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Evaluation on Multimodal College Music Teaching Mode Based on Interactive Sentiment

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Abstract: The teaching mode of music is a relatively stable and operational curriculum structure and system based on specific teaching concepts and specific teaching purposes. In the process of comprehensively promoting quality education, students' moral cultivation, aesthetic sentiment, and innovation consciousness have been given comprehensive attention. Music, as a main content of humanistic literacy, is widely used as an open elective course in many schools. Judging from the current music teaching, on the one hand, there are problems such as single teaching mode and loose structure; on the other hand, there are problems such as poor basic music skills of teaching objects, unclear teaching purpose, and poor teaching quality. To this end, it is necessary to change the current teaching status and study new teaching modes, so as to further stimulate students' interest in music learning and give full play to the role of music teaching in aesthetic education. Based on the multi-modality of interactive sentiment analysis, this paper studied the music teaching mode in colleges and universities. Through the research, students' interest in music learning has increased by 6.83%.

1. Introduction

In the practice of music teaching, teachers' teaching activities are of great significance. However, due to the long-term constraints of the concept of exam-oriented education, the importance of music as a basic course in promoting students' all-round development has been ignored, resulting in music courses have been marginalized in the education system and cannot fully mobilize students' subjectivity, enthusiasm and interest. Music education has a positive effect on the comprehensive education of students to promote the all-round development of students, but this effect is difficult to play. This paper took the multi-modal college music teaching model of interactive sentiment analysis as the main content and analyzed the current situation of music education, and proposed some measures.

In music education, music teaching mode is becoming more and more important. Wang P analyzed the current state of music education. On this basis, the innovation strategy of the music teaching mode led by artificial intelligence was expounded [1]. Fan B believed that the music teaching model under the Internet + MOOC + mobile terminal is an interesting online learning and teaching method, which can generate the benefits of famous teachers and social influence and is conducive to fragmented learning and mobile learning, and enhances the inheritance of music culture, so as to realize teaching regardless of society and promote the formation of educational big data [2]. Wei M A believed that the traditional teaching mode is difficult for students to understand the content of music teaching. On the basis of romanticism, the music teaching mode is innovated from three aspects: teaching method, teaching content and teaching characteristics [3]. Shan L I proposed that the teaching model has made great innovations in teaching methods, teaching content, and role-playing for teachers and students, breaking the impression of traditional music teaching models. School music education has its own particularity, focusing on practical teaching. Taking into account the differences in students' music foundation and learning ability, the teaching mode of teaching students according to their aptitude has become a teaching method in school music teaching [4]. Jing C took the development of students as the main body and closely followed the four aspects of knowledge, science, practicality and innovation and the basic laws of music discipline and education, and explored new ideas for the development of music courses, so as to optimize, integrate and expand new courses, and establish art A practical platform and a scientifically standardized music teaching model [5]. Zhang M believed that the development period of the public music teaching model is relatively short, and there is still a lot of room for development. Therefore, the current situation of public music teaching was analyzed, and the construction of music teaching mode with aesthetics as the core was further discussed [6]. Ruijun S U put forward some tentative ideas and solutions for the functional reform of "Internet +" in music teaching and the construction of new teaching models, so as to realize the effective combination of teachers in teaching and Internet technology, and make the music teaching model more diversity [7]. Although there are abundant researches on music teaching mode, there are still problems in music education.

Multimodality was used in many fields. Cheng X proposed a new method for heart sound biometric characterization based on multi-modal and multi-scale dispersion entropy. Multi-modality is effective for heart sound biometric recognition [8]. Andersen R A proposed that multimodal sensory signals as well as efferent replicated signals from motor structures converge in the posterior cortex to encode the spatial location of moving objects [9]. Serfaty J M described a technique that allows to extend unimodal function optimization methods to efficiently locate all optima for multimodal problems [10]. Jr N M presented specific solutions to the problem of multimodal text analysis and transcription for websites and movies. Therefore, it constituted a much-needed course in multimodal text transcription and analysis, and also proposed how multimodal discourse analysis can help educators and students understand how meaning can be created in an e-learning environment [11]. Srivastava N believed that multimodality is characterized by different statistical properties. A deep Boltzmann machine was proposed to learn generative models for such multimodal data. This model can create fused representations by combining features across modalities [12]. Torm M discussed various scenarios that may arise in multimodal biometric systems, reasonable levels of fusion, and integration strategies that can be employed to integrate information [13]. Raphael K analyzed the multimodal interactions of people speaking and writing to simulate dynamic map systems. Task analysis showed that multimodal interactions occurred most frequently during spatial orientation commands and moderately during selection commands. A long-term goal of research is to develop predictive models of natural modal ensembles to guide the design of emerging multimodal architectures [14]. Although there are many fields of multimodal

application, there are still some problems to be solved in the application of multimodality.

The teaching mode is a breakthrough, and teaching research should be strengthened. In the process of music education, combined with students' hobbies, their physical characteristics and their learning psychology, comprehensive and optimal music education is carried out, and music with correct orientation, positive energy and distinctive artistic style is introduced into teaching, in order to reverse the current educational form and teaching situation and establish a new educational method that conforms to the characteristics of students, and make music education play a good role in aesthetic education.

2. Evaluation on Music Teaching Mode

(1) Interactive sentiment analysis music level features

When everyone enjoys music, there would be an emotional response, which is a special information obtained by the music itself. After a series of reactions in the brain, it is finally reflected through facial and mental sensations. If human beings are regarded as a computer processing system, the process of music processing is as follows: first, the characteristic information of music is obtained by enjoying music, and then this information is sent to the brain. The brain changes and transforms this information through various existing knowledge of musicology, psychology, etc., and then obtains the emotional information of music and transmits it to the brain, and finally displays it through external emotions. Such a process exists for every listener. Interactive sentiment analysis music hierarchical features are shown in Figure 1.

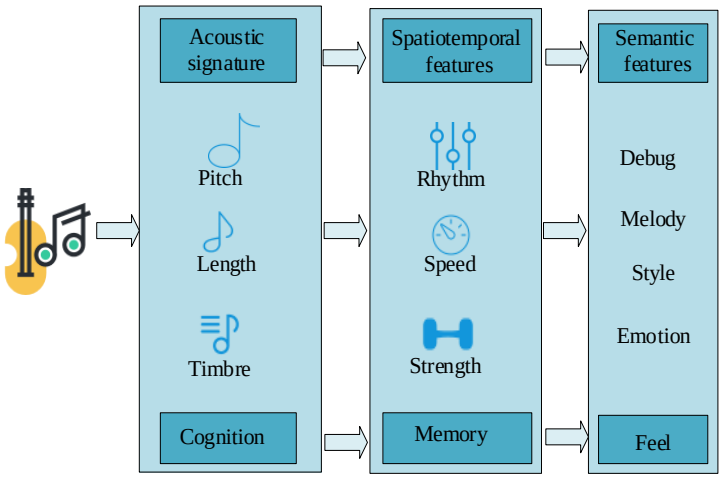

Figure 1. Interactive sentiment analysis music hierarchical features

For composers, music is a form of output, and composers express their emotions in a special way. Therefore, the production of music itself has subjective characteristics, and it is a reflection of the composer's subjective emotions. Psychological studies have shown that human interactive emotion and cognitive assessment activities are closely related [15]. In the process of appreciating music, it cannot be ruled out that it would intervene in personal thinking. While human beings appreciate music, the brain is active rapidly. Therefore, at the moment when the listener has an emotional experience, there is already the intervention of the personal consciousness. The process of human

beings acquiring musical emotions is also perceived by their own brains, their own experiences, and their own understanding, and this process itself is also highly subjective.

The expression of music in the external world is achieved through the medium of intuitive analogy. This determines that when the composer expresses the same content, he must master the corresponding relationship between the expressed content and the musical form. In other words, pure musical emotion does not exist, and emotion is meaningful only when it is connected with people. However, everyone has different feelings for the same emotion. Therefore, in order to convey the emotional experience of music to others, it is necessary to represent music through a specific set of rules and symbols, and in different music, the same rules and symbols represent the same emotional expression.

Listeners have a different level when they experience the emotional experience of music. The first level is the lower notes and the second is the musical level. Finally, there is the emotional level. After this process, music can be transformed into the listener's psychological feelings. If the listener has the ability to create, then these feelings may become the basis for re-creation after the creator's second brewing. When appreciating music, the listener first comes into contact with the sound of the music, that is, the pitch, length, intensity, etc. of each sound. In the process of appreciation, by transforming and remembering these characteristics, an isomorphic connection would be created with the psychological experience generated by a specific object stored in the brain. Finally, the listener enriches and concretizes the object associated with the music, and makes certain thinking and reasoning about the rhythm, speed and other characteristics of the music, and finally evolves into the listener's feeling of the music.

Human emotions are changing all the time. It is like sea water, sometimes quiet and sometimes surging. When listening to music, the movement of this emotion would be more intense. It is like sea water propelled by the wind, undulating with the speed of the wind. In the whole musical work, the emotions expressed also exist in the movement process on the time axis. The level, rhythm, and speed of music are constantly changing, and it is these changes that are used to reflect emotional changes. When listening to music, the mood would change with the movement of the music, thus forming a magnificent curve. Therefore, music is characterized by complex interactive emotions and multi-dimensional and multi-level structures.

(2) Systematic analysis of teaching activities

A system refers to an organic collection with special functions formed by multiple interconnections and mutual influences. Teaching is a composite system consisting of teachers, students, content and means. In teaching, teachers and students are two important subjects. They are related to each other by means of communication. Teachers are responsible for teaching knowledge, and students are also responsible for asking and giving feedback. In general, teachers are composed of specific teaching and research group members, and students are composed of specific learning groups. The model of education is the content of education. The content of education is centered on the purpose of the course, and the content mainly includes knowledge, ideas, emotions, etc. The purpose of the course is the central element of the object, which usually refers to the strength of cognition, quality and ability. Here, this course is differentiated from the overall and musicology course objectives compared to the related educational content. The content of education is attached to the physical object and manifested in various forms. When constructing teaching or carrying out teaching design, suitable teaching carrier forms can be selected or manufactured. In addition to the above factors, the teaching environment composed of different software, hardware, environment, human environment and other factors would also have a certain impact on the effect of teaching. The system element structure of teaching activities is shown in Figure 2:

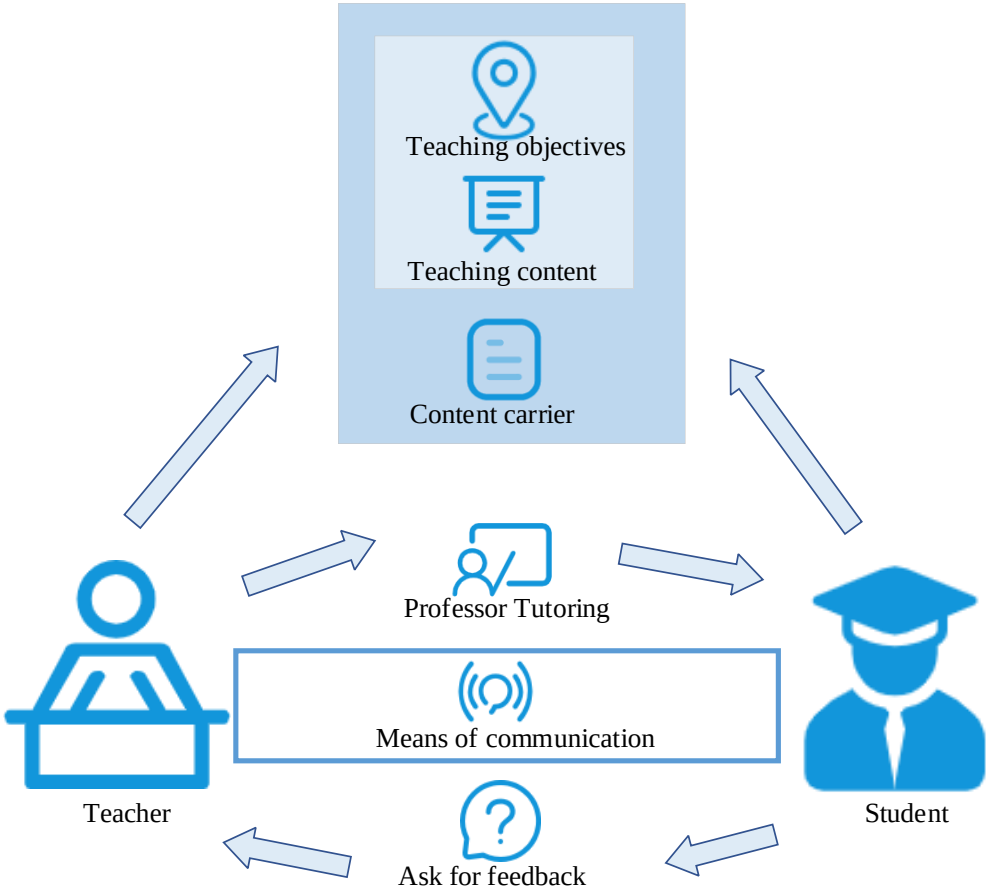

Figure 2. Systematic analysis of teaching activities

The components of teaching behavior are the basic systems for constructing educational models, and different educational methods reflect different contents. For example, some models emphasize the role of teachers, some models emphasize the initiative of students, some models rely on changes in teaching content, and some models focus on changes in educational means [16]. Therefore, when constructing a teaching model, it should be carried out according to the needs of educational concepts and in combination with the specific circumstances of each factor.

3. Interactive Integrated Teaching Mode

According to the actual situation of school music appreciation teaching, based on the idea of "interactive synthesis", the professional music teaching mode of "interactive synthesis" is adopted. Combined with the principle of graded culture, three corresponding forms of expression are designed. Music education in higher vocational schools pays attention to students' curiosity, thirst for knowledge and desire to express, and guides students to carry out music teaching by using factors such as network resources, occupational needs, and creating situations. There are three main teaching modes: Internet-based self-guided, vocational training-exploration, and music popularization experience-practice. In this model, the three kinds of motivation and interaction synthesis are combined with each other, but they have their own emphasis in the form of expression. In addition, guidance, inquiry, and practice mainly refer to teachers' guidance strategies and implementation methods, and the interactive comprehensive teaching mode is shown in Figure 3.

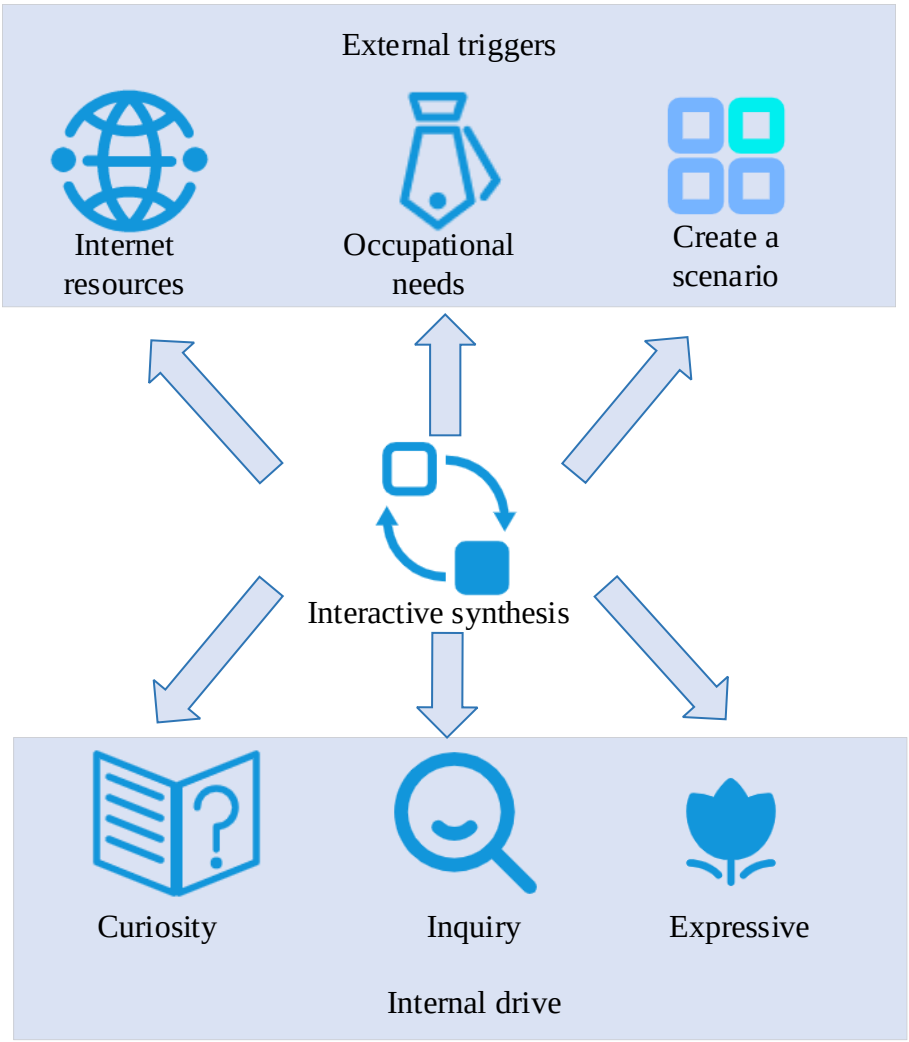

Figure 3. Interactive integrated teaching mode

4. Multimodal College Music Teaching Mode Algorithm Based on Interactive Sentiment Evaluation

1) Spiral model

Based on the spiral model, a feasible and efficient calculation can be provided for the analysis and processing of music information [17]. Because the model can compress the information of the sound into a part of a space, it can dynamically track the music signal.

The origin of the coordinates is taken as the center in the space, with r as the radius and h as the height of a quarter circle. A spiral that goes up in a clockwise direction, that is, in a counterclockwise direction, is expressed by a system of formulas as:

$$\begin{cases} a = r\sin w \\ b = r\cos w \\ c = hw/(\pi/2) \end{cases} \quad (1)$$

2) Pitch

In this spiral model, pitches are represented by points on the spiral [18]. Adjacent pitches are related by a simple five-tone scale, which is defined as:

Definition 1: the radius r of the cylinder and the height h of the quarter turn are where a pitch is determined:

$$P(d)^{def} = [a_d, b_d, c_d] = \left[r\sin\frac{d\pi}{2}, \cos\frac{d\pi}{2}, dh \right] \quad (2)$$

Therefore, the fourth pitch after each pitch can be perpendicular to the direction of this height in this spiral model, representing a major third. There are:

$$P(d+4) = P(d) + 4H \quad (3)$$

Definition 2: position $C_N(d)$ of a major triad is the weighted average of the positions of its root, fifth, and third.

$$C_N(d)^{def} = t_1 \bullet P(d) + t_2 \bullet P(d+1) + t_3 \bullet P(d+4) \quad (4)$$

Definition 3: position $C_n(d)$ of a minor triad is the weighted average of its root, fifth, and third positions.

$$C_n(d)^{def} = \varepsilon_1 \bullet P(d) + \varepsilon_2 \bullet P(d+1) + \varepsilon_3 \bullet P(d-3) \quad (5)$$

Definition 4: major $T_N(d)$ is represented by a weighted average of tonic $C_N(d)$, dominant $C_N(d+1)$ and subdominant $C_N(d-1)$.

$$T_N(d)^{def} = \alpha_1 \bullet C_N(d) + \alpha_2 \bullet C_N(d+1) + \alpha_3 \bullet C_N(d-1) \quad (6)$$

Definition 5: minor $T_n(d)$ consists of tonic $C_m(d)$, major dominant $C_N(d+1)$, and minor dominant $C_n(d+1)$.

$$T_n(d)^{def} = \sigma_1 \bullet C_m(d) + [\delta \bullet C_N(d+1) + (1-\delta) \bullet C_m(d+1)] + \sigma_3 \bullet [\beta \bullet C_m(d-1)] \quad (7)$$

Definition 6: if F_j represents the position of the j pitch in the spiral direction, then the persistence of this pitch is represented by g_i. In the case of the i pitch, the center of the sound effect is represented as:

$$q_i^{def} = \sum_{j=1}^{i} \frac{g_i}{D} \bullet F_j \quad (8)$$

$$D = \sum_{j=1}^{i} g_i \quad (9)$$

Definition 7: if the set of tones is used to represent the tones in the spiral space, it can be defined as:

$$G = \{G_m(k) \forall k\} \cup \{G_m(k) \forall k\} \quad (10)$$

In practice, since the pitch index is already centered on 0, a complete set of tonalities can meet the requirements, namely:

$$G = \{G_m(k) | k \in [-6,5]\} \cup \{G_m(k) | k \in [-6,5]\} \quad (11)$$

Definition 8: after the occurrence of the first pitch event, the most probable key at present can be

defined as:

$$g_i = \arg\min_{g \in G} \|c_i - g\| \quad (12)$$

Melody area method is a unique feature extraction that divides the music from time to time, which can comprehensively reflect the energy trend of the music.

According to the length and pitch characteristics of the notes, the melodic area is defined as:

$$\text{Area}_x = Pitch_x * Duration_x \quad (13)$$

Among them, Area_x indicates the sounding area of the x note; $Pitch_x$ indicates the pitch of the x note; $Duration_x$ indicates the length of the x note. Therefore, the melodic region of the entire piece can be expressed as:

$$\text{Melody Area} = \text{Area}_1 + \text{Area}_2 + \Lambda + \text{Area}_n \quad (14)$$

Adding a note's intensity, the note's energy is expressed as:

$$power_x = \{Area_x, Dynamic_x\} \quad (15)$$

In the formula, $Dynamic_x$ represents the duration of the x note.

3) Identification of the main melody

After the music is segmented, the features to be considered ignore the accompaniment information, and extracting the main track of the main melody from different tracks is a prerequisite for music emotion analysis [19].

For each audio track of the file, the extracted feature quantities are:

① Average strength (A_1)

In music, the main melody has higher average power than other parts. Therefore, to compare the energy values of individual orbitals, an eigenvalue can be specified for each orbital to represent the average intensity [20].

$$A_1(d) = \sum_{x=1}^{C} \frac{vel(d,x)}{C} \quad (16)$$

In the formula, d represents the track number; C represents the number of notes in the d track; $vel(d,x)$ represents the sound intensity value of the x note in the d track.

② Pronunciation time (A_2)

$$A_2(d) = \sum_{x=1}^{C-1} [note_{x+1} \cdot end - note_x \cdot start] \quad (17)$$

③ Melody area (A_3)

The combined effect of pitch and duration is represented by the melody area. The definition is the same as that of the melodic area used for section division.

$$A_3(d) = \sum_{n=1}^{C} [note_x \cdot pith * note_x \cdot duration] \quad (18)$$

The feature quantities are combined enough to highlight the characteristics of the main audio track. Therefore, the main audio track approximation degree function $T(d)$ of the d audio track in the definition file is:

$$T(d)=\sum_{n}^{m} a_n * A_n(d) \quad (19)$$

Among them, a_n is the weight of the track feature quantity A_n.

The strength of playing music is also an important means of emotional expression, and strength is a symbol of strength. The formula is used to calculate the dynamics of music:

$$Dyn=\frac{1}{m}\sum_{i=1}^{n} dynamic_x \quad (20)$$

The beat of music is the fundamental element of musical melody and is often likened to the structure of music. Rhythm is a phenomenon formed by the different lengths of notes, and its related formula is:

$$Rhy=\sum_{x=1}^{m-1}\left|\frac{I_{x+1}-I_x}{T_i}\right| \quad (21)$$

5. Evaluation on Multi-modal College Music Teaching Mode of Interactive Sentiment

This paper proposes a multi-modal college music teaching model based on interactive sentiment analysis, and selects College A as the survey content. The experimental results are analyzed from six aspects: satisfaction with music teaching materials, teaching methods of music lessons, cognition of music learning, participation in music activities, views on improving music education, interest and enthusiasm in music learning.

(1) Satisfaction with music teaching materials

Regarding the satisfaction of teaching materials, the survey is conducted from four aspects: very satisfied, quite satisfied, generally satisfied and dissatisfied. The results are shown in Table 1:

Table 1. Satisfaction with music textbooks

	Very satisfied	Quite satisfied	generally satisfied	dissatisfied
2017	7.94%	12.35%	45.21%	14.62%
2018	8.13%	13.85%	43.85%	14.11%
2019	10.41%	14.52%	42.18%	12.57%
2020	11.69%	17.53%	40.53%	9.92%

In Table 1, from 2017 to 2020, students' satisfaction with teaching materials continued to increase, and their dissatisfaction gradually decreased. Among them, the very satisfaction of music textbooks increased by 3.75%; the comparative satisfaction increased by 5.18%; the general satisfaction decreased by 4.68%; the dissatisfaction decreased by 4.7%.

(2) Teaching mode of music class

Aiming at the teaching mode of music class, the research is conducted from multimedia appreciation of music, explanation of music works, interdisciplinary research, classroom discussion, music practice, and other aspects. The specific results are shown in Figure 4.

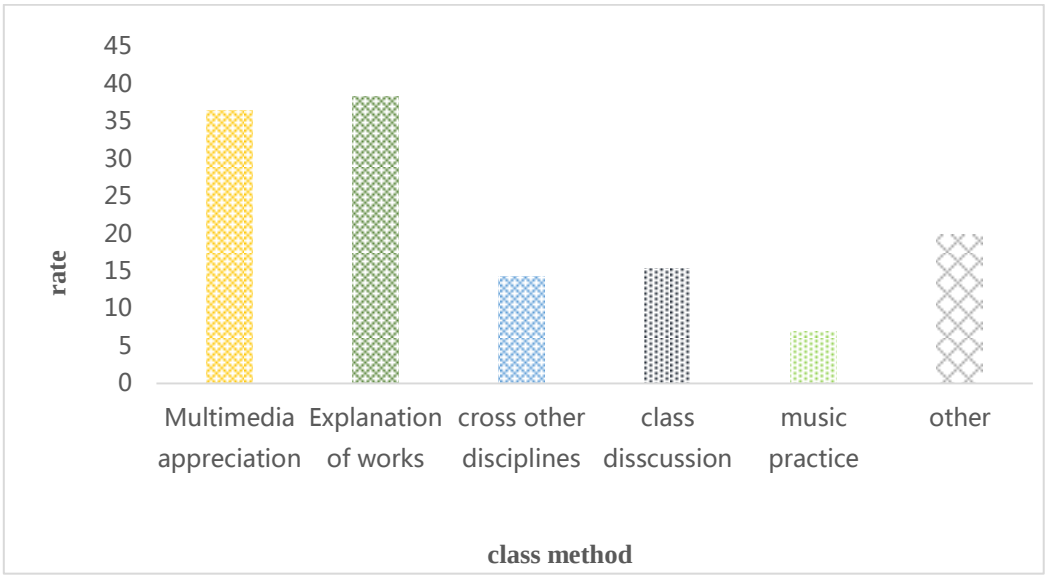

Figure 4. Music teaching mode

As can be seen from Figure 4, in the teaching mode of music class, multimedia appreciation of music and explanation of musical works are relatively used in teaching, and music practice teaching mode is relatively rare.

(3) Cognition of music learning

Cognition of music learning affects students' enthusiasm for music learning. According to the students' cognition of music, the investigation is carried out from the aspects of music knowledge, cultivating sentiment, enriching their comprehensive quality, and other four directions. The results are shown in Figure 5.

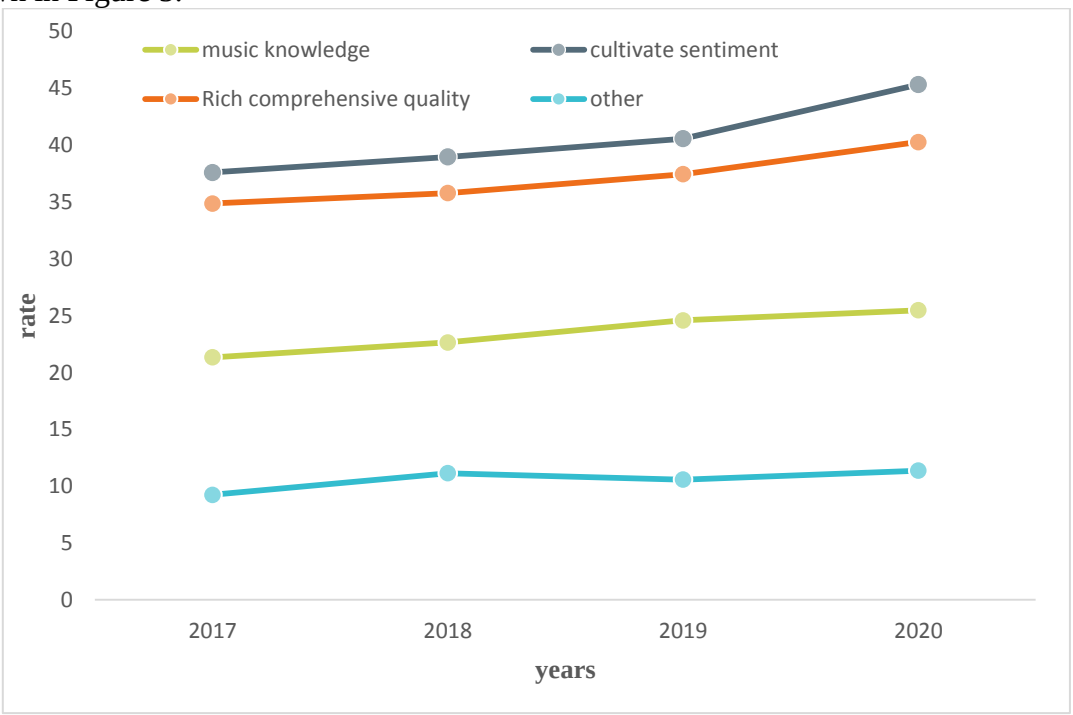

Figure 5. Students' perception of music learning

In Figure 5, in terms of cognition of music from 2017 to 2020, it is believed that music can

acquire music knowledge, cultivate sentiment, and enrich one's own comprehensive quality. Among them, the proportion of people who believe that music can cultivate sentiment is the highest, which was 37.58% in 2017 and 45.31% in 2020, an increase of 7.73% from 2017-2020.

(4) Participation in music activities

Music is not a symbol in textbooks. It requires performance and experience, so music needs to be practiced. The way of participating in music activities is studied from participating in music clubs and cultural performances, and carrying out cultural activities. The results are shown in Figure 6.

Figure 6. Participation in music events

From the broken line chart in Figure 6, it can be seen that among the students participating in music activities, music clubs, theatrical performances and the way of carrying out literary and artistic activities have increased year by year. The ratio of carrying out literary and artistic activities is the highest, and participating in literary and artistic activities is relatively rare.

(5) Perspectives on improving music education

In view of the current problems in music education, the viewpoints of improving music education are investigated and researched from teaching methods, students' acceptance ability, class size, teachers' knowledge level, and classroom management. The specific results are shown in Figure 7.

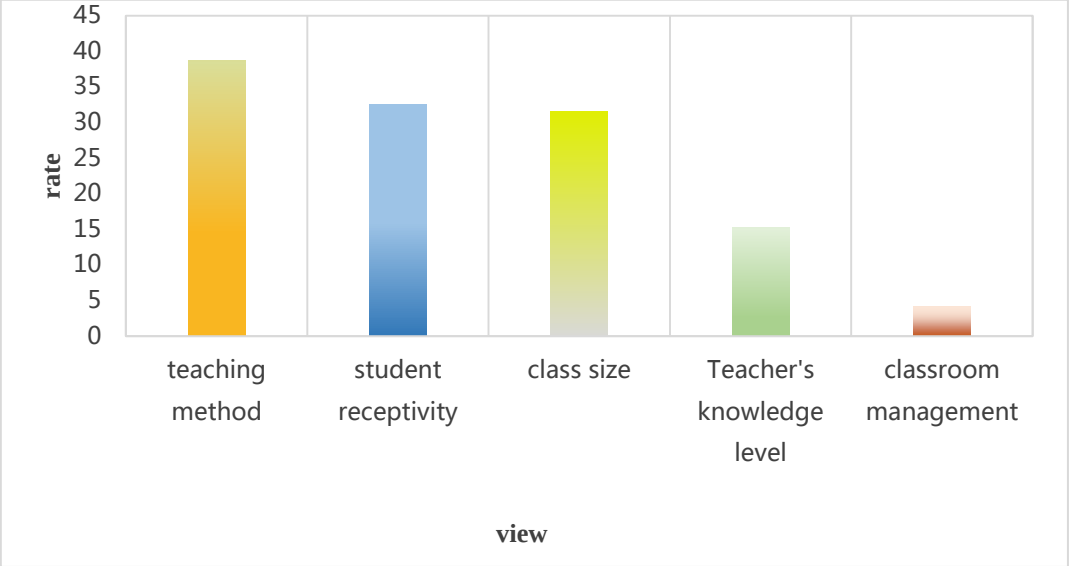

Figure 7. Perspectives on improving music education

From the bar chart in Figure 7, it can be seen that in the view of improving music education, the number of people who think that the three aspects of teaching methods, students' receptive ability, and class size need to be improved is relatively high. Appropriate educational methods can effectively achieve educational goals and fulfill the role of teachers; the introduction of teachers in teaching and the description and understanding of problems are the key factors affecting students' ability to accept.

(6) Interest and enthusiasm in music learning

Interest is the foundation of learning music and a prerequisite for keeping in touch with music, enjoying music, and beautifying life. Musical interest is a prerequisite for students' sustainable development in music. From 2017-2020 students' interest and enthusiasm in music learning, the analysis results are shown in Figure 8.

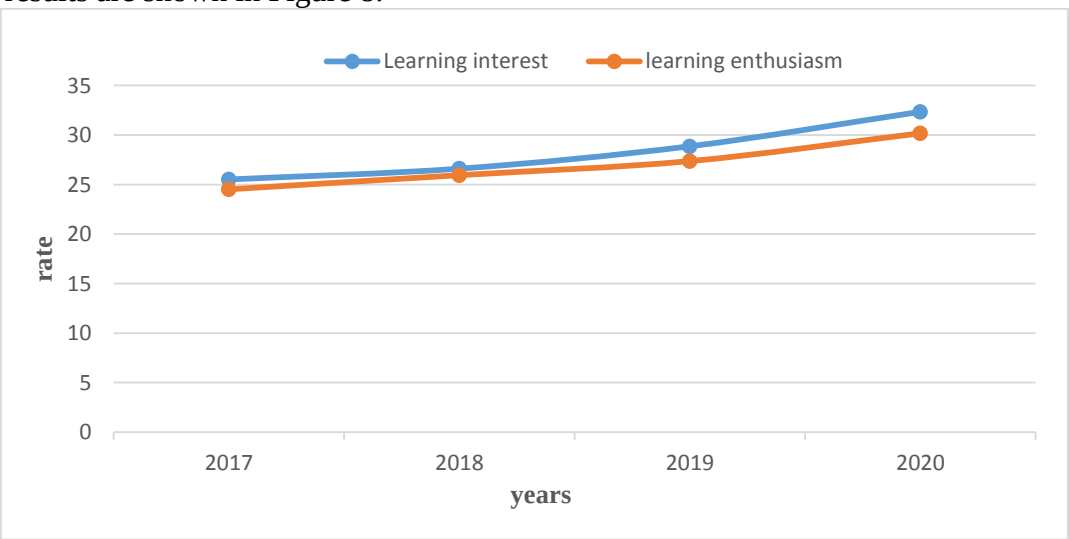

Figure 8. Music study interest and motivation

In Figure 8, students' interest and enthusiasm in music learning continued to increase from 2017 to 2020. Among them, the interest in music learning was 25.52% in 2017 and 32.35% in 2020, an

increase of 6.83%. The increased interest in music learning is conducive to improving the efficiency of music classrooms and the quality of teaching.

6. Conclusions

This paper focused on the interactive emotional analysis of the teaching model of music courses in colleges and universities and integrated music teaching with practice, and established a new multi-modal music teaching model, which can not only stimulate students' enthusiasm for learning, but also enrich teachers' teaching methods and improve the effect of classroom teaching, and achieve the purpose of comprehensive quality education. The idea of interactive emotional multimodal music teaching management has been implemented, and new teaching methods have been continuously explored and developed, so as to improve the teaching system and create a good teaching atmosphere, and promote the improvement of music teaching quality.

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