

Experimental research on digital empowerment of music ideology and politics

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ABSTRACT

In the context of the digital and intelligent era, the form of education has undergone profound changes. Intelligent technology is gradually penetrating into all aspects of teaching, promoting the deep integration of curriculum ideological and political education with professional courses. Taking the junior high school music course as the starting point, this paper explores how technologies such as artificial intelligence, big data, and the Internet of Things can empower ideological and political education in music classes, and constructs an innovative model of "intelligent guidance-personalized learning-immersive experience". Combining specific applications such as music analysis, personalized recommendations, and intelligent auxiliary tools, the article proposes a teaching path that integrates ideological and political elements, and uses brain-electroencephalography synchronization technology to evaluate the teaching effect, demonstrating the positive role of digital intelligence technology in improving students' ideological and moral qualities and aesthetic literacy. Research shows that digital intelligence can effectively enhance the emotional penetration and value guidance of music classes, and provide a new implementation path and evaluation mechanism for curriculum ideological and political education in junior high schools.

KEYWORDS

digitalization; junior high school music; ideological and political education in the curriculum; innovative model

Thanks to the rapid development of digital technologies such as artificial intelligence, big data, and the Internet of Things, education has officially entered the era of intelligence. These technologies have changed the way and means of teaching, and have also expanded new ideas and methods for the implementation of ideological and political education in courses. Zhang Qun et al. (2025) proposed that the development path of digital resources in the digital era is a comprehensive, dynamic, and evolvable process, and it is necessary to establish a demand-oriented resource service system and a feasible resource sharing mechanism and platform.¹ Nong Guanjun et al. (2025) suggested actively promoting the deep integration of digital technology and "big ideological and political courses", building digital teaching resources for "big ideological and political courses", leading students to think and experience, and promoting the connotation-based development of ideological and political courses.¹ Liu Hongxi (2021) proposed that in the era of digital technology transformation, teachers should change their roles, establish the educational concept of "human-machine symbiosis", improve their comprehensive literacy, and adapt to model changes.² As an important part of quality education, music classrooms are not only a key place to cultivate students' artistic literacy, but also an important platform for ideological and political education. Ding Xing (2024) proposed that schools should respond to the call for national education system reform, do a good job in the research of music aesthetic education content, methods, processes, effects and evaluation means and methods, pay attention to the promotion of students' learning interests in the learning process through the support of digital intelligence, and provide diverse and innovative learning environments and learning activities.³ Huang Wei (2023) proposed the current status of music education under digital intelligence technology.⁴

At present, the country's moral requirements for young people are getting higher and higher, but they still face some problems in ideology and morality. Sheng Xiaomin et al. (2025) pointed out that the values of young people are the concrete embodiment of the values of the times in a specific social group, reflecting the overall trend of changes in social values and the spirit of the times.⁵ However, due to the lack of ideological education, many young people have difficulties in forming a correct world outlook, outlook on life and values, which leads to their lack of judgment and moral guidance when facing complex social phenomena. Secondly, although the popularity of the Internet and social media provides a

1 Nong Guanjun, Wang Jie. Building digital teaching resources for "big ideological and political courses" [J]. Contemporary Guangxi, 2025, (07): 49.

2 Liu Hongxi. Teacher professional development in the era of digital technology transformation: challenges, core literacy and practical strategies [J]. China Adult Education, 2021, (21): 72-75.

3 Ding Xing. Construction of a digital "music brain" to empower music education practice and evaluation in colleges and universities [J]. Art Panorama, 2024, (21): 124-126.

4 Huang Wei. Practical exploration of digital technology empowering classroom teaching reform [J]. Modern Education, 2023, (04): 8-12.

5 Sheng Xiaomin, Wei Jun. Survey on the values of contemporary teenagers and its educational implications [J]. Educational Research, 2025, 46 (01): 70-80.

lot of information, it also brings bad content. Some young people have become too utilitarian and neglect their own spiritual and moral cultivation, which may have a negative impact on their ideology and morality. Furthermore, due to busy work, many parents may not be able to give their children enough attention and correct guidance, resulting in the lack of family ideological and moral education. Many problems show that the ideological and moral education of young people cannot stay on the surface, and practical and effective measures need to be taken to solve them. Shi Zhongying (2014) put forward seven suggestions to strengthen the value education of young people, which has certain enlightenment for the integration of ideological and political education into music.⁶

Under such circumstances, families, schools and society should work together to strengthen ideological and political education for young people and prevent adverse consequences. As the main battlefield of education, schools should integrate ideological and political education into various subjects, explore ideological and political elements in the curriculum, and promote the integration of ideological and political theory courses with other subjects, so as to achieve the goal of ideological and political education. Yang Wanting (2024) proposed improvement strategies for integrating ideological and political elements into junior high school music teaching in terms of teaching content, teacher quality and teaching methods.⁷ Xu Shiwu (2024) explored the necessity, feasibility and ways to integrate ideological and political education into junior high school music classes based on the psychological development characteristics of junior high school students.⁸ Zhou Wei (2024) discussed the practical methods of teaching red songs in junior high school music from the perspective of ideological and political education.⁹

1 The application of digital technology in music teaching

1.1 Intelligent music analysis

In recent years, the application of artificial intelligence in music analysis has gradually deepened. In terms of music structure analysis, researchers preprocess audio signals through short-time Fourier transform (STFT)¹⁰ and Mel-frequency cepstral coefficients (MFCC)¹¹, extract spectrograms as input features, and then use convolutional neural networks (CNN)¹² to recognize pitch, rhythm, and timbre.

Among them, the Google Magenta project and MIT's MusicNet dataset provide a large amount of labeled classical music data for training models to distinguish different instruments and beat positions, so that students can perceive the differences in melody and harmony more vividly; in terms of emotion recognition and music expression analysis, researchers often use recurrent neural networks (RNN) and long short-term memory networks (LSTM)¹³ to process music sequences that change over time, and discover some evolution trends of certain emotions. For example, a method based on multimodal emotion recognition is used to integrate different parameters such as pitch, volume, speed and mode to predict the basic emotional classification of a piece of music - happiness, sadness, tension or tranquility, etc. This method can help students better understand what the composer wants to express when composing. Intention can also be used in interdisciplinary fields such as music therapy and emotion regulation. In terms of teaching feedback, there are many educational software that integrate AI analysis systems, such as Yousician and SmartMusic, which can score and provide feedback on students' performances in real time. The most important part is the audio comparison algorithm, which is used to compare the similarity between students' performances and the correct answers. There is also a rhythm detection module, which can determine the accuracy of the rhythm and determine the correct, early or delayed position. The pitch matching system is used to detect whether students are out of tune or have semitone errors, and present them through

6 Shi Zhongying. Some suggestions on strengthening the value education of teenagers[J]. Chinese Journal of Education, 2014, (01):1-4+27.

7 Yang Wanting, Hu Yang. Some thoughts on the reform of junior high school music classroom teaching under the background of curriculum ideological and political education[J]. Popular Literature and Art, 2024, (13):144-146.

8 Xu Shiwu, Zhu Fengyu. The application of curriculum ideological and political education in junior high school music courses[J]. Musical Instruments, 2024, (06):40-43.

9 Zhou Wei. Research on the teaching of red songs in junior high school music under the background of curriculum ideological and political education[J]. Xueyuan Education, 2024, (09):37-39.

10 Mengran L, Chao Z, Hanghai F, et al. A sound source localization method based on multi-scale cross-STFT complex-valued convolutional neural network[J]. Sensor Review, 2025, 45(3):374-386.

11 Kawaguchi S, Kitamura D. Amplitude Spectrogram Prediction from Mel-Frequency Cepstrum Coefficients Using Deep Neural Networks[J]. Journal of Signal Processing, 2023, 27(6):207-211.

12 Ting L. Music emotion recognition using deep convolutional neural networks[J]. Journal of Computational Methods in Sciences and Engineering, 2024, 24(4-5):3063-3078.

13 Xi Y, Liang M, Gardi A, et al. Accurate and fast-converging trajectory prediction based on Long Short-Term Memory neural networks[J]. Journal of Air Transport Management, 2025, 125:102777-102777.

visual graphics. Another one is style consistency recognition, which is used to judge whether it meets the style requirements of the performance repertoire through training, such as distinguishing the performance styles of the Baroque and Romantic periods.

1.2 Personalized music recommendations

Based on the basic principles of machine learning, the teaching platform can understand and control students' learning behavior habits, learning methods and learning abilities based on the students' practice frequency, preference types, preferred styles and performance performance, and form personalized teaching and recommendation plans, which is particularly important for music teaching. The implementation path is: analyze students' learning data, understand students' preferences and mastery of music, recommend works with simple rhythms and clear tunes to students in the initial learning stage, let students complete some simple works practice first, and master some basic performance skills. For students who already have a certain foundation, some slightly more difficult and diverse styles can be recommended to enable students to continuously improve their technical level. On the basis of taking into account the students' original interests, it satisfies students' individualized music style tastes, recommends suitable music style types, matches students with relevant composition background information, work era background knowledge and other content, and promotes students to gain a sense of interconnection between different works and a sense of style changes in different eras. In addition, it can conduct more objective and targeted precision evaluation of students based on the recommendation system data. This recommendation mechanism not only improves learning efficiency, but also stimulates students' willingness to learn actively.

1.3 Intelligent teaching aids

With the development of digital intelligence, various intelligent auxiliary tools have emerged: performance feedback, learning guidance, teaching management, immersive experience, which have greatly broadened the teaching methods; in addition, the built-in sensors and artificial intelligence algorithms in smart pianos, smart piano accompaniment, and smart teaching software can be used to find fingering problems, strength problems, rhythm problems, etc. in the key playing, and give students timely feedback and make corrections. Smart music scores can reduce the problem of turning pages or forgetting scores, and can also correct the problems encountered by students when practicing the piano. In addition, the slow playback and local magnification functions can provide students with a comfortable piano practice environment.

At the same time, teachers can see the practice status, practice time and progress of each student through the system, making teaching more reliable. In recent years, advanced technologies such as virtual reality (VR) and augmented reality (AR) have also begun to be applied to music teaching.

Students can simulate performances in a virtual environment. This model helps students develop stage performance skills and psychological qualities; there are also some AR tools that can project rhythm prompts, finger trajectories and other content onto real instruments to make practice more intuitive.

2 An innovative model for digitalization to empower ideological and political education in junior high school music courses

2.1 Intelligently guided music class

The intelligent music classroom is supported by AI technology, which can realize the simultaneous advancement of music skills and ideological education in the teaching process. The system uses voice recognition and natural language processing technology to record classroom interaction content, determine students' learning status, and mark teaching knowledge points in detail. After each stage, it provides detailed feedback results to teachers to check the key points of education for teachers. The teaching platform can associate the historical information behind the red classic music works. When teaching "Yellow River Cantata", the Yan'an incident in the late 1930s is directly integrated into the melody learning. The platform can also link to intelligent music scores and intelligent instruments to provide more guidance in teaching. The intelligent score system can automatically mark key points and difficulties, play the background knowledge of the creation of red classics and comments from famous artists, and lead students to think about the value and significance contained therein. Intelligent musical instruments can combine knowledge learning with skill training by collecting and tracking information such as students' movements, rhythms and emotions during performance, thereby enhancing students' musical emotional cognition and enabling them to better understand the thoughts and feelings of musical works.

2.2 Personalized learning path based on individual teaching style

According to the music learning behavior data and intelligent recommendation algorithms, different personalized learning paths can be designed for students with different foundations and preferences: for students who have a certain sense of rhythm but relatively weak music theory foundation, rhythm training is carried out while strengthening basic music theory learning; for students who like to listen to folk music or red songs, corresponding songs are recommended to them first, and some background knowledge related to the song is introduced in detail, reflecting the concept of "using music to nourish the heart". It is also possible to set teaching goals for each stage according to the teaching plan, and evaluate and monitor students' learning situation through their stage learning process and data detection. Then, through the large visual screen, students can understand their learning process and the content of the ideological and political courses they participate in. Teachers can promptly discover students' "knowledge blind spots" and "ideological and political cold spots" and explain the key points; at the same time, the platform will also conduct comprehensive testing and analysis of students' abilities, summarize and provide feedback on what students have learned through performance, aesthetic understanding, and cultural literacy, so as to encourage students to learn.

2.3 Multi-dimensional interactive immersive experience platform

Digital technology breaks the one-way model of "teachers teach-students accept" in traditional teaching, and constructs a more open and immersive music learning ecosystem. Students can upload their own works on the platform, and the system automatically scores and supports mutual evaluation and interaction between teachers and students, creating a learning atmosphere where self-reflection and peer encouragement coexist. Teachers can set up a variety of themed activities. For example, with red as the main theme, they can set up themed music classes such as "Family and Country Feelings in Music" and "One Song, One Character", and guide students to think deeply about their ideological significance and social value through music works. Virtual reality (VR) or augmented reality (AR) can effectively break the classroom space, such as constructing historical scenes such as the Yan'an Literary Forum and the Anti-Japanese War Singing Concert, so that students can immerse themselves in them and feel the history of music playing a role in major social changes. The AR function can also embed teaching materials images, play instrument demonstrations, cultural explanations and other content, and trigger students' recognition of traditional culture and national spirit.

3 Experimental Cases

Under the background of the development of digital technology, it is a feasible method to use neuroscience to integrate music education to evaluate the effect of ideological and political education in courses. "Inter-brain Synchrony"¹⁴ can be used as a quantitative result of the collective emotional resonance of the student group after listening to different types of ideological and political music works to evaluate the effect of ideological and political education in courses, so as to evaluate the penetration and guidance effect of ideological and political education in music courses.

3.1 Research Background and Purpose

The evaluation methods of traditional music classes are mostly focused on students' behavioral performance and subjective feelings, without corresponding quantitative means, especially in the field of ideological and political education in courses. There is a lack of more effective emotional penetration feedback mechanism. To this end, this study introduces electroencephalogram (EEG) signal acquisition technology and EEG synchronization rate analysis method, and uses the "emotional resonance model" driven by neural data to explore the differences in the degree of influence of different ideological and political music works on students' emotions and cognition, and explore the mechanism of how music structure characteristics stimulate students' emotional response, so as to provide quantitative data support and intelligent reference for better optimization of music ideological and political content and classroom teaching design.

3.2 Experimental design and methods

3.2.1 Experimental subjects

30 junior high school students aged between 13 and 15 were selected. None of them had any neurological diseases

14 Chi M L ,Lin Y Z ,An C C , et al.Increased Phase Synchronization of Brainwaves Induced by Specific Music[J].SENSORS AND MATERIALS,2021,33 (2):595-600.

and had basic music literacy. Unified notification and informed consent were conducted before the experiment to ensure ethical compliance.

3.2.2 Experimental materials

Five representative red ideological and political songs were selected: "China in the Lights", "Wanjiang", "Love My China", "Yingshanhong", and "Spring Story", covering two styles: passionate rhythm and warm and slow. The songs were played by professional audio equipment to ensure the consistency of sound quality and the restoration of the situation.

3.2.3 Experimental process

Each student was asked to wear a multi-channel EEG acquisition device (such as EMOTIV EPOC, OpenBCI), and listen to the songs at the same time in groups of 5. There was a 3-minute pause between each song to eliminate residual effects. Environmental factors such as light, volume intensity and other variables were recorded synchronously during the data collection process. In the actual test, students should not be allowed to have serious anxiety about the order of precedence to control the interference of external factors on the experiment.

3.2.4 Data collection and analysis methods

The EEG signals were preprocessed using MNE-Python, including filtering, artifact removal, and segmentation, and the signals in the alpha (8–12 Hz), beta (13–30 Hz), and gamma (30–45 Hz) frequency bands were extracted. The phase locking value (PLV) of the EEG waves between adjacent students was then calculated to quantify their IBS levels, so as to further construct a brain synchronization network diagram and analyze the core structure and connection strength of group resonance.

3.3 Data results and chart analysis

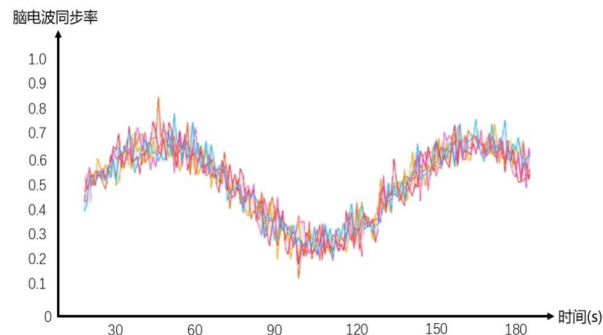


Figure 1 EEG synchronization rate change curve of ideological and political songs

The horizontal axis of the table above is time (seconds), and the vertical axis is the EEG synchronization rate (0–1). The results show that the synchronization rate of "March of the Volunteers" and "My Motherland" increased significantly in the climax section, reaching a maximum of 0.82, showing a strong group resonance phenomenon; while the overall synchronization fluctuations of songs with slower rhythms such as "Yellow River Cantata" were smaller.

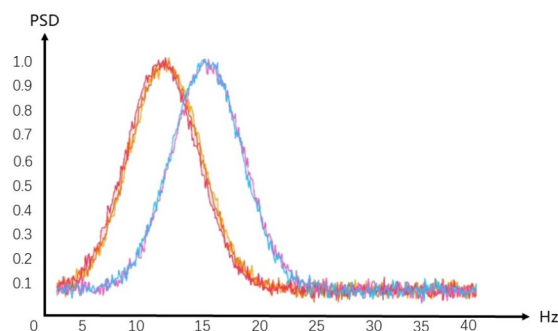


Figure 2 Power Spectral Density (PSD) frequency band comparison

The table above shows the PSD in the range of 1–40Hz. The peak of the alpha wave (8–12Hz) reflects relaxation or introspection, while the peak of the beta wave (13–30Hz) corresponds to concentration or excitement. The alpha band of the Yellow River Cantata has the highest energy, suggesting that it is more likely to induce introspection; the beta band of the March of the Volunteers is active, indicating that it is effective in stimulating concentration and patriotic enthusiasm.

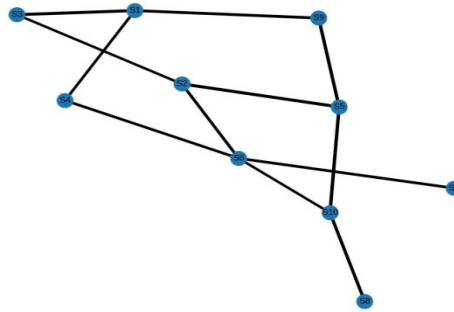


Figure 3 Student brain wave synchronization rate network diagram (collective resonance visualization)

The nodes in the table above represent students, and the thickness of the edge represents the EEG synchronization rate (weight $\times 4$). Only connections with synchronization rates > 0.7 are retained. The network reveals the "emotional resonance core group" formed in the climax section. For example, some student groups formed obvious emotional homophonic clusters when listening to the chorus of "My Motherland", which provides a neurological basis for the design of group classroom activities.

3.4 Experimental Results

3.4.1 Resonance: Quantifying the emotional unity of ideological and political teaching

Introducing Inter-Brain Synchrony (IBS) analysis in junior high school music courses can be used as an objective indicator to measure whether students resonate with the music content at the emotional and cognitive levels. When a group of students shows a high EEG synchronization rate during the performance or listening of the same musical work, it often indicates that they have achieved "same frequency resonance" in terms of emotions, that is, the unity of emotional resonance and value identification has appeared. This phenomenon of "group brain synchronization" can be used as quantitative feedback on the effect of ideological and political education. Teachers can use this to judge whether the teaching has achieved the ideal ideological appeal and emotional penetration, thereby promoting the transformation of ideological and political education from "indoctrination" to "empathy".

3.4.2 Song Selection Optimization: Improving the Emotional Touch Rate of Teaching with Data Driven

By analyzing the brain wave response induced by red classic music in the student group, especially the extraction of alpha waves and beta waves in the power spectral density (PSD), it can be judged whether a certain song has produced obvious resonance in this frequency band. For example, if the songs "Yingshanhong" and "Heroic Hymn" are confirmed to induce high-amplitude fluctuations in specific brain areas (such as the prefrontal lobe or temporal lobe), it means that the songs have caused resonance at the cognitive and emotional levels. Teachers can build a "high-resonance ideological and political music library" based on this, and give priority to music works that can activate the emotions of the student group and strengthen patriotism and sense of responsibility, so as to effectively improve teaching efficiency and the emotional depth of the course.

3.4.3 Model expansion: Neurofeedback and empathy me

In addition to being applied to music courses, this neural data-driven teaching model can also be extended to humanities expression courses such as history, Chinese, and fine arts, and can be especially applied to VR/AR immersive teaching scenarios. For example, the difficult march on the Long March is reproduced in a VR scene, and the soundtrack "The Red Army is Not Afraid of the Difficulties of the Expedition" is played, and students' EEG data is monitored in real time to observe whether they produce a dual reaction of "immersion + empathy" and to judge whether the teaching content has aroused value recognition. This new teaching ecology of "data-driven + empathy feedback" realizes the transformation path from perceptual experience to rational understanding, and provides a feasible template for creating visual, perceptible, and adjustable smart ideological and political teaching. At the same time, it also helps to build a personalized emotional intervention mechanism with students' psychological state as the core, and enhance students'

mental health awareness and cognitive self-consistency.

4 Conclusion

4.1 Constructing a systematic ideological and political education curriculum system

Digital technology provides an innovative solution for ideological and political education in junior high school music courses. Schools should plan the curriculum structure scientifically based on the physical and mental development characteristics of junior high school students and the characteristics of music subjects, and build a hierarchical, progressive and integrated ideological and political education system. In the music course, the teaching main line of "context-cognition-resonance" is designed. Through intelligent recommendations and personalized learning paths, students can improve their ideological and moral qualities while improving their music skills. The curriculum system should also combine red classic songs and interdisciplinary course content, so that students can achieve value recognition while understanding the ideas behind the music works.

4.2 Strengthen the development and integration of ideological and political education resources

Digital technology has provided new possibilities for the development and utilization of resources in music teaching. An open and shared digital resource library with schools as the main body has been established. Based on artificial intelligence recommendations, accurate classification and intelligent recommendations are made. The intelligent system automatically captures relevant data information such as teacher lesson preparation and student learning behavior through the background, and dynamically matches ideological and political education resources, so that every student can obtain learning content that meets their needs.

4.3 Establish a diversified teaching evaluation system

In order to make ideological and political education effective, it is necessary to establish a three-dimensional evaluation system of knowledge, ability, and attitude value, use an intelligent teaching evaluation system to evaluate the behavioral data of students' completed music learning tasks, and feedback the results to teachers in the form of quantitative scores. This can not only accurately judge students' playing ability, but also comprehensively test students' ideological and emotional participation, so that students' growth can be transformed from "technology-based learning" to "value-based learning."

4.4 Establish a digital teaching feedback mechanism

The digital teaching feedback mechanism is an important means to improve teaching effectiveness. By providing real-time feedback on online teaching situations, using online data analysis to timely obtain data on students' emotional changes, learning progress, etc., flexibly adjusting the teaching content and rhythm, and making good use of the digital feedback system to continuously grasp the weaknesses in classroom teaching, and provide each student with learning suggestions that suit their own situation, it promotes interaction between teachers and students, enables ideological and political education in courses to take root, and uses technology to establish an ideological and political teaching feedback mechanism for a "warm music ideological and political classroom" to build a "warm music ideological and political classroom."

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