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Retraction

Retracted: The Use of Artificial Intelligence Combined with Wireless Network in Piano Music Teaching

Wireless Communications and Mobile Computing

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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.

References

[1] L. Yu and Z. Luo, "The Use of Artificial Intelligence Combined with Wireless Network in Piano Music Teaching," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 7989620, 18 pages, 2022.

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Research Article

The Use of Artificial Intelligence Combined with Wireless Network in Piano Music Teaching

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Artificial intelligence (AI) development gives a new development direction to the traditional education model. The education reform in the intelligent environment is urgent. Under this background, the theory, methods, and characteristics of intelligent music education are expounded based on traditional piano music education. AI and Internet-based smart piano education is introduced. The characteristics of smart piano and its methods of assisting music teaching are analyzed. Moreover, literature review and questionnaire are adopted based on intelligent music education and smart piano theory. With two universities A and B in Nanjing as the research object, the questionnaire is designed to investigate and analyze the related problems of smart piano-assisted piano basic teaching in detail. The results show that smart piano positively improves skill training and psychological training in piano teaching. Piano major learners believe that smart piano can obviously help beginners and people with low piano levels. However, smart piano is not as good as traditional piano for high-level learners. In actual teaching, teachers should use different strategies for different levels of learners. Regarding curriculum quality, teachers have not fully played the role of the smart piano, and the curriculum of smart piano-assisted basic piano teaching still needs improvement. Finally, corresponding countermeasures and suggestions for the development direction of smart piano in piano music education are put forward according to the current situation of the smart piano. The results can reflect the current situation of smart piano-assisted basic piano teaching, provide a reference for researchers in related industries, and promote the related development of smart piano.

1. Introduction

With the rapid progress of artificial intelligence (AI), all walks of life combine with it to burst out new development direction and vitality [1, 2], and the education industry is no exception. Recently, intelligent education, a new teaching model based on AI [3], has been widely used in teaching various disciplines with educational informatization and has shown strong foresight and adaptability. In piano music teaching, intelligent music education has greater advantages than ordinary classroom music education. Piano education has been transferred from the classroom to online with the combination of AI and wireless networks. The educational form is more flexible, the educational concept is more advanced, and the teaching effect is more obvious. AI + wireless network piano music education is mainly in the form of "smart piano" [4]. Wireless network piano is mainly a wireless electronic piano equipped with intelligent Wi-Fi, which is equipped with a wireless communication module. The wireless communication module adopts a Wi-Fi communication module. In addition, wireless communication modules and various control modules are added to the student terminal of the electronic piano, which is more convenient for audio signal conversion and teachers' distance teaching. Smart piano combines traditional piano with AI, and it is the product of information technology and piano education. This form of piano music teaching mode is developing under the promotion of AI, so multiple researchers have done a lot of research on it.

Huang [5] quantitatively described how AI courses cultivated students' key abilities. First, the necessity of carrying out AI education in basic education and the current situation of AI education in China were analyzed. Next, the key abilities of students were expounded, namely, knowledge ability, team ability, and learning ability. The AI curriculum in the basic education stage was designed. Finally, the relationship between AI curriculum and the cultivation of students' key abilities was explored by collecting student questionnaires. The experimental evaluation showed that seven AI courses were conducive to cultivating students' six key subabilities. In addition, the problems of the current AI curriculum were also found, and suggestions for improvement were put forward. Mukhamedova [6] revealed the preconditions for the formation of piano and performing arts according to the personal works, personal dialogue, and understanding of pianist archives in the history of music education in Uzbekistan. The evolution of the national performance school presented a phased picture. The development and crystallization of contemporary piano art, the determination of performance tradition, and its main characteristics were reviewed, promoting piano education development. Li and Tian [7] proposed a knowledge-based questionnaire evaluation system for digital piano collective course of preschool education major in colleges. The system could collect enough data and information through questionnaire, accurately locate piano learning, and select teaching mode. The students' characteristics, teachers' post skills, and the positioning of digital piano syllabus in preschool digital piano collective teaching in normal universities were comprehensively analyzed. The countermeasures to improve the digital piano teaching mode were put forward to improve the piano teaching level of preschool education, realize the goal of stimulating students' learning enthusiasm, and reduce the pressure of teachers. Liu [8] combined piano teaching with information technology, developed the cloud classroom and student communication community, and used smart piano and Internet resources for collective piano lessons of preschool education major in secondary vocational schools. In fact, it realized intelligent error correction and interactive teaching and played a positive role in students' piano enlightenment. Wang and Jiang [9] investigated the current situation of piano music education in the information age from educational inclusion and educational equity and analyzed the reasons for the low efficiency of piano learning and practice. The results showed that in the information age of education, technologies such as the Internet and AI must be used to better carry out music education and keep up with the pace of the times to realize the personalization of music education and speed up the development of the music industry. In addition, in the past, it was difficult to objectively show the effect of piano learning through scientific and technological means, and there was no accurate effect analysis, which was one of the main reasons for the low efficiency of piano learning and practice. Nergiz and Demirci [10] used descriptive content analysis to study Turkish piano literature and analyze its changes. The results obtained through personal interviews with composers supported the information about the works. It showed that the piano performance action, style, and skills affect the composer's composition, which was significant for piano education and composition.

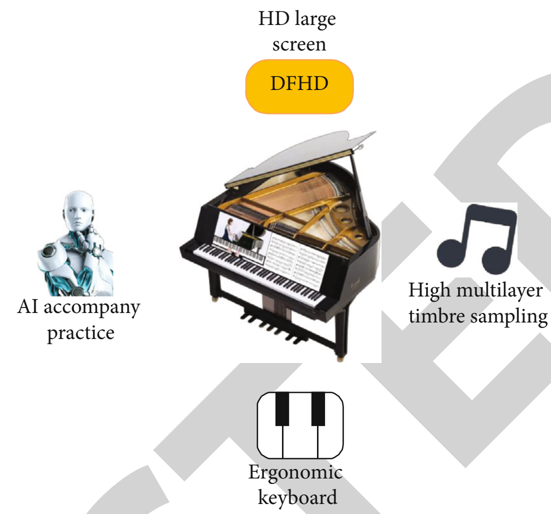

Figure 1: Characteristics of the smart piano.

The above research shows that the development of AI-based teaching mode has become an inevitable trend, especially in piano music education. Therefore, the application of AI in smart piano music teaching is deeply discussed according to the theory of intelligent music education. In addition, based on the theory of intelligent education, two universities in Nanjing, school A and school B, are taken as survey objects. A questionnaire is designed to investigate the application status of smart piano in piano music teaching. The current situation and problems of smart piano-assisted piano teaching are expounded through a comprehensive questionnaire survey, and the survey results are summarized. The causes of the problems are analyzed to put forward the countermeasures to solve the existing issues.

2. Materials and Methods

2.1. Intelligent Music Education Theory. Intelligent music education has broad and narrow definitions. Generally, the broad sense refers to all music-related educational activities, such as music appreciation, music creation, music teaching, and music performance. The most significant feature of music in the broad sense is through the transmission of music knowledge and the cultivation of music sense between music teachers and learners. The definition of broad music appeared as early as the Zhou Dynasty, such as China's six arts—rites, music, archery, charioteering, reading and writing, and arithmetic, reflecting the importance of music education. Music education in the narrow sense is mainly developed from modern times. It mainly refers to the music activities carried out by schools or professional music education institutions, which are purposeful, phased, and organized, such as chorus. In the 21st century, these two different definitions of music exist simultaneously. Social music education is representative of broad music education, and professional music education represents narrow music. Intelligent music education has both attributes. Therefore, its definition here is as follows. AI is adopted to conduct informationalized transformation and processing of the

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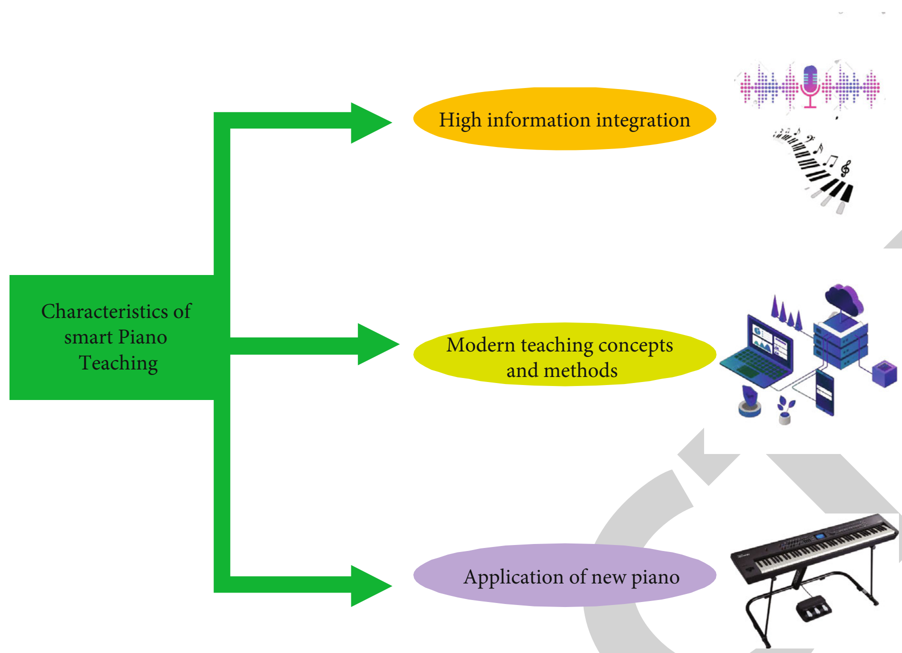

FIGURE 2: Characteristics and methods of smart piano teaching.

traditional music education to change the traditional music teaching mode, make its process audio-visual and efficient, and give it a distinct sense of science and technology. In intelligent music teaching, music differs from other disciplines. Therefore, intelligent music education should include more perceptual knowledge and highlight the function of aesthetic education. Besides, AI should be used to informationize music knowledge and train educatees to better perceive, appreciate, perform, and create music.

2.2. Ways and Characteristics of Intelligent Music Education. Intelligent music education has developed with AI in recent years. Although it is still in the early stage of development, it shows an advanced concept of music education and improves the disadvantages and deficiencies of traditional music education. For example, using AI's ability of big data analysis can scientifically and efficiently analyze the loopholes in the music education system, reasonably optimize the teaching structure, and provide a reference for improving the music teaching mode [11, 12]. For music teachers and learners, intelligent music education has brought a new teaching experience and school experience [13, 14]. For example, the emergence of massive music software such as piano simulation app and smart piano has changed the habits of music learners. This music learning method combined with software and hardware subverts the traditional music teaching mode, achieving a better teaching effect than the traditional one. Thereby, intelligent music teaching has the following characteristics [15].

2.2.1. Informatization of Music Learning Process. Unlike traditional music education, intelligent music education eliminates the boring feeling in music learning and increases the learning interest and motivation of music learners.

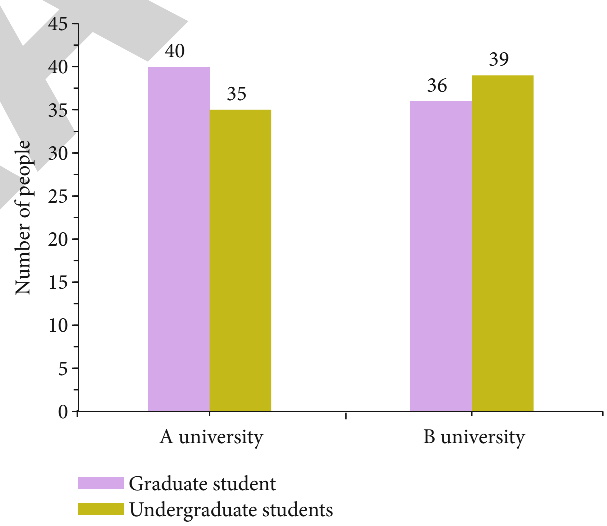

FIGURE 3: Information of respondents.

Moreover, the concept of teachers and students does not seem to have such a clear boundary. The high informatization of music teaching makes teachers no longer the only one to master music knowledge. Meanwhile, an intelligent music classroom also helps teachers constantly update their own knowledge [16]. Both learners and teachers can learn through network and other ways to improve the efficiency of learning. For example, students learning piano can increase their knowledge reserve and professional skills through excellent online lessons and teaching videos. Moreover, the new information equipment can help music learners make music more conveniently. Learners can make simple music editing and track drawing and

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Table 1: Questions of the questionnaire.

Question number	Problem description
Q1	Your gender
Q2	Your education level
Q3	I understand the sound generation principle of the smart piano.
Q4	I understand the relationship between smart piano and intelligent education.
Q5	I am familiar with the concept of smart piano education.
Q6	Smart piano can improve my training efficiency.
Q7	Smart piano can improve my sense of music.
Q8	Smart piano makes me recognize music scores quickly.
Q9	Smart piano can make me concentrate.
Q10	I think smart piano differs greatly from the traditional piano.
Q11	I am very interested in the future of smart piano.
Q12	I need time to adapt to the smart piano.
Q13	My school offers a separate smart piano course.
Q14	I have participated in smart piano projects, most of which are group lessons.
Q15	I can accept the teaching mode of the smart piano.
Q16	The school is equipped with smart piano teaching materials.
Q17	The teaching materials provided by the school differ greatly from the traditional teaching materials.
Q18	I think the teaching materials provided by the school can meet the needs.
Q19	The teachers of the smart piano can only teach roughly.
Q20	I do not think teachers use scientific teaching methods.
Q21	I do not think the role of the smart piano is fully played in class.
Q22	I can well understand what I learned in the smart piano class.
Q23	I think the current ordinary piano teaching system is not perfect.
Q24	I will review the smart piano course taught by the teacher after class.
Q25	I will ask my teachers and classmates for help with the smart piano.
Q26	My school has a special smart piano for students.
Q27	The piano provided by the school is old-fashioned.
Q28	The existing piano cannot meet the needs of teaching.
Q29	The smart piano is more effective in sound control training in basic piano learning.
Q30	The smart piano is more effective for finger training in basic piano learning.
Q31	The smart piano is more effective for repetitive training in basic piano learning.
Q32	Smart piano can improve my psychological quality of learning piano.
Q33	Smart piano can speed up the speed of memorizing music scores.
Q34	Smart piano can help me overcome stage fear in my learning.
Q35	My efficiency in using the smart piano to analyze works has been improved.
Q36	I use the smart piano to better grasp the style of the work.
Q37	I can learn the playing method more effectively by using the smart piano.

appreciate music anytime and anywhere through various music-related apps [17, 18].

2.2.2. Improving the Teaching Quality through Intelligent Music Education. Teachers are the main link of teaching quality in teaching activities. Intelligent music education requires teachers to innovate in teaching content and teaching methods. However, the limitations of traditional music teaching cannot meet this demand. The emergence of intelligent music teaching classrooms enables teachers to flexibly use the means of intelligent education to teach students according to their aptitude. In intelligent music teaching, teachers in the piano major can present the whole piano concert in the classroom through AI equipment, such as VR glasses [19, 20], so that students can have an immersive feeling, which can better cultivate learners' sense of music and learning interest [21].

2.2.3. Higher Student Participation. The intelligent music classroom regards students as the absolute center of music teaching. Students can effectively interact with teachers by using various AI electronic devices and software [22, 23]. It makes teaching activities no longer a separate word that runs from mouth to mouth from teachers, but a joint activity of

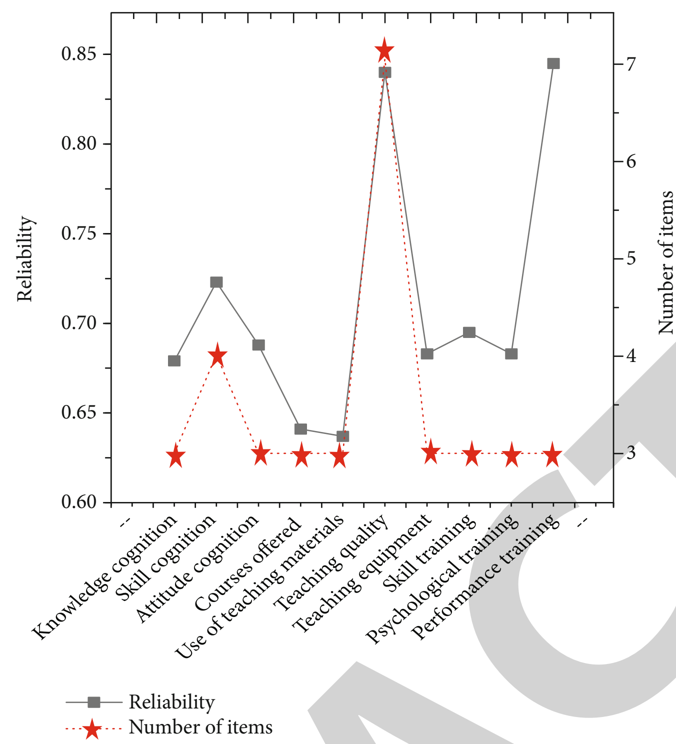

Figure 4: Reliability analysis results.

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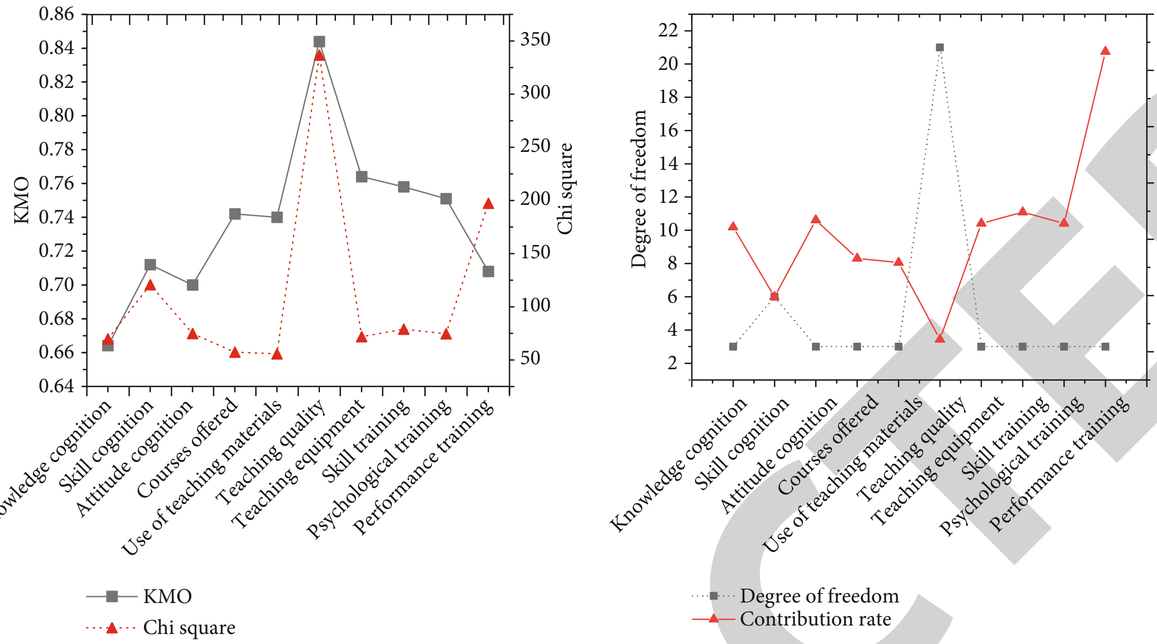
teachers and students. Students can feel the beauty of music directly through electronic devices. In addition, the school can also establish a music teaching library to make students participate directly without the restriction of time and space. Music teaching library can use Internet technology to realize interconnection, breaking the regional restrictions [24].

2.3. Smart Piano Education. The piano is a western musical instrument introduced into China during the Wanli period of the Ming Dynasty in the 18th century. Since the piano differs from other musical instruments, piano education generally focuses on professional school education. Smart piano is a new educational concept. It refers to the piano teaching concept that uses information technology to innovate the form, environment, and teaching method of piano education based on traditional piano education. Its ultimate goal is to achieve a high degree of unity between people's music aesthetics and body performance [25, 26]. The particularity of piano determines that it is a complex music teaching activity. Unlike the teaching methods of traditional disciplines, the piano needs more practice than theory. It cannot only rely on imparting knowledge to achieve the purpose of piano teaching like other disciplines. Figures 1 and 2 present the characteristics of smart piano and its teaching characteristics and means.

The characteristics of smart piano teaching can be summarized in Figures 1 and 2. The smart piano highly depends on AI technology and information technology, and its development degree is closely related to the development of science and technology. The smart piano is a modern scientific and technological achievement in an intelligent environment. Based on the music characteristics of the traditional piano, it adds a controllable LCD screen and superimposes intelligent software on the LCD screen. It has become a combination of multimedia optimization. Based on the traditional "one-to-one" piano teaching mode, this technology has changed the time-space relationship between teachers and students in the teaching process and has become a great opportunity for the integration of piano education and informatization in normal universities. Besides, the smart piano is equipped with AI accompaniment practice, which is its advantage compared with traditional teaching methods. Smart piano connects teachers and students with the network, achieves human-computer interaction simultaneously, and completes teaching and learning under the dual action of computer and network. Figure 2 shows the cutting-edge and information-based characteristics of smart piano teaching. Its performance and function depend on the development of science and technology, which represents the exploration direction of the modern piano manufacturing industry. Smart piano teaching is highly information integrated, which is in line with modern teaching ideas and a new piano teaching method.

2.4. Application of Artificial Intelligence in Smart Piano Teaching. Based on respecting the traditional piano teaching concept, the teaching content, teaching methods, and teaching means of traditional piano teaching have been optimized and upgraded. It can achieve the innovation of the relationship between teaching and learning in piano education in normal universities and create a new situation of piano teaching. Smart piano is a modern scientific and technological achievement in the intelligent environment. It is an AI product based on retaining the musical characteristics of the traditional piano. The application of AI intelligent



(a) (b)

Figure 5: Validity analysis results: (a) KMO + chi square; (b) degrees of freedom + contribution rate.

technology has significantly changed the concept and mode of music education. Computer systems and intelligent software are gradually applied in music education to improve the quality of music teaching and the interest of music learners. The emergence of smart piano has changed the way of traditional piano education. The application of AI in piano teaching is mainly reflected in the following aspects:

(1) *Smart Piano*. Smart piano makes piano education more intelligent and humanized. It can guide learners to self-study and improve teachers' teaching level in classroom teaching. Students can use it to create and play the music score on site to improve their learning and practice level. The smart piano can be played according to the set program in practical application to replace traditional piano learning mode. This personalized music programming ability replaces the traditional operation mode. Therefore, the emergence of the smart piano has greatly improved the quality of music teaching. It can be widely used in basic teaching and university teaching classes

(2) *Music Software*. In the rapid development of information technology, multiple smart piano teaching softwares gradually appear. This software improves the processing ability of music data; allows learners to edit, modify, and record; and intelligently processes the quality of music performance. This new music system is gradually applied in piano learning. In education, after the introduction of this system, teachers can interact with students in the process of teaching. Students can practice through music software, review the knowledge taught by teachers in this

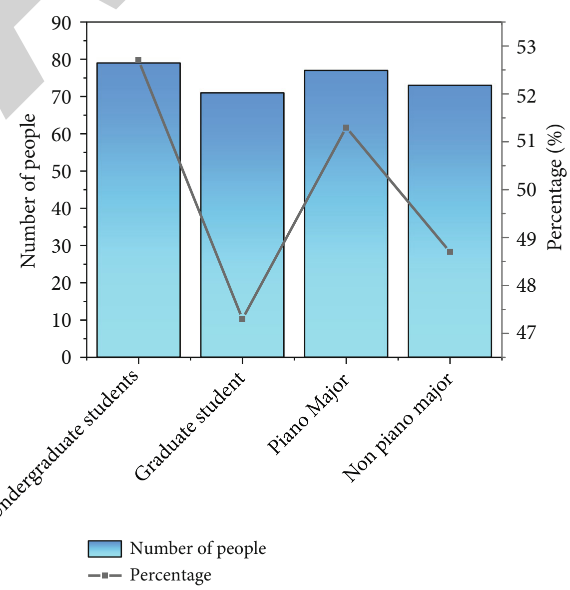


Figure 6: Descriptive analysis results of respondents.

AI software, and better understand the relevant theoretical knowledge through actual playing. In addition, in piano teaching, teachers and students can interact through intelligent software, and both sides can display through music performance. This intelligent system can let students experience the method and practical charm of music performance

(3) *Resource Integration*. The application of AI technology in piano education can effectively integrate

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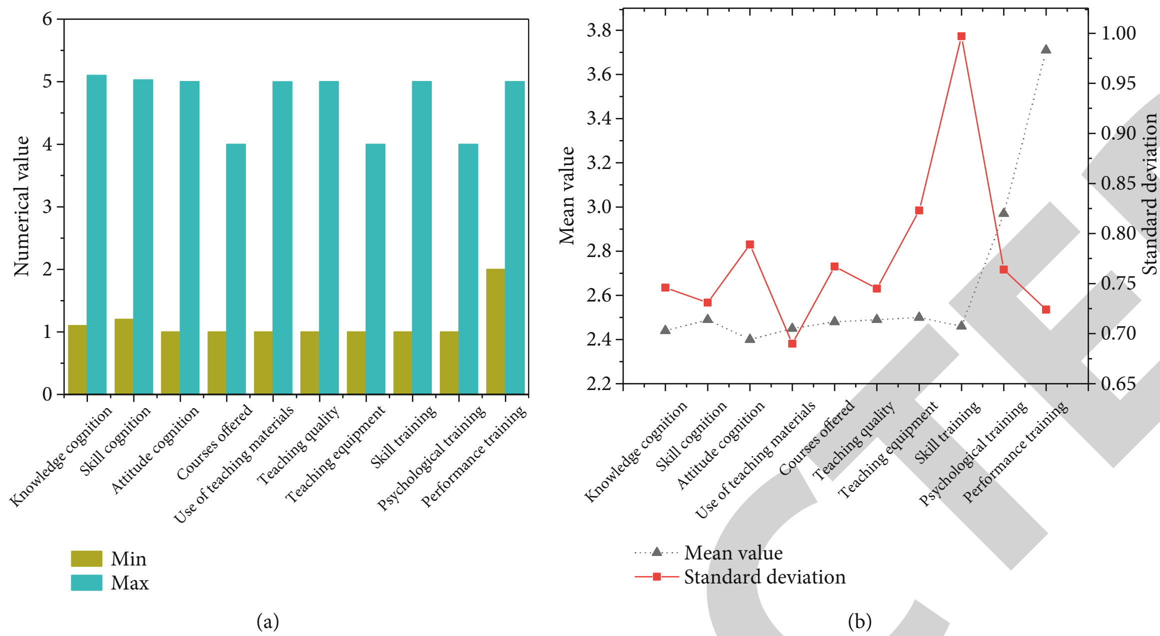

Figure 7: Results of small dimension descriptive analysis: (a) minimum + maximum; (b) mean + standard deviation.

various resources, especially the application of some music software. For example, in the actual teaching process, various emerging piano teaching courses can carry out work analysis and composition and performance. This way is to display intelligently, so that students can create, perform, and modify anytime and anywhere, and improve the overall learning efficiency

2.5. Investigation on the Current Situation of Smart Piano-Assisted Basic Piano Teaching. In this section, a questionnaire is designed, and its results are analyzed. The application of AI-based smart piano in practical music teaching is studied. Moreover, reliability analysis, validity analysis, and descriptive statistics are adopted to describe the questionnaire's content. First, the survey design is carried out.

2.5.1. Survey Questions. The questionnaire is adopted, mainly focusing on the following two questions:

(1) Students' attitudes towards smart piano teaching methods in two universities A and B in Nanjing

(2) The present situation of smart piano in piano music teaching

2.5.2. Survey Object. Undergraduate and graduate students from two music universities A and B are investigated. The selected subjects are piano majors and nonpiano majors to fully reflect the questionnaire's authenticity. The total respondents are 150 people, with 75 in each university. Overall, 150 questionnaires are distributed and recovered, with an effective rate of 100%. Figure 3 shows the specific information of the respondents.

2.5.3. Survey Tools. The questionnaire is named *AI-based Smart piano Assisted Music Teaching Survey*. The content of the questionnaire is divided into 37 test questions. The first 2 are the information survey of the survey object, and the last 35 are the survey content. Table 1 presents the specific contents of the questions.

Table 1 shows that the first 2 questions are the respondents' information. Therefore, the questionnaire is divided into three dimensions. Q3 to Q12 are divided into students' cognition, Q13 to Q28 are set as the development situation, and Q29 to Q37 are set as the specific content of smart piano-assisted basic piano teaching. The five-level scoring system is used for statistics. Meanwhile, the three dimensions are subdivided into 10 small dimensions. The first dimension is divided into three subdimensions: knowledge cognition, skill cognition, and attitude cognition. The second dimension is classified as four subdimensions: curriculum setting, use of teaching materials, teaching quality, and teaching equipment. The third dimension is divided into three subdimensions: performance training, psychological training, and skill training. Reliability analysis, validity analysis, and descriptive analysis are used to analyze the survey results. Reliability analysis refers to the consistency and stability of the scores of a scale. The higher the relevance of the items asked in a questionnaire is, the higher the consistency of the questionnaire content is, and the higher the estimated reliability is. Cronbach's alpha reliability is adopted to test the survey data of the questionnaire [27]. Likert scale is used for validity analysis, and factor analysis is adopted to test Kaiser-Meyer-Olkin (KMO) and Bartlett's test to judge whether the dataset can be used for factor analysis. The value between 0.7 and 0.9 indicates that it is suitable for factor analysis. Regarding Bartlett's test results, Sig.<0.05 suggests that there is a correlation among variables.

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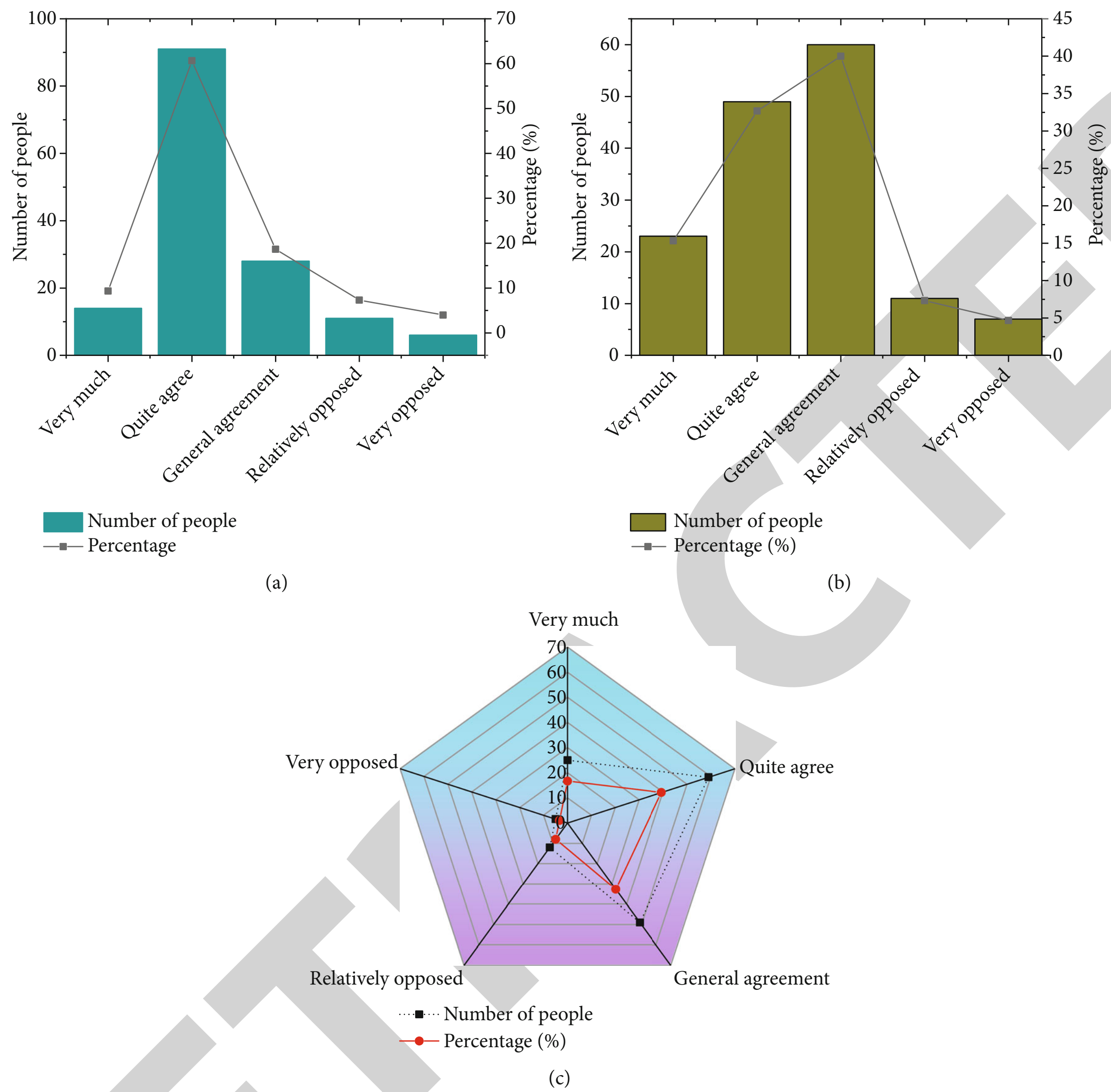

Figure 8: Descriptive analysis results of students' knowledge cognition: (a) Q3; (b) Q4; (c) Q5.

3. Results and Discussion

3.1. Reliability Analysis. Figure 4 shows the reliability analysis results of the respondents.

Figure 4 displays that the value of Cronbach's alpha coefficient in the *AI-based Smart piano Assisted Music Teaching Survey* is 0.959. It shows that the questionnaire has high reliability and meets the research requirements. Besides, the questionnaire of this exploration has been identified by experts in relevant fields. It is considered that the questionnaire content can truly, reasonably, and effectively reveal the current situation of the survey problems.

3.2. Validity Analysis. Figure 5 shows the validity analysis of the questionnaire.

Figure 5 displays that the KMO of the whole questionnaire is 0.94, the chi-square is 2991.27, the degree of freedom is 595, and the contribution rate is 58.34. Therefore, factor analysis is effective.

3.3. Descriptive Analysis. The respondents are analyzed descriptively according to the content of the questionnaire. Figure 6 displays the results.

Figure 6 shows that at the educational level, there are 71 graduate students, accounting for 47.3%, and 79 undergraduates, accounting for 52.7%; regarding major, the number of students in the piano major is 77, accounting for 51.3% of the total survey, and the number of students in the nonpiano major is 73, accounting for 48.7% of the total. It reveals that the hierarchical distribution of survey objects is relatively uniform and reasonable. Then, 3 large dimensions and 10 small dimensions are analyzed descriptively. Figure 7 shows the results.

Figure 7 reveals a descriptive analysis of the specific small dimensions of the three dimensions. The average value of the attitude cognition dimension is 2.4 points, which is the lowest average value, and the average value of the performance training dimension is 3.71, which is the highest average value. In the standard deviation analysis, students'

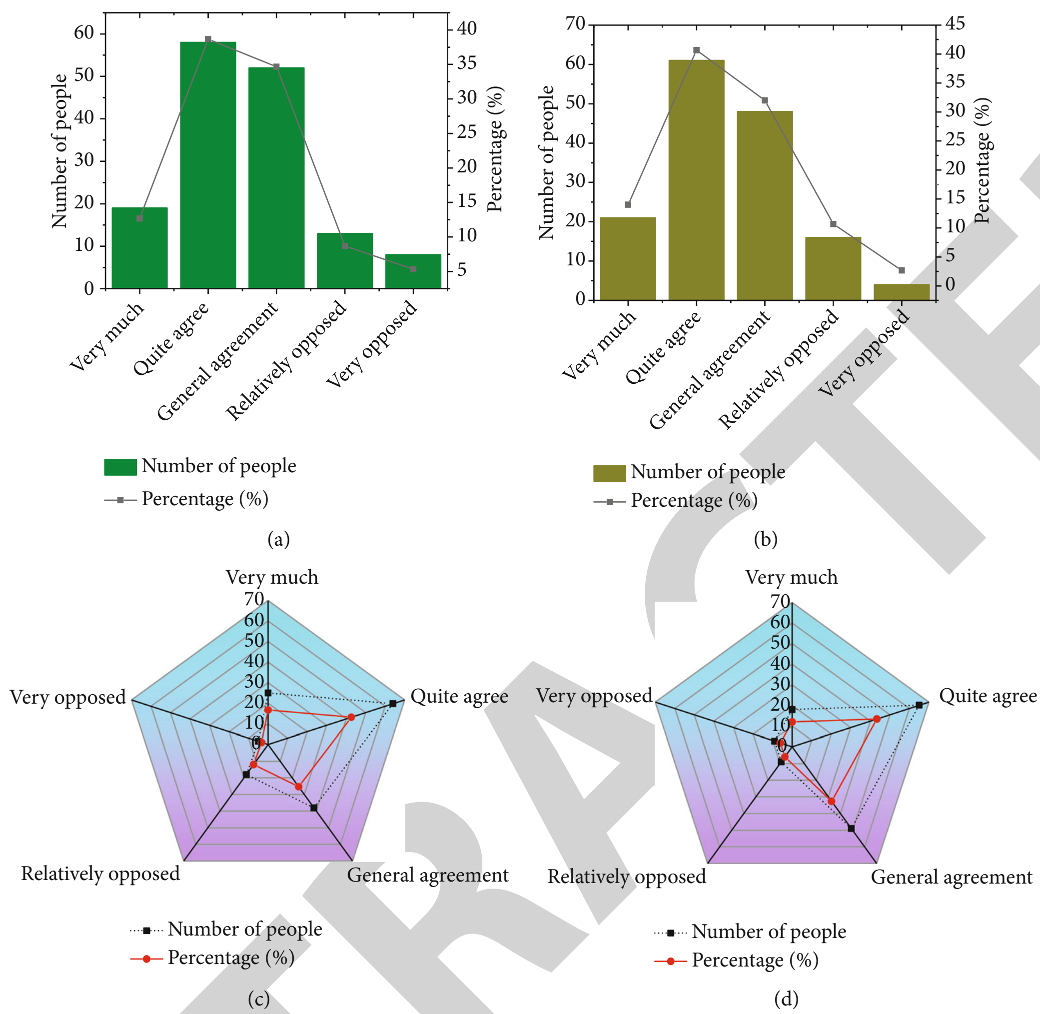

Figure 9: Descriptive analysis results of students' skill cognition: (a) Q6; (b) Q7; (c) Q8; (d) Q9.

cognition is the most stable, and the role of the smart piano in basic teaching is the lowest. The above results show that the development space of smart piano in piano music education is huge. However, at present, universities do not give full play to the maximum potential of smart piano.

3.4. Descriptive Analysis of Specific Questions in the Questionnaire. Figure 8 is a descriptive analysis of all the first small dimension problems. The first small dimension is students' knowledge cognition, mainly Q3-Q5.

Figure 8 reveals that the vast majority of students have a certain degree of understanding of the knowledge of the smart piano. Among them, the sound generation principle of the smart piano is question Q3. However, they are unfamiliar with the theoretical knowledge of smart piano. The option "general agreement," as an uncertainty answer, has a high proportion. Figure 9 is a descriptive analysis of the specific problems of the second small dimension-skill cognition dimension. The problems contained in skill cognition dimension are Q6-Q9.

Figure 9 shows that when referring to the relevant skills of smart piano, the students' overall feedback is relatively good, and they think that some characteristics of the smart piano can make them learn more efficiently. In the "recognization of music scores," more than 50% of students choose a score of 4 or more. Then, the attitude cognition dimension is investigated and analyzed. Figure 10 shows the results. The attitude cognition dimension includes Q10-Q12.

Figure 10 shows that there are three questions in the dimension of "attitude cognition," which reflect students' views on smart piano from different angles. Most people think that the smart piano is quite different from the traditional piano and has little contact at ordinary times. It shows that most students do not take the smart piano as their primary practice tool and are very interested in smart piano development. Then, the course setting is analyzed. The problems contained in this dimension are Q13, Q14, and Q15. Figure 11 shows the results.

Figure 11 shows the course offered. The course setting is an important index to evaluate the school teaching system. In the three questions designed, about 85% of the students choose that school has set up courses related to smart piano, and they are more able to accept this teaching form. However, it is worth warning that the smart piano class that most students take is a collective class, which shows that the use scene of smart piano in colleges has been greatly limited. Figure 12 shows the use of teaching materials, including Q16, Q17, and Q18.

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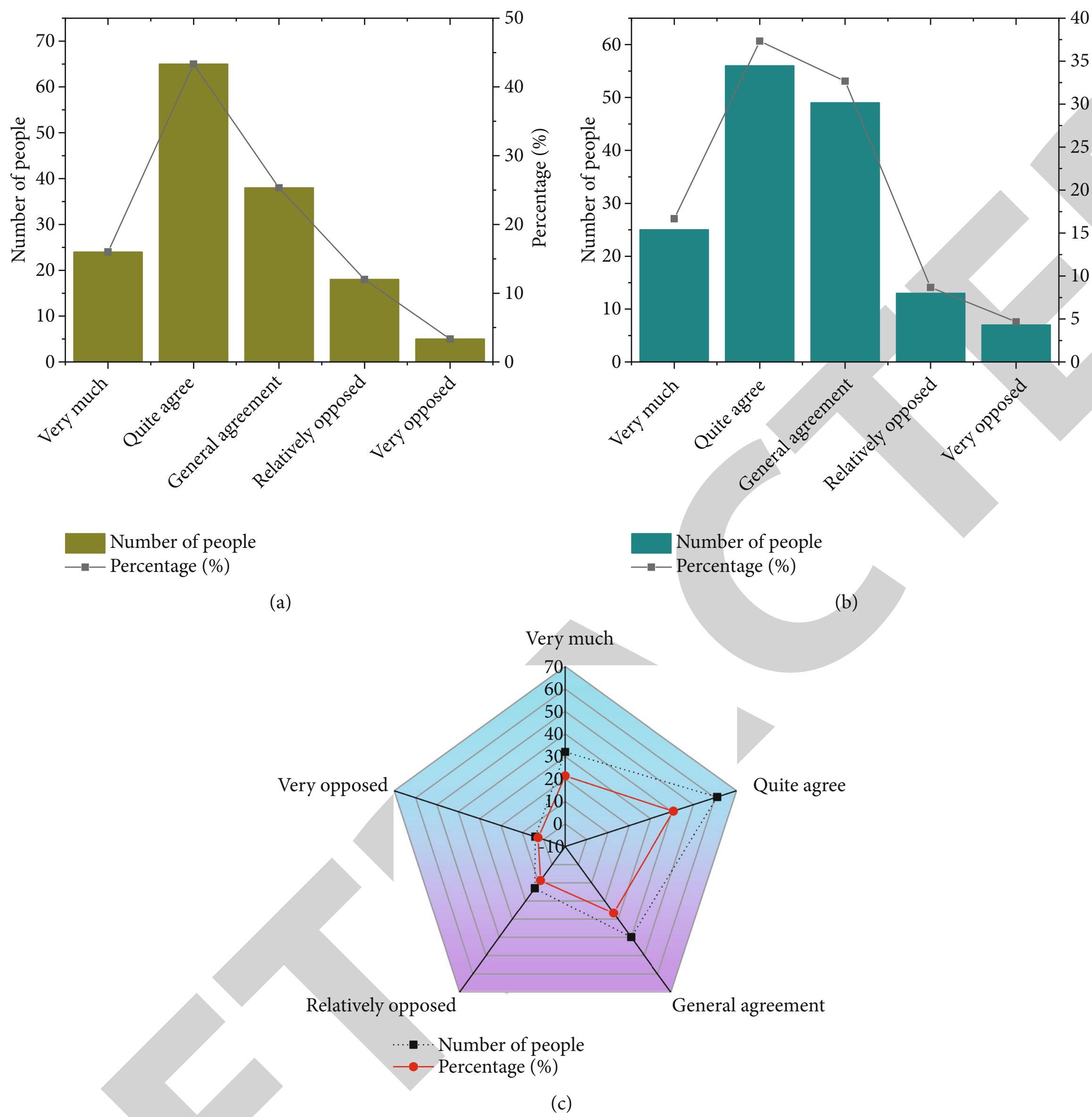

Figure 10: Descriptive analysis results of students' attitude cognition: (a) Q10; (b) Q11; (c) Q12.

Figure 12 shows that the students unanimously give a more positive evaluation in the dimension of textbook use. Most smart piano courses are equipped with special textbooks. The teaching content is also different from the traditional piano, which confirms the limitation of the use scene of intelligent piano in the previous dimension. Smart piano is often used as a "special" musical instrument. Then, the dimension of teaching quality is analyzed, including 7 questions of Q19-Q25. Figure 13 shows the results.

Figure 13 shows that seven questions in the dimension of teaching quality are set, which is the most complex part of the questionnaire. The survey results show that there are some problems in the quality of the smart piano class. They are reflected in the teachers' insufficient understanding of the smart piano course, which leads to the inability to use the corresponding teaching methods to ensure the teaching quality, and cannot fully play the role of the smart piano in the classroom. Most students have sufficient enthusiasm for learning the smart piano course and are willing to actively communicate with their classmates and teachers. Figure 14 shows the analysis of the survey results of teaching equipment, including Q26, Q27, and Q28.

Figure 14 shows that teaching device is a crucial part of smart piano teaching. The rich functions of the smart piano depend on whether the teaching device is advanced or not, but the actual situation is not optimistic. Most students use the old-fashioned digital piano for teaching, although there is a special device to meet their needs. Meanwhile, it also answers the problem in dimension 3 of attitude cognition: students have less contact with the smart piano. Figure 15 shows the analysis results of skill training dimensions.

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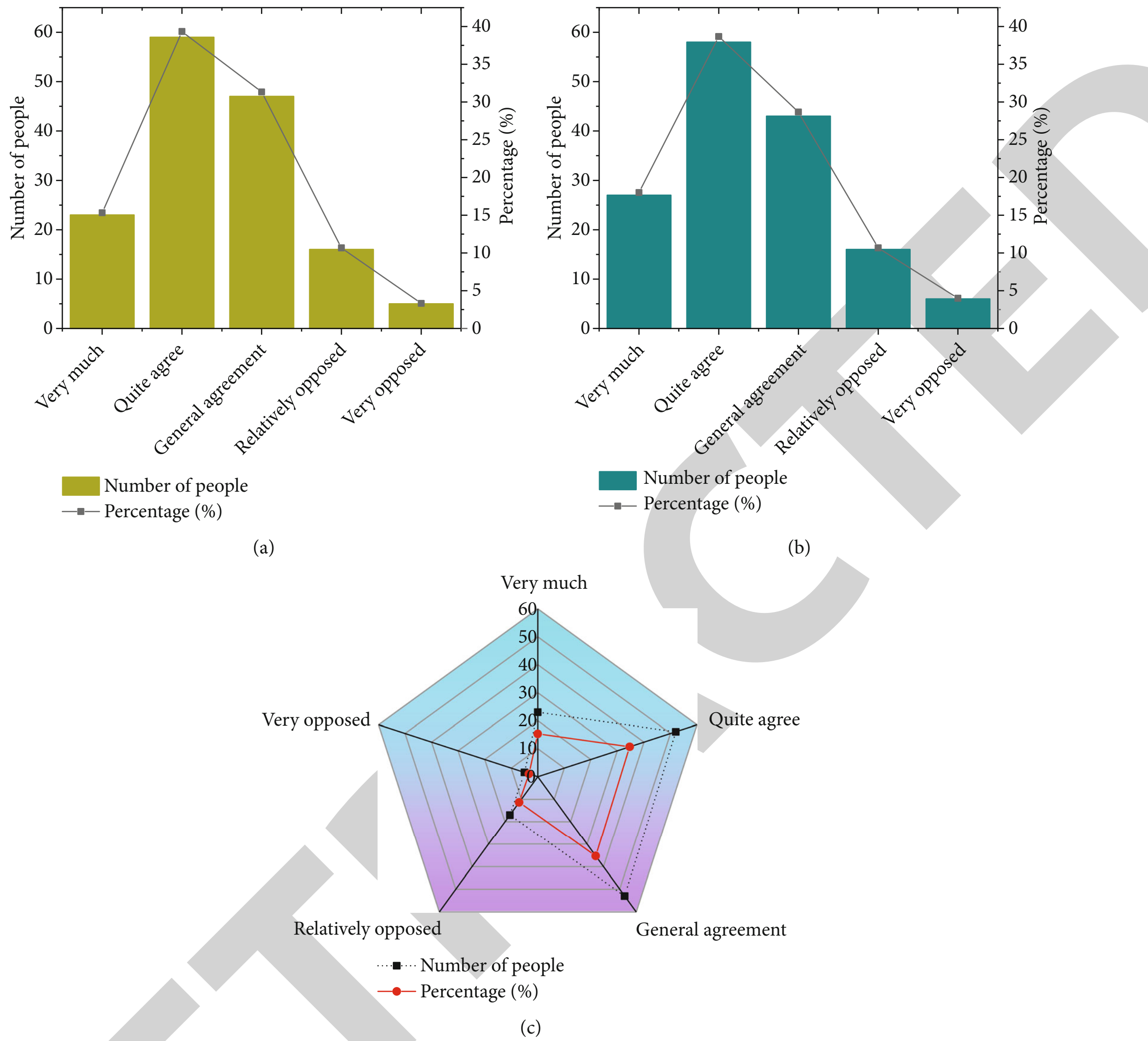


Figure 11: Descriptive analysis results of the course offered: (a) Q13; (b) Q14; (c) Q15.

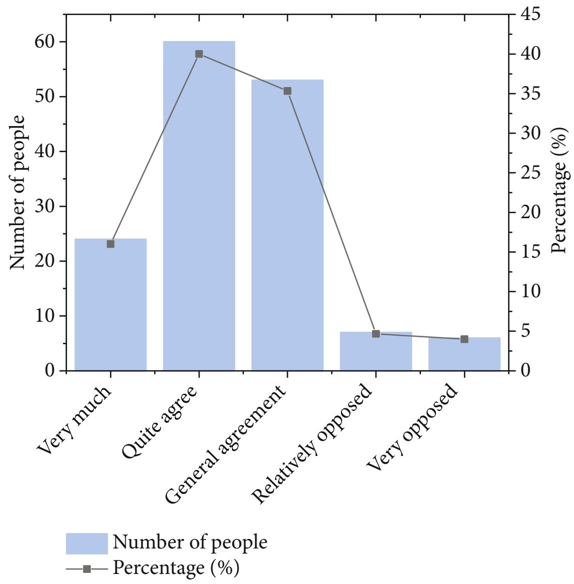
Figure 15 reveals that skill training is the basic part of primary piano teaching, accounting for most of the learners' primary piano learning. The survey results show that most students believe that smart piano plays a certain role in skill training and can help lay a good foundation for their primary piano teaching. Figure 16 shows the result analysis of the psychological training dimension, including Q32, Q33, and Q34.

Figure 16 shows that psychological training differs from the physical training of skill training, which is an invisible and ubiquitous difficulty. Q32: "improving psychological quality" is the item with the highest average score. Q34: "overcoming stage fear" has the least number of people in the high score options, which shows that the psychological training function of the smart piano under normal practice is greater than that during the stage performance. Figure 17 is an analysis result of performance training. This dimension includes Q35, Q36, and Q37.

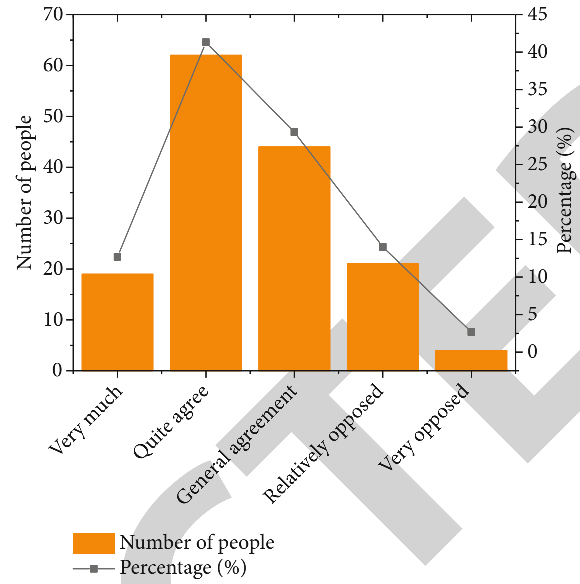
Figure 17 reveals that the dimension of "performance training" has the lowest score in this questionnaire. The low score rate of the three questions (less than 3 points) exceeds 50%. Most respondents believe that the help of smart piano for performance training is quite limited. The conclusion shows that the existing smart piano is not very popular in advanced primary piano teaching, and most pianists and high-level learners are willing to use the traditional piano for this training.

3.5. Difference Analysis. The differences in the learning stage of the three dimensions of teaching cognition (W1), curriculum development (W2), and specific teaching content (W3) are analyzed, respectively. Each dimension is divided into two dichotomous variables. Independent sample t-test is used for test. Table 2 shows the results.

Table 2 shows that the learning stage is a dichotomous variable divided into undergraduate and graduate students.



(a)



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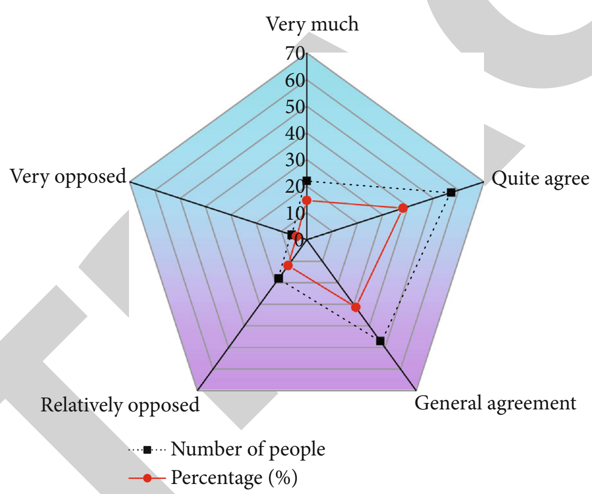

(c)

Figure 12: Descriptive analysis results of the use of the teaching materials: (a) Q16; (b) Q17; (c) Q18.

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Therefore, the independent sample t-test method is used for test. The t values of the role of teaching cognition, curriculum development, and specific teaching contents are -5.872, -6.185, and -8.207, respectively, and the corresponding p values are less than 0.05. This shows significant differences in teaching cognition, curriculum development, and the specific content of teaching in the learning stage. Graduate students' teaching cognition, curriculum development, and specific content of teaching in the learning stage are higher than that of undergraduate students. Then, the major differences of the three dimensions (W1, W2, and W3) are analyzed, as shown in Table 3.

Table 3 shows that major is a dichotomous variable divided into piano major and nonpiano major. Therefore, the independent sample t-test method is used for test. The t values of the role of teaching cognition, curriculum development, and specific teaching contents are -4.857, -5.391, and -5.529, respectively, and the corresponding p values are less than 0.05, which indicates that there are significant differences in the role of teaching cognition, curriculum development, and specific teaching contents. In other words, the scores of nonpiano majors are higher than those of piano majors in the role of teaching cognition, curriculum development, and specific teaching contents.

3.6. Analysis on the Problems of Smart Piano-Assisted Basic Piano Teaching. Music learning should be intellectualized from the aspects of learning process, learning methods, learning means, and learning environment. However, according to the results of the survey, in the current music learning, the smart piano has not achieved the expected results, and it is common for students to question it. At present, smart piano has some effects on basic piano teaching. It is a learning method that students can accept and have a

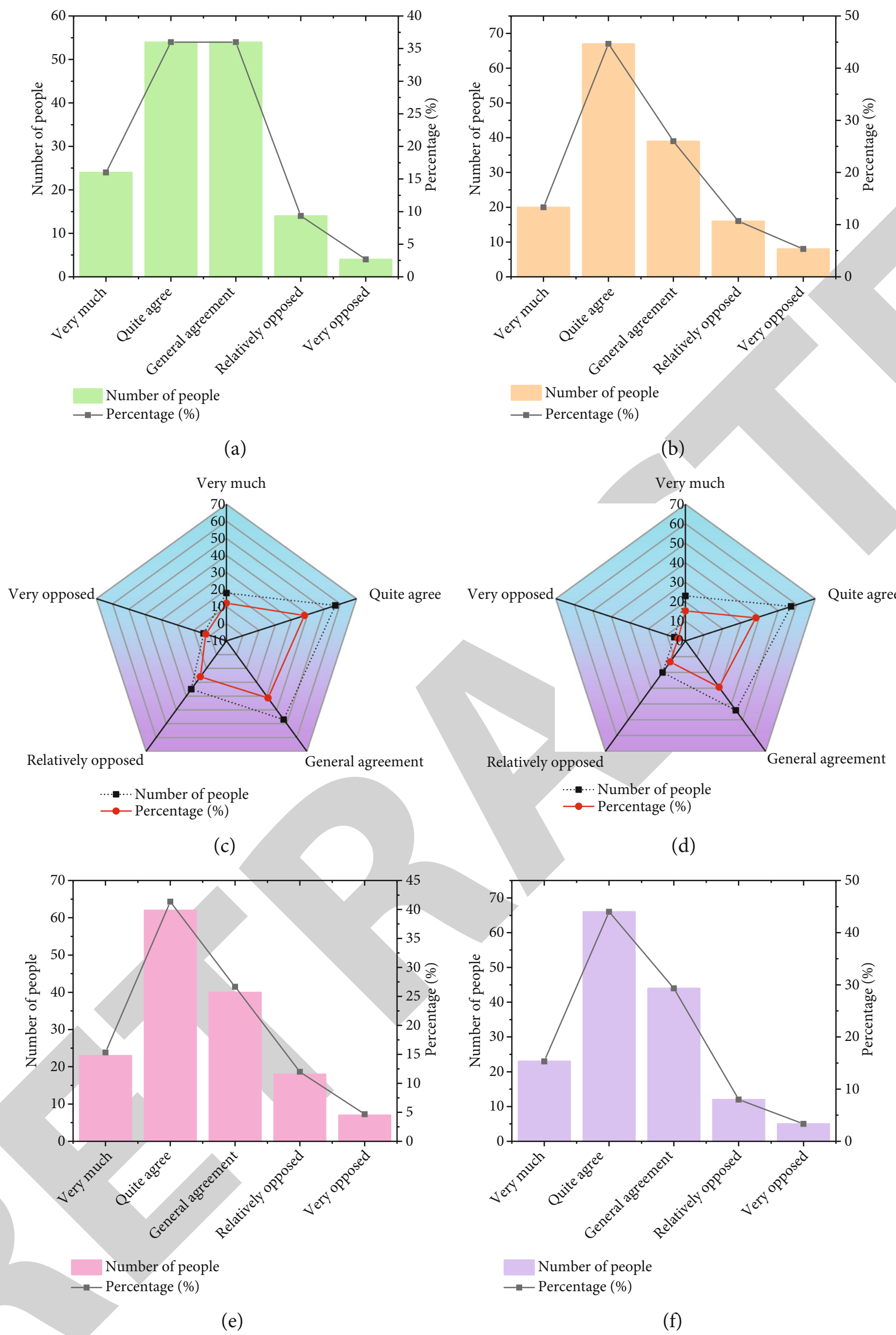

FIGURE 13: Continued.

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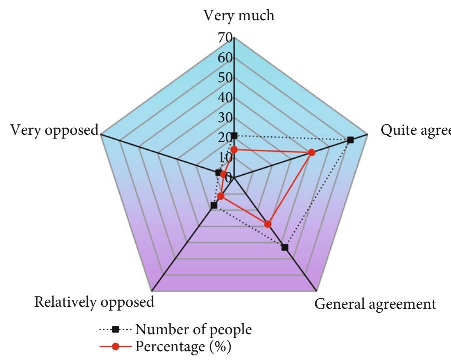
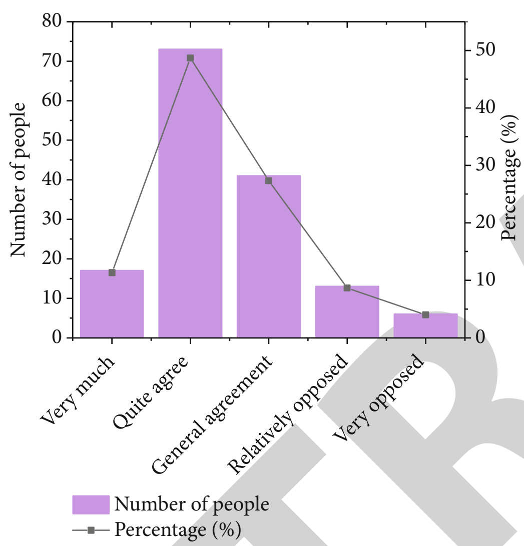
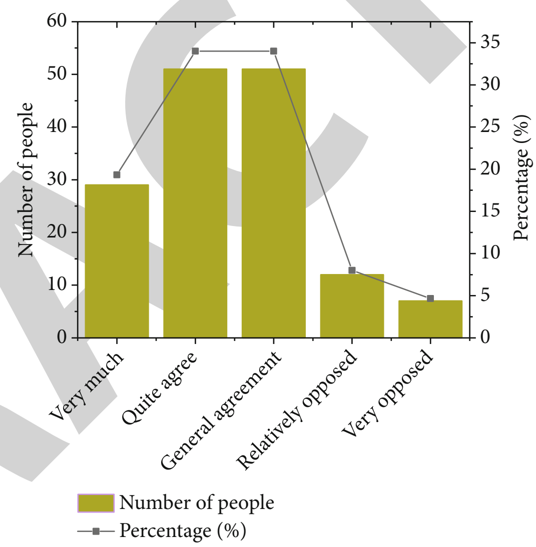


(g)

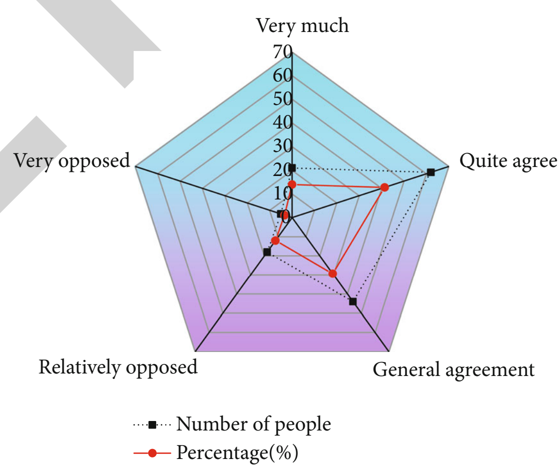
Figure 13: Descriptive analysis results of the teaching quality dimension: (a) Q19; (b) Q20; (c) Q21; (d) Q22; (e) Q23; (f) Q24; (g) Q25.



(a)



(b)



(c)

Figure 14: Descriptive analysis results of the teaching equipment dimension: (a) Q26; (b) Q27; (c) Q28.

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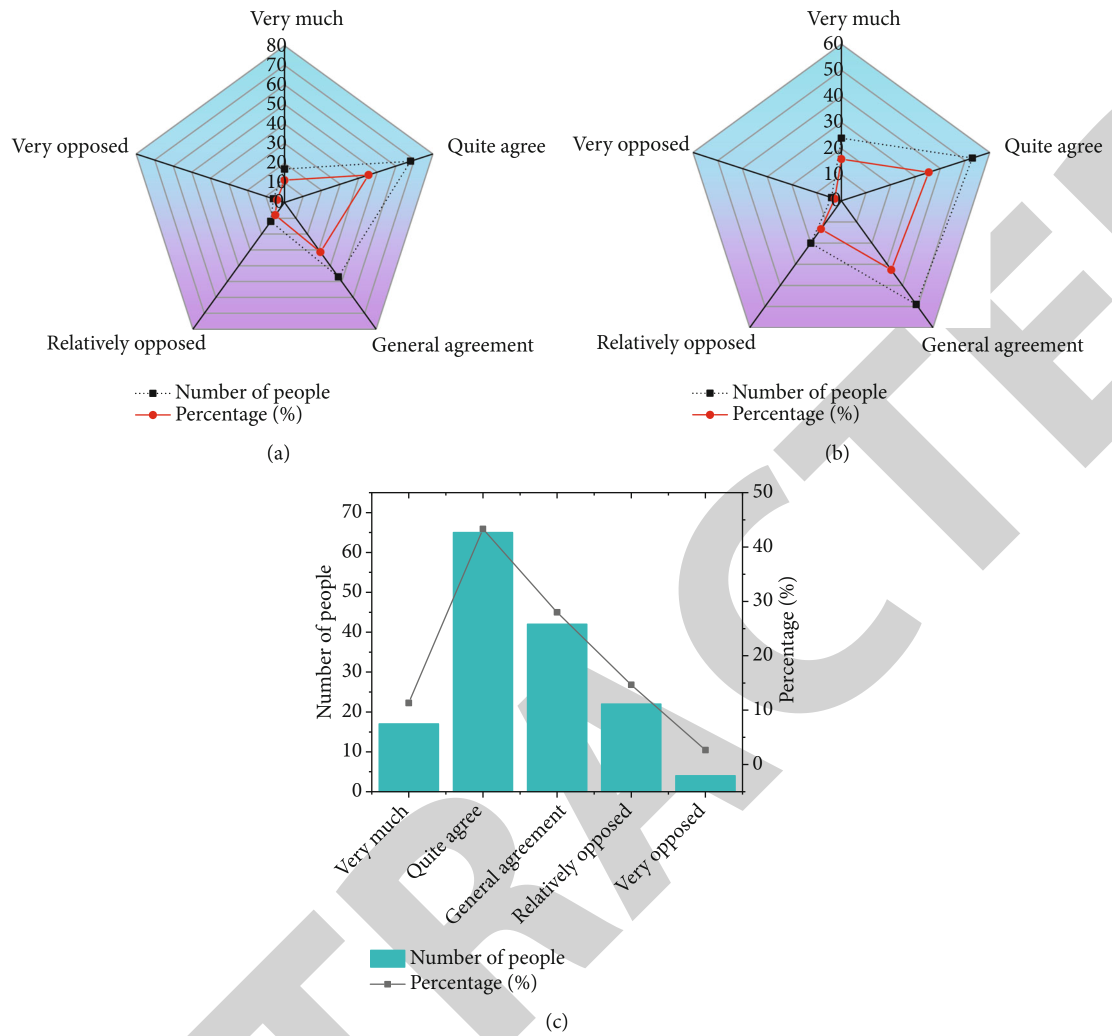

Figure 15: Descriptive analysis results of the skill training dimension: (a) Q29; (b) Q30; (c) Q31.

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promising future. The reasons for the survey results are deeply understood and analyzed from the perspectives of teachers, students, and schools.

(1) *Teacher*. First, teachers have too much pressure on scientific research and heavy teaching tasks in the current teaching form. It is difficult for teachers to conduct detailed research on new theories, especially those they are not familiar with. Under the pressure of scientific research, it is good enough for most college teachers to teach students the professional courses according to their aptitude. The key to intelligent education lies in the proper application of information technology to inspire students' interest in learning. If teachers cannot understand the theory by themselves, the teaching quality will become a big problem. Second, students' different majors and professional degrees are often problems perplexing teachers. When facing students of different majors, different methods bring different effects. According to the questionnaire results, the smart piano courses of the two schools investigated are mainly collective courses. How to balance collective teaching and individual training is a tough thing. For example, for piano majors and nonpiano majors, the method of learning the same work may be completely different. Piano majors can quickly recognize and play music through accumulated experience, while nonpiano majors may spend a lot of time preparing for performance. The function of the smart piano is often more effective for the latter in the face of this situation

(2) *Students*. First, students are not interested in smart piano-related courses, and the conversion efficiency of different forms of learning is slow. Second, students' learning process is lack of continuity, and the actual operation level is lack of rationality. In the survey question: "most of the smart pianos provided by the school are old-fashioned digital pianos," about 90% of the students agree with this view. According to the field survey, in the actual smart piano class, the hand feel of the old digital piano is far from that of the traditional piano, and the keys

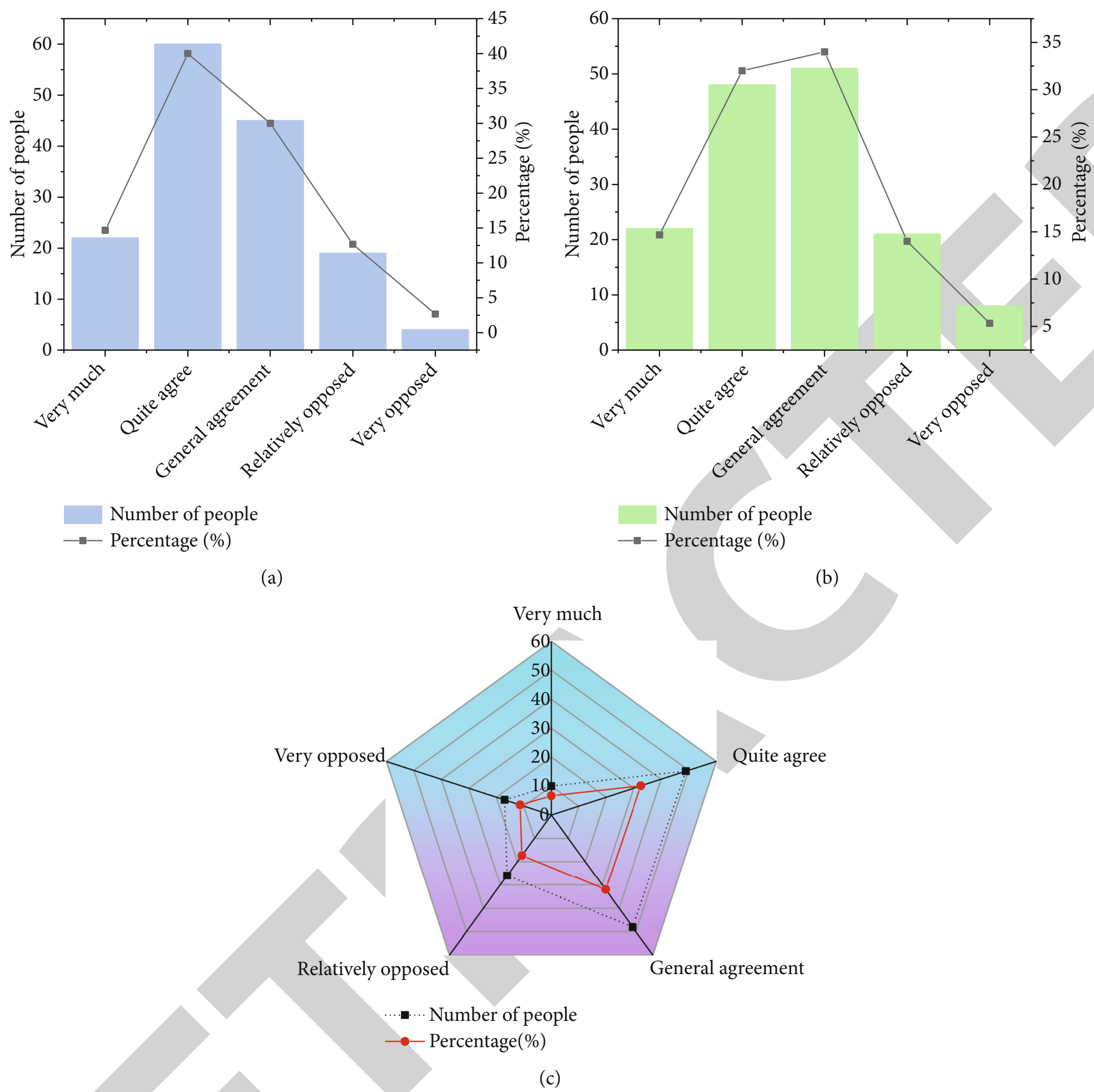

FIGURE 16: Descriptive analysis results of psychological training dimension: (a) Q32; (b) Q33; (c) Q34.

are stiff. Because of the lack of string machine devices, the sound is also very different from the traditional piano

(3) *School*. Funds also restrict the development of the smart piano course. From the perspective of schools, the investment of different types of schools in music discipline is often different. Subdivided into courses, the college's smart piano course also has some problems. At present, the courses related to smart piano mainly focus on impromptu accompaniment and solfeggio, in the form of collective class. However, the college may need to reexamine the setting of specific course contents and teaching methods. Many students feedback that the existing smart piano courses cannot fully play the role of smart piano. Perhaps, smart piano can be applied to more courses, such as orchestration and composition. The teaching ideas and methods in specific teaching are also worthy of further research by teachers to improve the teaching quality

3.7. Countermeasures of Smart Piano in Piano Music Teaching. According to the above questionnaire, the corresponding countermeasures for applying smart piano in music education are put forward as follows.

(1) Teachers should strengthen theoretical study, update and optimize relevant professional knowledge, deepen professional quality, change educational concepts, and combine scientific and technological means to create a music classroom with scientific and technical charm

(2) With the help of teachers, students should actively learn relevant knowledge, dare to innovate, maintain an open vision to look at the development of smart

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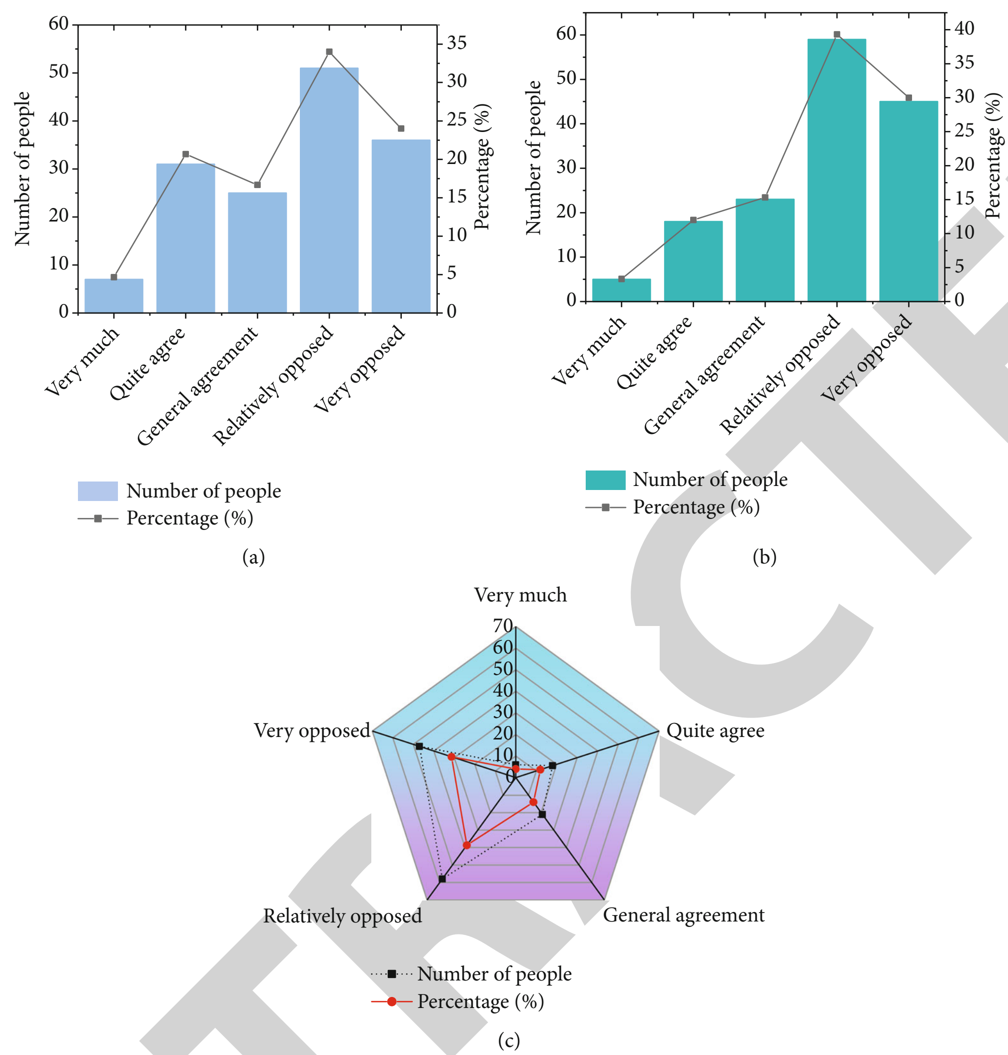

Figure 17: Descriptive analysis results of performance training dimension: (a) Q35; (b) Q36; (c) Q37.

Table 2: Difference analysis of three dimensions in learning stage.

	Learning stage	N	M	SD	t	p
W1	Undergraduate	79	2.16	0.539	-5.872	0.000
	Graduate student	71	2.77	0.703		
W2	Undergraduate	79	2.19	0.481	-6.185	0.000
	Graduate student	71	2.82	0.740		
W3	Undergraduate	79	2.59	0.590	-8.207	0.000
	Graduate student	71	3.40	0.615		

Table 3: Analysis of major differences in the three dimensions.

	Learning stage	N	M	SD	t	p
W1	Piano major	77	2.20	0.545	-4.857	0.000
	Nonpiano major	73	2.71	0.731		
W2	Piano major	77	2.21	0.479	-5.391	0.000
	Nonpiano major	73	2.78	0.765		
W3	Piano major	77	2.68	0.580	-5.529	0.000
	Nonpiano major	73	3.28	0.736		

piano curriculum, and maximize the role of smart piano for their usual learning

(3) Universities should increase investment in smart piano, optimize the course structure of smart piano, accurately locate the role of the smart piano, and reasonably select smart piano equipment according to the actual needs of students

4. Conclusions

Based on traditional piano music education, intelligent music education's theory, methods, and characteristics are expounded. Smart piano education based on AI and Internet is introduced. With two universities in Nanjing as an example, the application status of smart piano in music education is investigated, and the following conclusions are drawn.

(1) Smart piano has a positive effect on the improvement of skill training and psychological training in piano teaching

(2) Smart piano plays a more significant role in basic teaching, but it is not as good as traditional piano in high-end teaching and performance scenes

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

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