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Research Article

Constructing a Music Network Teaching System by Using Neural Network Model with Wireless Audio Transmission

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The purpose is to solve the problems that the traditional teaching methods limit the openness and extension of the music classroom, the interaction between teachers and students, the environment of students' autonomous learning, and the music teaching situation. Wireless local area networks, Bluetooth, and intelligent transmission channels based on specific frequency can replace wired audio transmission and are widely used in the digital music classroom. Moodle system is used to build a music teaching network system based on the analysis of previous studies and the existing music teaching network platform. The system combines with Convolutional Neural Network (CNN) structure based on cloud computing to effectively identify and create music scores. The system effectiveness is further proved by analyzing the learning effect of the students and teaching effect of teachers in the conservatory of music. The results show that the system makes the experience of teachers and students in the teaching system different from before, and students can freely choose the time and place of class. In addition, the teaching method is flexible, and the teaching methods and resources are real-time. Therefore, in the music teaching network course, it overcomes some shortcomings of the traditional teaching mode. The music class is open and flexible. Teachers and students can have more interactive behavior and realize the students' self-study and music teaching environment. This exploration can provide a theoretical basis and practical experience for music-related teaching.

1. Introduction

Today, cloud computing is not a strange word. Cloud computing is a service model related to the Internet [1]. In general, it is a calculation of dynamic virtual resources. This resource is provided by the Internet [2], so the cloud is the name of this resource-providing network. Like clouds in the sky, the amount of resources in these "clouds" is infinite and can be accessed at any time. Access costs are also quite low [3]. The access method is also very convenient. It only needs a computer or a mobile phone. Cloud computing is very fast, and it can reach 100,000 computing cycles per second, which allows users to use this computing power to meet their needs. For example, cloud computing can be used to simulate the changing trend of the market economy. Then, according to the simulation results, people can take certain business actions, such as buying or selling stocks [4]. The advancement of network and multimedia technology has provided new support for education reform and development [5]. The purpose is to satisfy the different conditions of educational reform for different disciplines, diversify the teaching form, and make the teaching resources more vibrant and colorful. It can meet the needs of different types of students and different classes and improve teaching efficiency and teacher-student satisfaction. The Moodle teaching platform is deeply studied based on traditional disciplines with modern network technology and cloud computing technology. Moreover, the traditional teaching model of music discipline is analyzed [6]. Based on the actual curriculum of the music subject, the two are innovatively integrated by integrating the constructivist learning theory to satisfy the actual creation conditions of the music curriculum in this system [7]. Based on the basic functions of the Moodle platform, the functional modules are redeveloped to expand the functional modules of their learning activities [8]. An effective music teaching system based on

the Moodle platform is developed. It provides a reference for the development of Moodle platform online course, education information, and music education.

Specific operations are as follows. First, cloud computing technology is used to summarize and analyze the current music teaching situation in all colleges. For example, how do teachers teach and what music students like? Then, the data of online music playing, downloading, and online karaoke songs from computers, TV, mobile phones, and other media are analyzed using cloud computing technology. Then, the data and all kinds of data information obtained from the analysis are input into the online music education curriculum system and used for reference to enrich teaching resources and teaching forms. For example, exercises in class can adopt the form of karaoke songs, which can systematically input the songs sung by students. Then, the songs can be compared with those previously recorded in cloud computing data to summarize the advantages and disadvantages of students' singing performance and evaluate the system scores.

E-learning is an educational model that establishes new communication mechanisms and interactions between people through the support of the network [9]. The research can promote the birth of the online teaching platform to promote the development of new learning methods of online learning [10]. Therefore, some shortcomings of the traditional teaching model are overcome in the network course of music education. The network teaching platform supplements the shortcomings of the traditional teaching mode and enriches the teaching activities. In traditional teaching, teachers talk more, and the teaching form is single. Compared with traditional teaching, online learning has more diversified teaching modes and abundant teaching resources, effectively improving students' sense of participation and teaching efficiency. It will become an indispensable teaching method and application in future teaching [11].

The informationization of music education is the inevitable requirement of improving music teaching and innovating music classroom teaching mode. The digital construction of the music classroom is the performance of the close combination of music discipline and educational informatization. Unlike traditional wireless systems, such as Wireless Local Area Networks and Bluetooth, the intelligent transmission channel based on a specific frequency can send a series of low-power pulses on broadband. The interference caused by a wider spectrum, lower power, and impulsive data is less than that caused by traditional wireless solutions. Hence, it can meet all the applications of traditional wireless in the digital music classroom and provide comparable performance with wired in the indoor wireless environment.

Learning resources are the support of network teaching. All kinds of excellent learning resources are integrated. Constructing the teaching resource library has become the development trend of online education. The open-source network teaching platform comes into being under this demand [12]. Open source is an abbreviation for open source code. In the open-source agreement, the developer's rights are guaranteed. Meanwhile, users can enjoy the right to copy, distribute, and modify freely. The Moodle platform is one of the open-source teaching platforms.

2. State of the Art

Chinese educationists' teaching ideas and practices unconsciously contain the idea of effective teaching. They are mainly embodied in the teaching aims, methods, and principles [13]. Exploration of teaching efficiency starts from a primitive tribe in China and has a long history. Confucian ideology about the teaching of students according to their aptitude and western-style schools reflects Chinese' pursuit for teaching efficiency. It is embodied in many ways [14]. The basic principles of the effective teaching idea are applied in practical teaching and learning, including the humanities and social sciences. It has achieved some success. Many studies abroad apply the effective teaching idea to music teaching.

These research theories are tightly integrated with the practice of music teaching. First, the teaching theory is enriched by it. Then, it has instructive significance for the content and method of the music. There is a strong criticism of the past teacher education model in modern western countries [15]. It thinks that it only focuses on imparting the principles of education and teaching content, which is far from reality. For example, German scholar Hart believes that the former teaching philosophy still plays a major role in nurturing teachers. In other words, the teaching material of the theory can hardly be reflected in the actual examination [16]. The discussion of teaching theory is relatively isolated from each other and stands in their respective positions. They ignore reality and work without thinking. In the reform of teacher education, the western developed countries have always been in a leading position, but the effect is not so obvious. There is a contradiction. First, multiple scholars are actively engaged in studying the effective teaching idea. Then, they engage in a rigid and unrealistic educational model [17–19]. Compared with the domestic, although the application of the effective teaching idea in the music has not been mature in the teaching of music, the attention of this kind of research is still very high. In addition, the application research of the effective teaching idea in music only stays in the superficial change, and there are no deeper research results. In the practice of music teaching, it is difficult to put forward an excellent suggestion. Quite a few countries have applied the effective teaching idea widely in the practice of music research [20–23]. Learning is the process of students' self-construction cognition. The perfect knowledge system is just a repository of theories, so learners should build up their own knowledge of the real world. There are many studies on the practical behavior of music teaching as an experimental method of the effective teaching idea, and they also draw good conclusions.

The achievement of efficient teaching needs certain conditions. This condition is the method and approach for effective teaching. The educators and practitioners attach importance to teaching efficiency and actively explore and seek effective teaching methods and ways. At present, the research on the effective teaching idea is mainly

concentrated in the psychology and educational circles in China. If the application of the effective teaching idea in music is taken as the keyword, there are only six papers in this field. Among them, half of the main content is to analyze and study the curriculum system, and the other three are to study music teaching in teacher's college. Moreover, few citations and download times show that few people pay attention to it [24–26]. From the above analysis, the importance of the effective teaching idea is not emphasized in music teaching in China. The students' curiosity and thirst for knowledge should be used in music teaching. In this way, students' enthusiasm and initiative can be greatly inspired, and students can achieve an efficient combination of theory and performance in music learning. The effectiveness of teaching idea of teacher education is a scientific and advanced concept in the world, but it has not been widely applied. Therefore, in order to achieve the expected teaching effect, it is necessary to influence students through teachers' routine teaching behavior, thus obtaining satisfactory learning effect [27].

According to the practical problems, such as high maintenance costs, delayed updates, and insufficient teaching resources in colleges, scholars analyzed the related concepts of CCAI (Cloud Computing and Artificial Intelligence) and discussed the materialization of cloud computing. In addition, cloud platform status and cloud service modes of PaaS, SaaS, and laas are also analyzed. Combined with the teaching design and the organization of teaching resources, the access technology of the domestic typical cloud platform and the Google App Engine "public cloud" platform is discussed, and the cloud software supporting CCAI and the performance of CCAI under different cloud services are discussed [28, 29].

To sum up, music teaching has gradually developed towards the direction of music education informatization. While realizing the new reform of music teaching, it also leads the new concept of music teaching and effectively promotes the development of music teaching. However, there is a lack of a mature teaching system according to the characteristics of music teaching. Based on this, from the perspective of actual needs, this thesis will introduce a neural network model to improve the recognition efficiency of the music score and then realize a set of network teaching systems that makes full use of teaching resources.

3. Methodology

3.1. Research Subjects. Six teachers and 100 students of music performance major in Northeast Petroleum University are selected as the research subjects. The students and teachers are divided into experimental and control groups, with three teachers and 50 students in each group. Before the experiment, the scores of 100 students are basically the same. Teachers spend the same amount of time preparing lessons, effectively attending classes, correcting homework after class, and evaluating grades.

Teachers in the experimental group take the music teaching system under the Moodle platform for classes. Students attend classes on time, complete the homework assigned by teachers on time, and submit it on the system. Teachers in the control group take the traditional teaching form. Students attend classes on time and complete homework assigned by teachers on time.

After half a semester, the six teachers are interviewed about preparing lessons, reviewing homework, and evaluating their grades in class and after class. Besides, in the experimental group, the curriculum design, curriculum resource design, curriculum activity design, curriculum interface design, and curriculum evaluation design of the system are required to be evaluated by teachers. In addition, five professional achievements of 100 students are compared, including vocal music, the theoretical basis of music, rhythm training, Chinese and foreign music history, and songwriting.

3.2. Analysis of Music Teaching Needs under Moodle Platform. The Moodle platform is developed based on constructivist theory. The functional view of the Moodle platform, which is emphasized by the constructivist theory, is also basically satisfied. There are five functional modules in the platform. They are user management, course development, teaching activities, evaluation management, and management of learning process tracking. Based on Moodle platform, as for the teaching system design, specific curriculum in the music discipline should be involved to analyze the requirements of the music teaching system, as shown in Figure 1.

As for the system of music teaching based on Moodle platform, the role of a system administrator, teacher, course creator, a teacher without editorial authority, students, and visitors should be included in the design of the user role. The course creator creates a new course for others on the platform, authorizes the teacher's authority, and approves the student's admission. Teachers can conduct all activities within the course. Teachers without edit rights can participate in all activities in the course but cannot edit or change activities.

The use of system administrators, teachers, and students is mainly analyzed. System administrator application: the system administrator controls the highest authority in the system and authorizes other user role permissions in the system, as shown in Figure 2.

In the Moodle platform music teaching system, the realization of the system is also an achievement of the change of teacher's role. The teacher is transferred from the traditional knowledge-teacher, mainly composed of "teaching", to the leader, organizer, and evaluator of teaching activities. When systematic teaching is carried out, the problems and teaching objectives to be solved are clearly defined by teachers to create an online learning environment. According to the transformation of the teacher's role, the functional module design for the teacher is shown in Figure 3.

Students are the subject of knowledge learning. In the Moodle platform music teaching system, all the teaching contents are always carried out around the students' learning. They are system users and the main participants, collaborators, and evaluators in the learning activities. Students complete the various functions for the student function module by using a computer connected to the Internet.

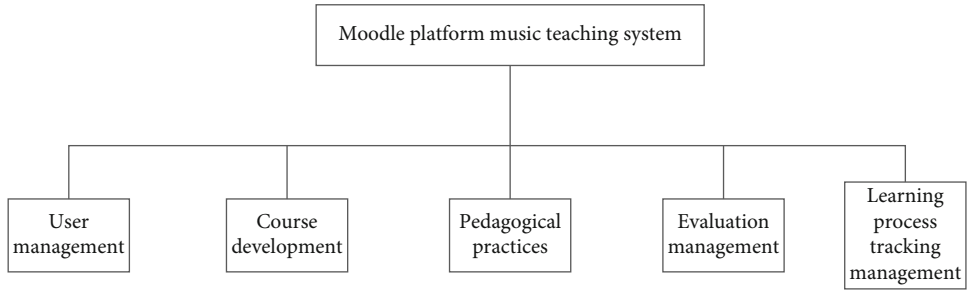

Figure 1: Functional block diagram of the music teaching system on the basis of Moodle platform.

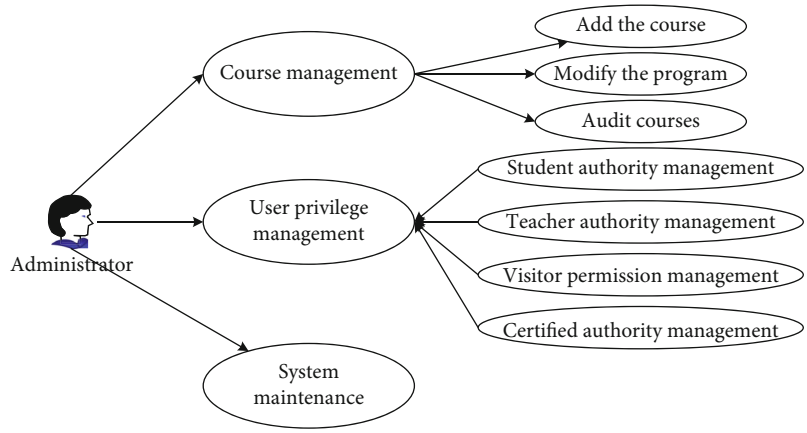

Figure 2: Application permissions of system administrators.

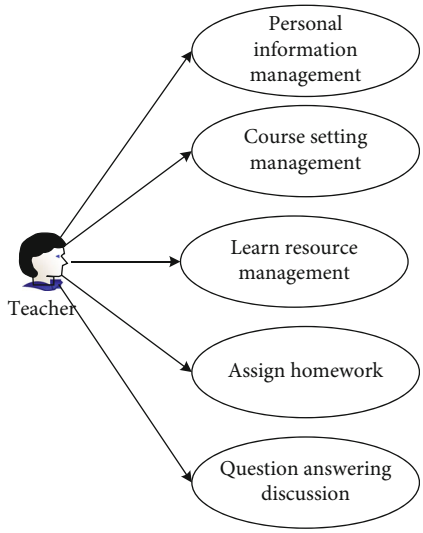

Figure 3: Application permissions of teacher.

Through research and analysis, the student-oriented functional modules in the system are listed in detail, as shown in Figure 4.

In the online music teaching platform, the wireless transmission equipment needs to support the synchronous access of multiple devices to realize the cable replacement between traditional musical instruments and electronic musical instruments and tuning equipment. The musical instruments in students' hands are wirelessly connected with the tuning equipment through wireless communication technology. Hence, students can hold musical instruments and move freely in the classroom. They can also plug and play to simplify the steps of using musical instruments. After the wireless transmission of the device, teacher management is also particularly important. The wireless device is connected to the network transceiver through integration. The teacher monitors the working status of all wireless transmitting devices in real-time through the teacher control software under the transmission network to realize the effective audio output under the one-to-many management mode. The tuning interface is open for teachers to realize the effect management of digital mixer. Teachers simulate the best tuning effect by choosing different performance modes and complete the unity of teaching and learning through the interaction between teachers and students provided by digital music management software.

3.3. System Specific Design. According to the system requirements analysis, the music teaching system based on Moodle platform is constructed. The aim is to conduct online teaching of music subjects through the Moodle platform and realize the integration of teaching and learning on the network environment platform. This thesis was aimed at scientifically combining the music course teaching with the Moodle open-source teaching platform and strives to develop and design a music teaching system based on the Moodle platform. The shortcomings of traditional music classes are supplemented. Students study music in the online environment. It provides a reference for music educators and promotes the development of music teaching.

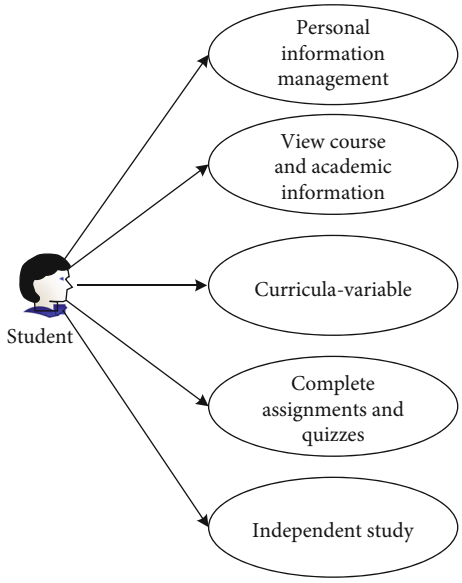

Figure 4: Application permissions of student.

The Moodle platform itself is a way of constructivist theory. In the Moodle platform, various common social software is integrated, such as blogs (weblogs), wikis (multiperson collaborative writing tools), and RSS (online news). Various social software is integrated to achieve a diversity of teaching activities and learning evaluation methods. In the Moodle platform, the role of the teacher has been changed. In the Moodle platform, the teacher's task is the design of teaching resources and teaching activities, rather than the design of teaching content in traditional teaching. Therefore, the design of the music teaching system under the Moodle platform should be guided by constructivist learning theory and teaching system design theory. Music lessons' flexibility, openness, and interactivity based on the Moodle platform are realized.

The music teaching system based on the Moodle platform adopts the modular structure system design. System engineering perspectives and methods are applied. The modular design of the system emphasizes learning-centered. The modular structure is used as a guiding ideology. The overall platform system is designed. Figure 5 shows the flow chart of the design method of the music teaching system in the Moodle platform.

3.4. Audio Transmission Technology of Digital Music Classroom. Wireless transmission equipment needs to support synchronous access of multiple devices to realize cable replacement among traditional musical instruments, electronic musical instruments, and tuning equipment [30, 31]. Through wireless communication technology, the musical instruments in students' hands are wirelessly connected with tuning equipment. It enables students to hold musical instruments and move freely in the classroom. Besides, it can achieve the plug-and-play function, simplifying the steps of using musical instruments [32]. Low-power pulses are sent over a wide frequency through a specific frequency intelligent transmission channel. This transmission mode has a wide spectrum, low power, and nerve impulse, so the interference in the transmission process is relatively small, and the transmission efficiency can be comparable with that of a wired digital music classroom. In a complete digital music classroom, when configuring the receiving end and transmitting end of wireless audio transmission, the number of transmitting ends is configured according to the number of students' synchronous performance needs, and the receiving end is connected to the active speaker or mixer [33]. In the network environment, teachers control the switch of any transmitter and equalize the timbre on the management software of digital music classrooms to realize the effect management of digital mixer. Teachers can simulate the best tuning effect by choosing the current performance mode. The unity of teaching and learning is realized through the interaction between teachers and students provided by digital music management software.

The audio transmission system is connected with the computer display platform. The performance process of sound effects of musical instruments can be directly displayed on the screen through the spectrum-making software. Then, students can intuitively and audiovisual synchronously understand the sound generation mode of music theory and the location of different high and low audio frequencies.

3.5. Music Recognition Method Based on Neural Network. Due to the complex structure and great implementation difficulty of traditional music score recognition algorithms and the low accuracy of existing commercial recognition software, it is necessary to study an easy-to-implement and high-precision algorithm. According to the previous research, a music recognition method based on a neural network is proposed. Figure 1 shows the principle of the identification method. First, the height of the input music score image is fixed to 128 pixel, and the width is scaled up and down. Then, the noise is added to simulate all kinds of unsatisfactory music score images in the real environment. Next, a five-layer residual Convolutional Neural Network (CNN) is used to extract different levels of features from the note information in the image. Meanwhile, the deep semantic feature information is fused with the shallow detail feature information in multiscale. Through the cross supplement of multilevel information, more perfect feature information is provided for the next stage of note recognition. Finally, the dimension transformation of the extracted feature sequence is performed and used as the input of the note recognition part. Bisru completes the recognition of the note sequence. The Connectionist Temporal Classification (CTC) function is adopted, with no forced alignment requirements on the dataset. Figure 6 shows the specific structure.

In the score image, the notes are discrete and evenly distributed, mainly composed of straight lines or curves in multiple directions, solid or hollow near circle graphics. The convolutional layer in CNN has local connection and weight sharing characteristics, which is conducive to extracting the edge features and position information of notes. Therefore, CNN is used to extract the features of notes in the music score image. The activation function layer can enhance the

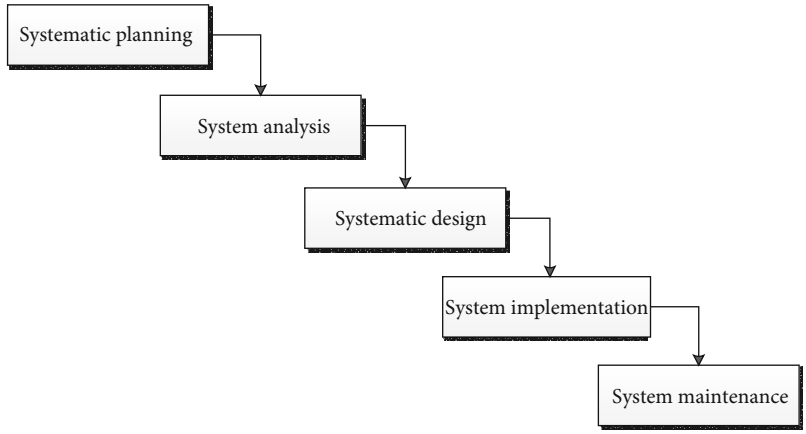

Figure 5: System design diagram.

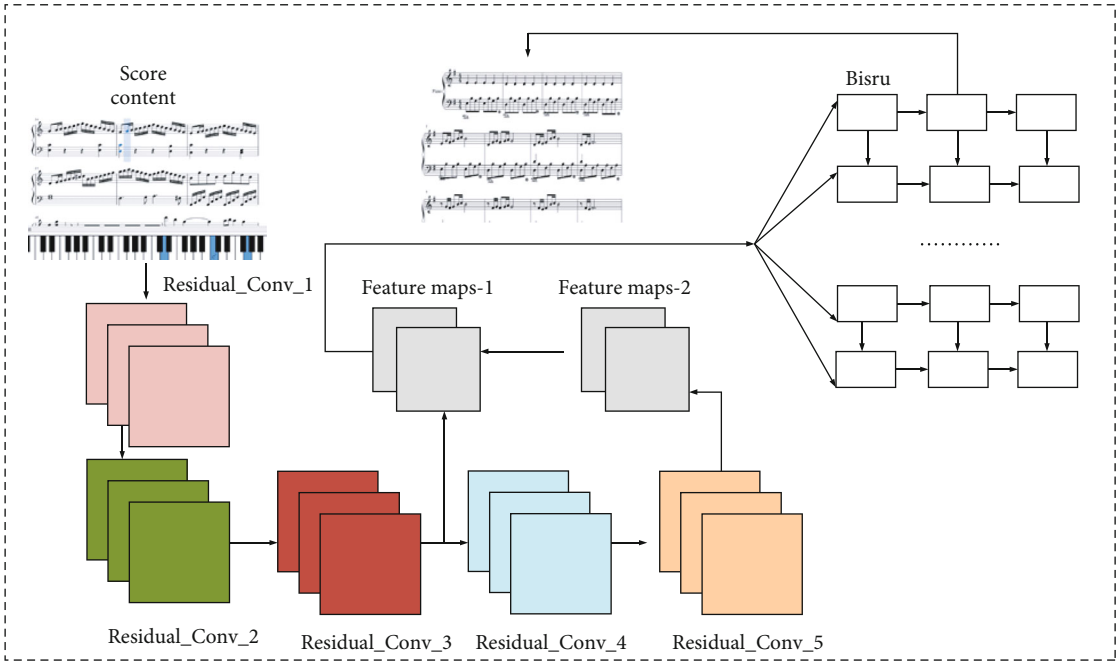

Figure 6: Music recognition method based on neural network.

expression ability of CNN and make CNN have differentiability to realize the nonlinear mapping of music score image from low dimensional simple features to high dimensional complex features. On the premise of retaining the main features of the convolutional layer, the pooling layer reduces the amount of weight parameters, speeds up the calculation speed, and prevents overfitting problems. It is usually necessary to increase the layer width or depth of CNN to improve the detection accuracy of the model. However, in the process of parameter updating, the gradient disappearance/explosion problem is easy to occur, leading to the model's nonconvergence.

When using CNN to extract note features, the convolutional layer increases, making the model extract features of different levels of information. Shallow features generally include note location and edge information. Although the resolution is small, deep features have rich semantic information, which can help the network to recognize notes better. However, due to the lack of detailed features in the shallow network, the recognition accuracy of notes may be affected. Therefore, in note recognition, the deep semantic information and shallow detail information of CNN are fused in multiscale. Figure 7 shows the specific process.

Many kinds of networks can effectively recognize the notes in the music score image. The note type and order in each score are fixed due to the note sequence. Moreover, the notes at the current moment have a strong correlation with the notes before and after. In the experiment, recurrent neural networks (RNN) are used to recognize notes. RNN is prone to gradient disappearance in the training process due to the large data length. Therefore, it is necessary to control the information flow through the long short-term memory (LSTM) network with "gate mechanism" or gated unit to alleviate the potential problem of gradient disappearance.

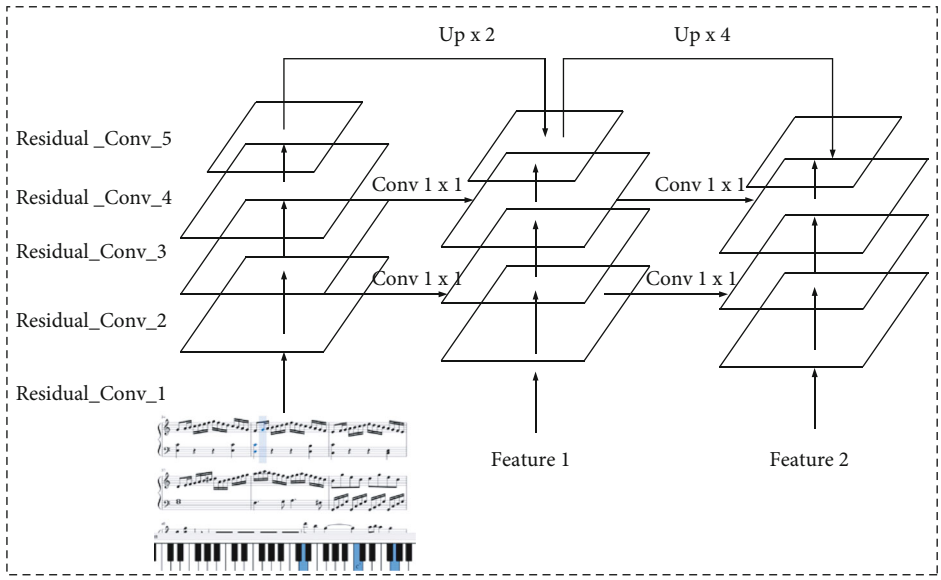

Figure 7: Schematic diagram of multiscale feature fusion.

However, the forget gate, input gate, and unit state of LSTM network or gated unit still need the output of the hidden unit at the previous time in addition to the input at the current time, which greatly limits the speed of parallel operation. Therefore, the simple cycle unit module is used to remove the constraint between the states at the continuous time. The weak circularity and high parallelism make the calculation of gate state only depend on the input information at the current time.

3.6. Experimental Design and Dataset Selection. MuseScore data are selected as the dataset of music score note detection. MuseScore is a free music annotation software that allows its users to upload their music scores to their websites and share them with others. It can be downloaded in the form of MuseScore file (mscz), PDF, MusicXML, MIDI, and MP3. MuseScore Compressed Music Score (MSCZ) and Music XML (MXL) files are downloaded from MuseScore, and the tag format required is generated by parsing these files. The whole training process is completely end-to-end, and the music score image is directly input. Through the model, the loss function is calculated. Finally, the model parameters are optimized by the loss function. Data enhancement is applied during training, and different training samples are presented to the network model each time. The batch size of the training model through the stochastic gradient descent optimizer is 32, the initial learning rate is 0.001, and the learning rate is constant attenuation.

4. Results and Discussion

4.1. Note Recognition Results. The model tests a total of 1500 music score images converted by MuseScore. These music score images do not have any data enhancement. Finally, the overall recognition results' average symbol accuracy (mAP) is 0.92, the accuracy of note pitch is 0.98, and the accuracy of time value is 0.96. Table 1 displays the average

Table 1: Note recognition results of neural network model.

Class	Sharp	Flat	Natural	clefG	clefF
AP	0.96	0.93	0.91	0.98	0.97
Class	clefC	Barline	Timesig	Note	Rest
AP	0.88	0.91	0.82	0.93	0.92

mean precision (AP) for each class. The results show that the neural network model here performs well in note recognition, and the accuracy of time value and pitch is higher than 0.9.

4.2. Implementation of Music Teaching System Integrating Wireless Audio Transmission. The music teaching system based on Moodle platform is based on "constructivism." The music discipline is supported explicitly by the curriculum. The use of the platform has subverted the traditional teaching model. As for the subject and object of teaching, personalization and intelligent learning navigation are considered. Meanwhile, it should be emphasized that teachers and members of student groups must help each other. The scientific knowledge curriculum system is studied, and the music teaching classroom is transplanted to the network. The fast and distributed information exchange characteristics of the network make the teaching advantages and effects more prominent. Humanized, intelligent, dynamic, and scientific learning programs are gradually adopted, which promotes the improvement of learners' learning effects and effectively reduces learning costs. The site is currently named "Magic Light" music.

The system is composed of multiple wireless music box playing systems, and wireless resource sharing between small systems is realized through WiFi. Through the design of wireless mode, resource sharing is realized. Each music box wirelessly transmits its own stored audio files or shared audio files in other music boxes in the wireless environment

Table 2: Evaluation and feedback of the music teaching system.

	Teacher1	Teacher2	Teacher3	Average score
Course objective design	10	9	10	9.66
Course resource design	9	9	9	9
Course activity design	10	10	9	9.66
Course interface design	9	9	9	9
Course evaluation design	9	9	10	9.33

to the wireless speaker for playback. Playback control is realized through mobile terminal devices such as mobile phones, pads, or PC. The wireless audio transmission module of the system is Nordic company's nRF24L01 wireless module and adopts 2.4 GHz short-range wireless transmission technology. In the transmitting part, the main control module transmits the sound source data through the 2.4 GHz band of nRF24L01 module. In the receiving part, the MCU controller receives audio data from the 2.4 GHz of wireless module nRF24L01 through the SPI interface. Then, the audio data are transmitted to the audio output module through the SPI interface to play music.

The system of network music teaching is mainly built based on the Moodle platform. For music teaching, modern network technology is used to combine the network platform with traditional teaching to realize new applications. The system can be used to enrich the deficiencies in traditional teaching. It can also be used as an independent online learning course in a self-directed way. The current four basic courses in the system can meet the basic learning of music subjects. All these courses are designed effectively based on the guidance of constructivist theory. It is completely different from traditional music teaching.

In the research of the subject, Moodle is redeveloped and practiced for the specific needs of the music subject course. New plug-ins have been developed, and new learning activity modules have been expanded to meet the specific needs of the discipline. The complete construction of the course is realized, which lays a foundation for the learner's knowledge and cognitive construction. Based on the generation of dynamic and characteristic learning programs under the constructivist theory, the introduction and application of a personalized intelligent learning platform in music learning fully combine the Moodle platform with online music teaching.

4.3. Application Analysis of System Administrator. Based on the music teaching system of Moodle platform, the teaching process design of three teachers in the experimental group after using the system is evaluated. The evaluation content includes the curriculum, resource, activity, interface, and evaluation designs. The evaluation standard is 10 points. Ten points represent total satisfaction, and no shortcomings. Nine points show great satisfaction and means that the system can be improved. Eight points show general satisfaction, and there are many areas needing improvement. A score of 7-5 indicates a general effect. 5 points below indicate dissatisfaction, and the system should be perfected if it is going to be used. The feedback results can be clearly seen in Table 2.

Table 2 reveals the specific scores of five evaluations of the teaching process design of the music teaching system. The total score is 46.65, which reaches the excellent level of teaching design. It also suggests that in the experimental group, teachers are satisfied with the music teaching system. There is no evaluation below 9 points. However, the scores of five indicators indicate that the system needs further improvement in curriculum resource design and curriculum interface design. The system has been modified and improved according to the corresponding scoring standards.

In addition, the teaching process of the teachers in the experimental group and the control group is interviewed. As for the experimental group, teachers say that after using the teaching system, the time spent in various teaching links is much shorter than before, and class efficiency is significantly improved. As the system effectively records the students' homework submission and classroom performance, the performance evaluation can be automatically generated, which is quite convenient and fast.

As for the control group, teachers say that the time spent in each teaching link has not changed. Preparing lessons still requires a lot of reading materials. Therefore, more time is spent. In class, students are easily distracted and a lot of time is needed to maintain classroom discipline, resulting in less effective class time. Reviewing homework after class also wastes a lot of time, which reduces private time after class. Grade evaluation is also relatively slow. It needs to read massive classroom records and check past classroom performance to evaluate scores comprehensively.

The teachers' average time spent in preparing lessons, effectively attending classes, reviewing homework after class, and evaluating their achievements is compared. Table 3 reveals the results.

Table 3 suggests that the teachers in the experimental group spend only 0.5 hours preparing lessons, which is 0.4 hours less than the teachers in the control group. The effective class time of the teachers in the experimental group is 1.4 hours, which is 0.3 hours more than that of the teachers in the control group. Teachers in the experimental group spend 1.5 hours reviewing homework after class, which is one hour less than those in the control group. Teachers in the experimental group spend 2 hours on performance evaluation, which is 2 hours less than that in the control group.

These data suggest that the teachers in the experimental group spend less time preparing lessons, correcting homework assignments, and assessing the scores than the teachers in the control group. However, the effective class time of the experimental group teachers is higher than that of the control group. Thus, through the analysis of the results, it is

Table 3: Comparisons of the time spent in the teaching process between the experimental group and the control group.

Time (h)	Experimental group	Control group
The average time spent on preparing lessons	0.5 h	1.3 h
The average effective class time	1.4 h	1.1 h
The average time spent on correcting homework after class	1.5 h	2.5 h
The average time spent on performance appraisal	2 h	4 h

considered that using the system can effectively shorten the time of teaching links, improve the effective class time and the work efficiency of teachers, and reduce the burden of teachers in all aspects.

4.4. Application Analysis of Students. The practicality of the course content of the online teaching platform, the rationality of the course structure, and the effect of music learning are studied. 100 professional students from the experimental and control groups are collected to prove the system effectiveness after half a semester, including vocal music, the theoretical basis of music, rhythm training, Chinese and foreign music history, and songwriting. Then, the average scores of the five professional courses of the experimental group and the control group are compared. Table 4 suggests the results.

Table 4 reveals that in the vocal music class, the average score of the experimental group students is 9 points higher than the scores of the control students. In the course of the theoretical basis of music, the average score of the experimental group students is 8 points higher than the average score of the control students. In the rhythm training class, the experimental group is 8 points higher than the control group's average. In the course of Chinese and foreign music history, the experimental group is 9 points higher than the average score of the control group. In songwriting, the experimental group is 6 points higher than the average score of the control group. It reveals that the average scores of the five courses of the students in the experimental group are higher than the average scores of the students in the control group. It fully demonstrates the effectiveness of the use of the music teaching system.

In addition, 50 students from the experimental group are also surveyed for their satisfaction with the use of the system. The full score is 10 points. 10 points mean that they are very satisfied, have no shortcomings, and are willing to continue using it. 8-9 points mean that they are very satisfied, there is a shortcoming, and they are willing to continue using it. 6-7 points indicate general satisfaction, some defects need improvement, and they are willing to continue using it. 4-5 points suggest that they are generally satisfied, many shortcomings need improvement, and they are willing to use them after improvement. 2-3 is not satisfied, but the system can be used after improvement. 1 point means very dissatisfaction and they are unwilling to use it again. Table 5 presents the results of the student satisfaction score.

Table 5 shows that all the students are satisfied with the music teaching system, while the degree of satisfaction is different. More than 90% of students are willing to use the Moodle platform to learn more courses. This system can effectively improve their learning efficiency and academic performance. Therefore, the effectiveness of the system has also been verified.

Table 4: Comparison of the average scores of 5 professional courses in the experimental group and the control group of students.

Courses	Average score of students in the experimental group	Average score of students in the control group
Vocal music	89	80
Theoretical basis of music	95	83
Rhythm training	93	85
Chinese and foreign music history	96	87
Song writing	87	81

Table 5: Satisfaction results of the use of the music teaching system by the experimental group students.

Score	The number of the students	Proportion of students (%)
1	0	0%
2-3	0	0%
4-5	2	4%
6-7	3	6%
8-9	40	80%
10	5	5%

The music module based on the Moodle platform has been implemented in the expected functional modules through the application analysis and summary of specific roles. When using functional modules, the principle of "learning" is followed as much as possible. The advantages of the module function are effectively combined with the actual course as much as possible. Curriculum construction comes from the guidance of constructivist theory. The teaching methods under the direction of the constructivist theory are integrated into the specific curriculum. The unification of theory and practice is realized, and the system construction of the curriculum is completed. Teaching resources are rich. Course resource content can meet the needs of the actual course. Music teaching content is presented on the platform in various ways, which is in line with the actual needs of students. The secondary development guarantees the implementation of the course. According to the particularity of the music discipline, the effective secondary

development satisfies the original intention of the design and realizes the full implementation of the course.

5. Conclusion

First, the wireless transmission technology in the digital music classroom environment is analyzed. On this basis, the neural network model is applied to music score recognition, which lays a foundation for the subsequent construction of the network curriculum system for music education. The main functions, relative advantages, and development status of the Moodle platform are introduced in detail. The constructivist theory is applied to study its significance for music teaching. The importance of the reform of music education is explored. The music curriculum guided by constructivism theory is built on the Moodle platform, and the music teaching system based on Moodle platform is designed. However, there are also some research deficiencies. Due to the limited music data input of the system, the music types in the music teaching system are not comprehensive enough. In the follow-up research, corresponding measures will be taken to collect more music data to further improve the music teaching system.

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

Consent

Informed consent was obtained from all individual participants included in the study.

Disclosure

A preprint has previously been published in 2021 IEEE International Conference on Advances in Electrical Engineering and Computer Applications (AEECA).

Conflicts of Interest

The author declares no conflict of interest.

Authors' Contributions

The author has made a substantial, direct, and intellectual contribution to the work and approved it for publication.

References

[1] J. O. Connelly and P. Miller, "Improving learning outcomes for higher education through smart technology," *International Journal of Conceptual Structures and Smart Applications (IJCSSA)*, vol. 6, no. 1, pp. 1–17, 2018.

[2] V. Kumar and D. Sharma, "Creating collaborative and convenient learning environment using cloud-based Moodle LMS," *International Journal of Web-Based Learning and Teaching Technologies (IJWLTT)*, vol. 11, no. 1, pp. 35–50, 2016.

[3] M. Gupta, S. Marsden, T. Oluka, R. Sharma, and H. Lucas, "Lessons learned from implementing E-learning for the education of health professionals in resource-constrained countries," *Electronic Journal of e-Learning*, vol. 15, no. 2, pp. 144–155, 2017.

[4] B. Gan, T. Menkhoff, and R. Smith, "Enhancing students' learning process through interactive digital media: new opportunities for collaborative learning," *Computers in Human Behavior*, vol. 51, pp. 652–663, 2015.

[5] L. Johnson, S. Adams Becker, and C. Hall, "NMC technology outlook for Australian tertiary education: a horizon project regional report," The New Media Consortium. Cover image courtesy of Open Universities Australia ISBN, Austin, Texas, 2015.

[6] C. D. Dziuban and A. G. Picciano, "What the future might hold for online and blended learning research," in *In Conducting Research in Online and Blended Learning Environments: New Pedagogical Frontiers*, vol. 173, Routledge, 2015.

[7] T. S. Hew and S. L. S. A. Kadir, "Predicting the acceptance of cloud-based virtual learning environment: the roles of self determination and channel expansion theory," *Telematics and Informatics*, vol. 33, no. 4, pp. 990–1013, 2016.

[8] E. M. Mocanu and A. Deaconu, "The use of information and communication technology (ICT) as a teaching method in vocational education and training in tourism," *Acta Didactica Napocensia*, vol. 10, no. 3, pp. 19–34, 2017.

[9] B. L. M. Harasim, "Online Education," *American Journal of Nursing*, vol. 107, no. 5, p. 74, 2019.

[10] Y. U. Lasheng, W. U. Xu, and Y. Yu, "An online education data classification model based on Tr_MAdaBoost algorithm," *Chinese Journal of Electronics*, vol. 28, no. 1, pp. 21–28, 2019.

[11] O. Odena, "Multicultural dialogues in post-conflict music education settings," in *In Advancing multicultural dialogues in education*, pp. 215–233, Palgrave Macmillan, Cham, 2018.

[12] M. C. Moore, "Reflections on traditional African American music: its function and relevance in contemporary music education," in *In Traditional musics in the modern world: Transmission, evolution, and challenges*, Springer, Cham, 2018.

[13] D. Sirek, "Our culture is who we are! "Rescuing" Grenadian identity through musicking and music education," *International Journal of Music Education*, vol. 36, no. 1, pp. 47–57, 2018.

[14] M. K. Hedgecoth and M. Major, "Revisioning and reinstating: music education after the great recession," *Arts Education Policy Review*, vol. 120, pp. 1–10, 2019.

[15] A. Fung, "Transgenerational father-son resistance: a phenomenological inquiry of a music education professor's learning and parenting," *Music Education Research*, vol. 20, no. 5, pp. 616–626, 2018.

[16] L. B. Horodyskyj, C. Mead, Z. Belinson, S. Buxner, S. Semken, and A. D. Anbar, "Habitable worlds: delivering on the promises of online education," *Astrobiology*, vol. 18, no. 1, pp. 86–99, 2018.

[17] L. Feng and M. Suzhen, "Bounds for nonisotropic Marcinkiewicz integrals associated to surfaces," *Journal of the Australian Mathematical Society*, vol. 99, no. 3, pp. 380–398, 2015.

[18] T. Fabio, A. A. Elsadany, X. Baogui, and H. N. Agiza, "Local stability of the Cournot solution with increasing heterogeneous competitors," *Nonlinear Analysis-Real World Applications*, vol. 26, pp. 150–160, 2015.

[19] C. Yujun and Z. Yumei, "Monotone iterative technique for $(k, n-k)$ conjugate boundary value problems," *Differential Equations*, vol. 69, no. 69, pp. 1–11, 2015.

[20] "on observability and detectability of continuous-time stochastic Markov jump systems," *Journal of Systems Science & Complexity*, vol. 28, no. 4, pp. 830–847, 2015.

[21] Y. Zhiguo, Z. Guoshan, W. Jiankui, and Z. Weihai, "State and output feedback finite-time guaranteed cost control of linear it stochastic systems," *Journal of Systems Science & Complexity*, vol. 28, no. 4, pp. 813–829, 2015.

[22] M. Xinzhu, L. Rui, and Z. Tonghua, "Adaptive dynamics for a non-autonomous Lotka-Volterra model with size- selective disturbance," *Nonlinear Analysis-Real World Applications*, vol. 16, pp. 202–213, 2014.

[23] "Stochastic linear quadratic optimal control with constraint for discrete-time systems," *Applied Mathematics and Computation*, vol. 228, pp. 264–270, 2014.

[24] J. Tang, H. Guoping, and F. Liang, "A new non-interior continuation method for second-order cone programming," *Journal of Numerical Mathematics*, vol. 21, no. 4, pp. 301–323, 2013.

[25] X. Zhou, X. Shi, and H. Cheng, "Modelling and stability analysis for a tuberculosis model with healthy education and treatment," *Computational and Applied Mathematics*, vol. 32, no. 2, pp. 245–260, 2013.

[26] S. Pang, T. Li, F. Dai, and M. Yu, "Particle swarm optimization algorithm for multi-salesman problem with time and capacity constraints," *Applied Mathematics & Information Sciences*, vol. 7, no. 6, pp. 2439–2444, 2013.

[27] J. Wang and Q. Zhan, "Visualization analysis of artificial intelligence technology in higher education based on SSCI and SCI journals from 2009 to 2019," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 16, no. 8, pp. 20–33, 2021.

[28] D. Wang, X. Lv, S. Zhang, and T. Zhu, "Role of network cloud platform-based and progressive health education in postoperative rehabilitation of patients with tibial fracture," *American Journal of Translational Research*, vol. 13, no. 5, pp. 4819–4824, 2021.

[29] Y. Ding, Y. Li, and L. Cheng, "Application of Internet of Things and virtual reality technology in college physical education," *IEEE Access*, vol. 8, pp. 96065–96074, 2020.

[30] V. Caputo, "Add technology and stir: music, gender, and technology in today's music classrooms," *Visions of Research in Music Education*, vol. 16, no. 5, p. 10, 2021.

[31] P. J. da Silva and M. R. Voelzke, "Digital technology and musical instruments as methodology of teaching sound waves in physics," *Brazilian Journal of Development (ISSN)*, vol. 7, no. 9, pp. 89593–89601, 2021.

[32] P. R. Webster and D. B. Williams, "Technology's role for achieving creativity, diversity and integration in the American undergraduate music curriculum: some theoretical, historical and practical perspectives," *Journal of Music, Technology & Education*, vol. 11, no. 1, pp. 5–36, 2018.

[33] A. M. Hart, "The tablet as a classroom musical instrument," *Athens Journal of Education*, vol. 5, no. 3, pp. 299–324, 2018.