicts of Interest

The authors declare that they have no conflicts of interest.

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