**Research Article**

**Application of Composite Nanomaterials in the Teaching of Piano Touch Technology and Timbre Expressiveness**

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The piano is a western musical instrument. The art of piano performance has made great progress in China. Education is essential for the inheritance and development of the arts, including the piano. Piano lessons play an important role in music education and are the foundation of music education. Teachers play a leading role in the learning process. The comprehensive quality of teachers, including ideological and moral accomplishment, cultural accomplishment, work level, teaching theory, and artistic aesthetic level, directly or indirectly affects the teaching level and the growth, learning, attitude, and concept of students. Through the research and experiment on the application of composite nanomaterials in the teaching of piano touch and timbre expressiveness, the experimental data showed that after the improvement of piano touch and timbre performance by nanomaterials, the students’ interest in the piano improvisational accompaniment course has greatly increased. There were 86 people who were interested, accounting for 86.13%. There were 13 people who were not interested and indifferent, accounting for 13.87%. Compared with the increase of 36 people who were interested before the improvement, the number of people, who were not interested and indifferent, was decreased by 36 people. From the abovementioned data, it can be seen that the application of nanomaterials in piano teaching, it has made an indispensable contribution to the development of piano teaching.

**1. Introduction**

In the 1950s and 1960s, China’s piano career flourished, with great progress and development in composition, education, performance, and theoretical research. At the same time, the arrival of Soviet experts enhanced the strength of Chinese piano teachers, and injected new impetus into Chinese music education through the introduction of Soviet educational models, teaching ideas, textbooks, scientific performance methods, and advanced educational theories. All these developments have greatly expanded the Chinese people’s understanding of the Soviet educational model and educational theory, and many world-renowned musicians have come to China to perform and give lectures. As part of cultural exchanges, these activities are very effective in improving the aesthetic level of the Chinese people and improving the performance and singing level of Chinese students. At this time, many Chinese pianists and singers have won awards in international competitions. This is thanks to the excellent teaching of the teachers and the tremendous musical talent and diligence of the students. In addition, the state’s emphasis on talent education and training also contributes to the healthy development of art. Some of these musicians were sent by the state to study or visit, and later this part of the people became the backbone of the Chinese music industry. They have cultivated generations of outstanding talents for China in the fields of composition, performance, and education, and have made great contributions to the development of Chinese contemporary music.

In the 1950s and 1960s, some world-class Chinese pianists emerged in China, some of whom are still active on the world stage today. Why did so many outstanding Chinese pianists emerge during this period? How does music education work? What role did the social environment, family, and personal upbringing play? How do students learn to play the piano and gradually become pianists? What are the implications of this Chinese phenomenon in the 1950s and
1960s for the further development of piano education in China today? These are the questions to be discussed and analyzed in this paper.

In this paper, the teaching research of composite nanomaterials in piano key touch and timbre expressiveness has been carried out. Its data showed that after the optimization of nanomaterials, students’ satisfaction with the quality of the piano has risen in a straight line. There were 90 students who expressed satisfaction, accounting for 90.09%, while only 50% of students were satisfied before improvement. After the improvement, the satisfaction rate was directly increased by 40.09%. From the abovementioned data, it can be seen that the research experiment of composite nanomaterials in the teaching of piano touch and timbre expressive teaching.

2. Related Work

This paper studies some techniques of piano touch and timbre expressive teaching, which can be fully applied to the research in this field. Zhang aimed to study the mechano-acoustic characteristics and properties of the overall relationship between the musical spatial organization and the means of artistic expression formed by the piano in the process of musical practice [1]. Teixeira attempted to uncover the quantitative relationship between the action repetition patterns of a group of clarinet experts and the expressive sound processing they employed in their performances [2]. Zhang discussed how composers use the traditional musical elements of Chinese opera to create a certain kind of dramatic work, and how to reflect the timbre specificity of the sound, the skills of vocal production and recitation, and the image of Chinese musical instruments on the piano [3]. Shubina tried to consider the vocal performance works of the Ukrainian people’s artists from the perspective of the concept of “actual recitation” [4]. The relevance of Sun’s research theme was to demonstrate that the structure and harmonic set of vocal compositions are the relevance of Sun’s research theme was to demonstrate that the structure and harmonic set of vocal compositions are the basis for forming performance thinking [5]. These methods have provided some references for our research, but due to the short time and small sample size of the relevant research, they have not been recognized by the public.

Based on composite nanomaterials, the following related materials were reviewed to optimize the teaching research of piano touch and timbre expression. Akm Iqbal’s research used powder metallurgy to prepare SiC nanoparticle reinforced aluminum matrix composites and studied the effects of compaction load and sintering temperature on the mechanical properties of Al-SiC nanocomposites [6]. Fa et al. mainly developed active photocatalysts based on TiO₂ modified by coupling to ZnO: Mn/SiO₂ (Zn-Si) [7]. Kumar et al. study used coprecipitation method to prepare nano-ZnO particles. By controlling the ratio of ZnO, forced loading, and torque, the nano-ZnO particles were further reinforced with PVDVF on twin-screw composites [8]. Zinchenko and Smetankin analyzed the relationship between the temperature and friction coefficient of epoxy composites and the content of modifiers and fillers [9]. Yang et al. prepared MnO₂/nanocarbon sphere composite powders by three different methods [10]. Chen et al. prepared nano-MnO₂/activated carbon composites by one-step coprecipitation method and characterized them by FT-IR, back titration analysis, and scanning electron microscopy [11]. These methods have provided a sufficient literature basis for the study of composite nanomaterials in the teaching of piano touch and timbre expression.

3. Overview of Piano Touch and Timbre Expressiveness of Composite Nanomaterials

Nowadays, more and more people realize how important it is to learn the piano. Therefore, through the study of composite nanomaterials, the development of piano touch and timbre expressive teaching has been improved to a higher level.

3.1. Overview of Composite Nanomaterials

Nanotechnology is the technology of making and manipulating matter in the nanometer size (1–100 nm) range. Due to the special properties of matter at nanometer size, nanotechnology has been widely used in various fields and has become a symbol of science and technology in the new century [12, 13]. Nanoscale structural materials referred to as nanomaterials for short, refer to materials with at least one three-dimensional size in the nanometer range, or are composed of these materials as basic units. Since the rise of nanotechnology and nanomaterials, people’s cognition of traditional materials science has been constantly refreshed, and human life has undergone revolutionary changes again.

Due to the size of nanometers close to the coherence length of electrons and the self-organization caused by strong coherence, their properties can vary significantly. On the other hand, because of their size close to the wavelength of light, and large specific surface area, they can have some special properties that are different from traditional materials [14, 15]. These properties lead to changes in the melting point, optics, electrical conductivity, thermal conductivity, mechanical properties, and magnetic properties of nanomaterials, making the materials widely used in biology, medicine, energy, environment, communication, construction, paint, optoelectronics, and other fields [16].

There are many ways to prepare nanomaterials, which can be classified according to different classification methods. The main preparation methods include the hydrothermal method, gel method, template method, chemical vapor method, liquid phase precipitation method, sonochemical method, and laser method. Different preparation methods directly determine the type, morphology, size, and properties of nanomaterials. Therefore, suitable preparation methods can be selected according to different needs. Among many preparation methods, the hydrothermal method is widely used in the preparation of nanomaterials due to its simple operation, easily controllable conditions, good particle dispersion and high purity, low production cost, and environmental friendliness. The classification of nanomaterials is shown in Figure 1:
In nanotechnology, nanomaterials with various special properties occupy the foundation and core position. In a general sense, nanomaterials refer to materials with at least one dimension in the range of 1–100 nm, and these materials are used as basic units to constitute some materials with other properties. Nanomaterials science appeared in the public eye as a new branch of materials science in July 1990, marking its birth as a relatively independent discipline [17]. Nanomaterials are classified by material as shown in Figure 2:

Nanomaterials have four basic physical effects that are different from macroscopic objects. In addition, nanomaterials have other effects, such as dielectric confinement effects, surface effects, and quantum tunneling. Therefore, nanomaterials not only have excellent optical, electrical and catalytic properties but also can improve various physical properties of composite materials such as lower melting point, higher strength and hardness, lower density, lower thermal conductivity, and higher diffusivity.

Nanocomposites are nanomaterials with special properties, which are composed of two or more selected and contain a certain number of components and are assembled artificially. Nanocomposites have the following characteristics. They are synthetic rather than naturally formed, and the components and contents are designed and selected by humans. Some of the components contained still maintain their original physical and chemical properties after compounding. Performance is the result of the synergy of the properties of the various components, which can compensate for the shortcomings of the material to achieve better performance. There is an obvious interface between the components [18]. Therefore, nanocomposite materials can make the raw material components play a synergistic advantage through the selection of raw materials, the design of component content and component distribution, and the optimization of process conditions to enable nanocomposites to exhibit new, multifunctional properties.

Nanocomposites are a type of nanomaterials that combine the special properties of nanomaterials. When the size of material particles reaches the nanometer scale, they acquire very special physical and chemical properties that ordinary materials do not possess. These characteristics include quantum size effect, surface effect, small size effect, medium confinement effect, tunnel effect, Coulomb blocking, and quantum tunneling.

Nanocomposites exhibit multiple and new properties due to smaller sizes and diverse compositions, creating broad application prospects for the development of science. Various fabrication processes and techniques are used to synthesize nanocomposites with different functional properties. They are classified according to the state of the synthetic raw materials and can be divided into liquid phase, solid phase, and gas phase methods [19]. According to the state of the reactants, it is divided into dry and wet method. Chemical methods refer to the preparation of nanocomposite materials of atoms, molecules, and ions through planned chemical reactions, mainly including chemical sol-gel method, electrospinning method, hydrothermal synthesis method, and coprecipitation method [20]. The electrospinning device is shown in Figure 3:

Electrospinning is a method in which a polymer solution or molten salt generates a certain polarity charge under the action of a high-voltage electrostatic field, and then the charged polymer solution or molten salt ejects a large number of fibers from the Taylor cone. The electrospinning device mainly consists of four parts: a high-voltage electrostatic generator (such as a positive or negative electrode that charges the polymer solution or molten salt), a spinning system, a spinning liquid supply system, and a receiver.

Nanomaterials themselves have a large surface-to-body area ratio, and it is hoped that they can become ideal materials. One of the focuses of scientific research is to study the properties of nanomaterials. There are three main approaches to this research: theoretical mathematics, scientific experiments, and computer simulations [21]. In the case of solids, the presence of large numbers of nuclei and electrons requires the necessary approximations to handle such large numbers of multiparticle systems. Since the mass of the nucleus is much greater than the mass of the electron, the velocity of the nucleus relative to the electron is very small. In order to simplify the motion of electrons and nuclei, some researchers have proposed adiabatic approximations. Under this approximation, electrons move at high speeds around the nucleus, which is thought to be almost static. Solid state physics can be divided into two parts. One is the movement of electrons in the solid lattice. The other is that the movement of nuclei does not consider the distribution of electrons. Under the adiabatic approximation, the wave function of the system consists of two parts: the wave function of atoms and the wave function of electrons. The wave function is represented by:

$$\psi(r, R) = \psi(r, R_0)\psi(R).$$  

(1)

The movement of the nucleus and electron is treated separately, and it is considered that the electron can closely
follow the movement of the lattice particle. The movement of the electron is related to the instantaneous position of the lattice particle [22]. Under this approximation, the multi-electron problem becomes a problem of solving the single-electron Schrödinger equation, as shown in:

\[ H_0\psi_y = (T_e + V_{\text{ec}} + V_{\text{os}})\psi_y = E\psi_y \]  

(2)

In (2), \( T_e \) represents the kinetic energy of the electron. \( V_{\text{ec}} \) represents the potential energy of the electron. \( V_{\text{os}} \) represents the interaction between the electron and the nucleus, and \( y \) is the number of electron state quantum. The problem of multielectron systems is dealt with under the adiabatic approximation, which is very complex. Therefore, some scholars have proposed a one-electron approximation to deal with this problem. According to the idea of single-electron approximation, the multielectron problem can be transformed into a single-electron problem. Using the one-electron approximation, a single-electron solution is established. Under the one-electron approximation, the wave function of the system can be expressed as:

\[ H\psi(r_1, r_2, r_3 \ldots r_y) = E\psi(r_1, r_2, r_3 \ldots r_y) \]  

(3)

In equation (3), \( E \) is represented by (4) and (5):

\[ E = \int d^3r_1 \int d^3r_2 \ldots \int d^3r_y \left( \sum_{i=1}^{y} \phi_i(r_i) \right) + \sum_{i=1}^{y} \int d^3r_i \left( \sum_{j=1}^{y} \phi_j(r_j) \right) \]  

(4)

\[ E = \sum_{k=1}^{y} \int d^3r_k \left[ \frac{\hbar^2}{2m} + V_{\text{ion}}(r) \right] \psi_k(r) + \sum_{i=1}^{y} \int d^3r_i \left( \sum_{j=1}^{y} \phi_j(r_j) \right) \frac{e^2}{r_i - r_j} \psi_i(r_i) \psi_j(r_j). \]  

(5)

Among them, considering the translation periodicity of an ideal crystal, the abovementioned single-electron problem is transformed into the problem of solving the single-electron motion in a periodic potential field. The Hartree wave function is expressed as:

\[ \psi(r_1, r_2, r_3 \ldots r_y) = \varphi_1(r_1)\varphi_2(r_2) \ldots \varphi_y(r_y). \]  

(6)

Under the Hartree–Fock approximation, the wave function of the system is expressed as:

\[ \psi(y) = \frac{1}{\sqrt{y}} \left[ \begin{array}{c} \varphi_1(r_1) \varphi_2(r_2) \ldots \varphi_y(r_y) \\ \varphi_1(r_2) \varphi_2(r_2) \ldots \varphi_y(r_y) \\ \vdots \end{array} \right]. \]  

(7)

The Hartree–Fock equation can be derived from (7), as shown in equation:

\[ E\phi_i(r) = \left( -\frac{1}{2}\nabla^2 + V(r) \right)\phi_i(r) + \sum_{j=1}^{y} \frac{\phi_j(r)}{|r - r_j|}\phi_i(r) \]  

\[ - \sum_{j=1}^{y} \int dr \frac{\phi_j(r)\phi_i(r)}{|r - r_j|}\phi_j(r). \]  

(8)

On the basis of the inhomogeneous electron gas theory, in order to better consider the interaction between the electrons in the system and effectively describe and express the exchange-correlation potential, the Hohenberg–Kohn theorem was proposed [23]. According to the theorem, the ground state energy functional of the system is as:

\[ E_T(r) = E(p) + \int V(r)\rho(r)dr. \]  

(9)

The energy functional \( E \) can be expressed as equation:

\[ E(p) = T(p) + \frac{1}{2} \int \int \rho(r)\rho(r') \frac{|\rho(r') - \rho(r)|}{|r - r'|} dr'dr + E_{MC}(p). \]  

(10)

In order to determine the specific expression of the density functional, the system density function is constructed by the sum of \( y \) single-particle wave functions. Then (11) can be obtained:

\[ \rho(r) = \sum_{i=1}^{y} \rho_i |\psi_i(r)|^2. \]  

(11)

The Kohn–Sham equation can be derived from the variation as:

\[ \left[ -\frac{1}{2}\nabla^2 + V_{\text{eff}}(r) \right] \psi_i(r) = E_i\psi_i(r). \]  

(12)

The average potential field is used in the Hartree–Fock approximation, ignoring the correlation. At this time, it is necessary to consider the local density approximation and the generalized gradient approximation. The exchange-correlation functional under the local density approximation can be expressed as:

\[ E_{MC}(\rho) = \int \epsilon_{\text{xc}}(\rho(r)|\rho(r)|) dr. \]  

(13)

Under the generalized gradient approximation, the exchange-correlation functional is as:

\[ E_{MC}(\rho) = \int \epsilon_{\text{xc}}(\rho(r), \nabla\rho(r)) dr. \]  

(14)
Compared with the local density approximation, the generalized gradient approximation yields better data for large variations in charge density.

The plane wave is considered to be the most obvious ground state function of the periodic system, and the function in each orbit can be expressed as the sum of the plane wave functions. The one-electron wave function expanded with a plane wave is as:

\[ \psi^k(r) = \sum_i a_{ik} \phi_i \exp(i(k + G)r) \]  \hspace{1cm} (15)

The wave function is analyzed by orthogonalizing a plane wave, namely, as shown in:

\[ \psi_k(y) = \sum_i a_i \phi_i(k, y) \]  \hspace{1cm} (16)

On the basis of the orthogonalized plane wave, a pseudo wave function as (17) is obtained by the variational method:

\[ \psi = \sum_i A_i |r + k_i\rangle \]  \hspace{1cm} (17)

This smooth function weakens the oscillation near the atomic real, and the pseudopotential is obtained as:

\[ V_p(r) = V(l) + \sum_i (E_i - E_j) \langle \phi_i | k \rangle \langle \phi_j | k \rangle \]  \hspace{1cm} (18)

The band structure calculated by the pseudopotential is in good agreement with the experimental results, and the pseudo wave function calculated by the pseudopotential is in good agreement with the real wave function except for the real wave function close to the nucleus [24].

3.2. Overview of Piano Touch and Timbre Expressiveness.

The piano is considered to be a musical instrument with rich artistic expression. The timbre of a piano is the color of the sound produced by the piano. “Color” is a visual effect. The “color” of music is produced by hearing. A famous pianist said: “The color sense of music is highly subjective, but it does exist. The word timbre just describes the inexhaustible acoustic charm that the pianist’s ever-changing finger touch can obtain.” Different sounds have different functions. The timbre of the piano is the artistic color produced by the sound of the piano in the human hearing, and it is a subjective feeling of the human being. Playing a piece of music with the same volume and tune on a piano, if the timbre is different, will produce a painting with the same hue and saturation but with a different hue in a painting. Therefore, the timbre in piano performance, compared with the other three dimensions (pitch, volume, and sound length) of the four attributes of sound in music, is the most attractive sensory attention and touches the depths of people’s souls, which is the most important means of expression to reach the depths of people’s hearts. Similarly, in piano performance, people’s subjective feelings are also a factor to measure the quality of timbre.

The development of piano touch can be divided into two main stages. One is the development of piano touch technology, and the other is the golden period when piano touch reached its peak. The touch keys of the piano have developed with the arrival of the musical age, and the continuous improvement of the piano structure has had a great impact on piano technology. Today, the general piano is composed of strings, percussion devices, and body, and the device closely related to the keystrokes is the percussion device. From the earliest pianos to the appearance of modern pianos, percussion devices have been perfected. The percussion mechanism is a mechanism that converts the performer’s contact with the keys into the movement of the percussion strings, so the tone is largely determined by the performer’s ability to touch the keys. From the Baroque to the modern music of the twentieth century, each musician has his own ideas, his own composition style, his own aesthetic concept, etc. These are the results of different musical trends of their respective eras in different musical contexts. Therefore, different eras and different musicians have different requirements for piano touches [25].

It is important to relax before touching the keys. In physics, free fall is defined as the movement of an object without any resistance, falling only due to gravity. The same is true for the nature of free fall when playing the piano. When playing the piano, the arms should be raised, the elbows, hands, and wrists should be relaxed, not stiff so that the whole arm will fall freely with the shoulder joint as the fulcrum. The fingers should not fall together when touching the keys, and the wrists should be in a low position parallel to the keys while maintaining good arm form. This series of movements complete the relaxation before playing the piano.

Finger touch is the simplest form of touch. The hand is relaxed. The strength of the arm and wrist is naturally concentrated on the fingertips, and only the muscles of the forearm pull the tendons of the fingers to the keys without any external support.

With the improvement of old-fashioned piano craftsmanship, finger touch became the most distinctive feature of piano and music, and a new way of keystroke appeared. Hand touches the keys. That is, the arms and palms are raised over the keys. Then a quick, free-fall motion in which the wrists relax and fingers rest firmly on the keys is performed.

The idea of forearm touch is to feel the hand and forearm as a whole. This way of touching the keys is a symbol of weight. Other things move freely with the elbows for support, and the keys are pushed all the way down by the fingers when the keys are pressed. Wrist muscles are dropped after pressing the keys and feel the entire hand and forearm when pressing the keys. Therefore, when playing slow legato passages, the fingers are pushed forward slightly after pressing the key, and the sound is usually softer and even smoother.

The whole arm touch method is also developed according to the requirements of piano music. It takes the waist as the fulcrum and the whole hand, wrist, palm, and fingers as the unit. The force comes from the shoulder muscles, and the arm directly flows to the fingertips to touch the keys.

The full sequence of piano touch actions includes pre-touch, hold touch (including the effect of finger and pedal
persistence on sound duration and resonance), and key-off (including stop and mute).

By using the piano dampers, the natural decay of the piano sound can be controlled. Without the sustain pedal, the sound stops as soon as the fingers leave the keys. Therefore, after pretapping the key, the finger must remain on the key so that the sound can continue naturally. It is natural that the sound fades away if the fingers rest on the key. The need for tonal perfection evolved, and the nature of the piano as a harmonic instrument made it necessary to expand the number of simultaneous polyphonic notes to create broader and denser harmony. The appearance of the sustain pedal is, in the most important sense, a replacement and extension of the sustaining action. When playing an arpeggio, the sustain pedal is used to simulate all previously executed keys as continuous keys. Many piano students confuse finger hold with pedal extended hold and rely too much on the pedal instead of finger hold, which leads to some musical errors. Therefore, only by correctly understanding the meaning and function of the touch keys can people reasonably choose to achieve the effect of the touch sound through finger sustain or pedal sustain.

Piano touch is known as the art of momentary. That is, the momentary speed of finger contact with the key controls the strength of the connection (headstock amplitude), and then the natural decay time of the sound is controlled by the position of the finger, the sustain, and the resonance of the pedal. In short, the articulation of the piano is a momentary decision, after which it is impossible to change the sound that has been played, but only when to stop. The only way to express the dynamics of musical lines on a piano is to add articulation, expressing dynamic lines through a series of points. For example, modification of long melodies on the piano is usually done by continuous chords or broken chord arpeggios in the accompaniment. It is important to combine dynamic waves at each articulation point with continuous high-density speech through linear changes in sound intensity and texture.

Throughout the history of piano work, there has been a trend towards denser notes and more sounds. This enriches the expressiveness of piano compositions. The denser the pixels, the more imperceptible the change in color and the stronger the effect. To sum up, there are basically three ways to enhance the expressiveness of piano music. First, the number of connections should be increased so that piano music has more connections within a certain period of time. Second, there needs to be an attempt to guide the evolution of each note within the sound, and the interaction between the sounds, in a more subtle and precise direction. Finally, fingers and pedals are needed to adjust the duration, zones, and resonant harmony to meet the artistic requirements of the piece.

### 4. Teaching Effect of Piano Touch and Timbre Expressiveness

#### 4.1. Situation of Piano Teaching.

This section adopted the method of sampling survey to investigate the piano learning situation of 100 students majoring in music in colleges and universities. A total of 100 questionnaires were distributed and 99 were recovered, with a recovery rate of 99%.

The survey of students’ piano learning situation is to conduct a question-and-answer survey on the students’ weekly piano practice time, difficulties encountered in piano learning, accompaniment ability, accompaniment learning situation, and piano quality satisfaction. The survey statistics of students’ weekly practice time are shown in Figure 4:

As can be seen from Figure 4, there were 54 students who practiced piano for only 2–4 hours per week, accounting for 54.45%. A total of 30 students practiced the piano for 5–10 hours a week, accounting for 30.7%. There were also 15 students who practiced the piano for more than 10 hours a week, accounting for only 14.85%. The data showed that students were not very motivated to practice the piano every week, and their emphasis on piano lessons was not ideal. Difficulties encountered by students in piano learning (multiple choices) are shown in Figure 5:

As can be seen from Figure 5, 30 students, accounting for 12%, thought it was difficult to read scores. There were 80 students who thought their fingers were not flexible enough, accounting for 32%. There were 50 students who thought that they had less time to practice piano, accounting for 20%. There were 90 students who thought that the efficiency of piano practice was low, accounting for 36%. In learning the piano and practicing the piano at ordinary times, the students encountered various difficulties. Among them, most students thought that the inflexibility of the fingers and the low efficiency of practicing the piano were the main problems in their usual practice. The students’ improvisational accompaniment abilities are shown in Figure 6:

It can be seen from Figure 6 that there were 5 students who thought they can play well, accounting for 4.94% of the
A total of 60 students could play some after practice, accounting for 60.4%. There were also 34 students who could not play at all, accounting for 34.66%. From this, it is concluded that the students’ impromptu accompaniment ability for the piano is poor, and it is necessary to strengthen the training to improve the students’ impromptu accompaniment ability. The level of interest of students in the piano improvisational accompaniment course is shown in Figure 7:

It can be seen from Figure 7 that 50 students were interested in improvisational accompaniment courses, accounting for 49.5%. A total of 28 students were not interested, accounting for 29.71%. A total of 21 students held an indifferent attitude, accounting for 20.79%. This showed that students’ interest in piano accompaniment lessons needed to be improved. Students’ satisfaction with piano quality is shown in Figure 8:

As can be seen in Figure 8, 50% of the students were quite satisfied with the quality of the piano. A total of 30% of the students were dissatisfied with it, and 20% of the students said it did not matter.
To sum up, there are still many problems in the piano teaching situation in this university, and the school needs to customize improvement plans for these students’ learning situations.

4.2. Use of Composite Nanomaterials in Piano Teaching.
This section optimized the piano teaching problem in the previous section. The piano is optimized with composite nanomaterials to make the touch and tone of the piano more expressive, so as to increase students’ interest in learning. In order to prove that composite nanomaterials have an optimized effect on piano touch and timbre expression, and can improve the teaching effect. This section used the same method as the previous section for investigation and comparison. After the improvement, the weekly practice time of students is shown in Table 1:

| Option        | Subtotal | Proportion (%) |
|---------------|----------|----------------|
| 2–4 hours     | 10       | 9.9            |
| 5–10 hours    | 35       | 34.65          |
| More than 10 hours | 54     | 55.45          |

It can be seen from Table 1 that after improvement, only 10 students practiced piano for 2–4 hours per week, accounting for 9.9%. There were 35 students practicing 5–10 hours, accounting for 34.65%. There were 54 people who practiced for more than 10 hours, accounting for 55.45%. After the improvement of composite nanomaterials, the number of people who practiced the piano for more than 10 hours per week increased by 39 people. It showed that the improved piano touch and the improvement of timbre expression can promote students’ interest in piano practice. After the improvement, students’ interest in piano improvisational accompaniment courses are shown in Table 2:

| Option       | Subtotal | Proportion (%) |
|--------------|----------|----------------|
| Interested   | 86       | 86.13          |
| Uninterested | 6        | 6.44           |
| Indifferent  | 7        | 7.43           |

It can be seen from Table 2 that, after the optimization of nanomaterials, students’ satisfaction with the quality of the piano increased linearly. There were 90 students who expressed satisfaction, accounting for 90.09%, while only 50% of the students expressed satisfaction before the improvement. After the improvement, the satisfaction rate was directly increased by 40.09%.

After comparing the data before and after the improvement, it can be seen that the composite nanomaterials can greatly improve the performance of piano keys and timbre, and play an important role in promoting the development of pianos.

5. Conclusions
The piano is considered to be the king of instruments, not only because of its huge range and full orchestral volume but also because of its rich timbre. Among the factors that affect the changeable timbre of the piano, the problem of key touch has always been a subject of great concern and controversy. Different keystrokes produce different sounds. The theme of music works can be expressed in different ways through different timbres. Therefore, the study of touch technology is closely related to the expressive power of timbre. It can be said that it is difficult to achieve a wide range of tones to express different emotions if the touch keys are not used correctly. Therefore, based on composite nanomaterials, this paper proposes research on key touch skills and timbre expressiveness in piano teaching. The main focus of the analysis is on the strength, speed, and angle of the touch, thus forming the theory of touch and tone expression. The research on the relationship between touch and tone has made a great contribution to the artistic expression of the piano. Through the research on composite nanomaterials, this paper puts forward practical suggestions for the teaching of piano touch and timbre expression, which has important theoretical and practical significance.

Data Availability
The data of this paper can be obtained through e-mail to the authors.
Conflicts of Interest
The authors declare that there are no conflicts of interest regarding the publication of this work.

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