Design and Implementation of Computer Visualization Assisted Vocal Music Teaching System

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Abstract. In vocal music teaching, teachers and students constantly put forward the urgent problem to be solved in the teaching work. For example, due to the lack of teaching time, teachers do not have enough classroom time for students to carry out a comprehensive vocal music skills professor, The homework that the teacher does not know after class needs to check, and the score is lowest, workload is biggest，in addition to classroom time, the lack of communication channels between teachers and students. It is a general trend to combine music teaching research with modern information technology, especially computer multimedia technology. In view of the current vocal music teaching visual market demand, this paper designed a kind of the teaching of vocal music visualization system for virtual reality, to show the operation in the form of intuitive teachers to students, can bring unique advantages for vocal music teaching, and also can make the visual teaching and the traditional vocal music teaching mode to cooperate with each other, The quality and level of vocal music teaching can be improved and promoted in the process of complementing each other and progressing together. Teaching practice shows that：The system has the advantages of high efficiency, objective, accurate, rapid and controllable, flexible, multi-way, creative and other characteristics, has a good man-machine interaction interface, interface design beautiful and generous, can support mobile terminal App application, help students to digest the classroom knowledge as much as possible, greatly improve the vocal music teaching effect.

Keywords: vocal music teaching; computer visualization; instructional system design; multimedia technology; human-computer interaction interface

1   INTRODUCTION

Network information technology education and resource utilization, integration and interaction. Computer aided instruction (CAI) has become an advanced teaching method because of its incomparable advantages compared with traditional teaching methods. Kaur et al. [1] mentioned that it has been accepted by teachers and students gradually and has been widely used in teaching practice. However, the traditional vocal music teaching mostly uses the training of auditory perception to guide students to memorize, so it can be seen that this teaching mode and teaching idea is a relatively weak method to analyze students' memory from the perspective of students' memory. Atkins and Sharma [2] indicated that the way to solve this problem is to make the teacher's operation process visualization, the auditory perception into visual content to guide students to memorize, can significantly improve the effect of students' memory; At the same time, for students with different learning ability, vocal music can be connected according to their own needs, so that students can really learn independently, so as to strengthen students' understanding and mastery, improve vocal music teaching effect. The aided teaching system based on computer visualization can let students experience a new education mode and mode, students' learning is no longer limited by time and space, and learning activities are based on students themselves. Pires and Azar [3] indicated that visual teaching assistant system uses electronic documents, video and audio files and other carriers to spread the teaching information through the Internet, and uses modern educational technology to teach, expand the educational scope, break through the shackles of traditional time space and time, and to a large extent, alleviate the current situation of insufficient software and hardware of traditional universities. And because the learning time of freedom, flexibility and openness, that more students can according to their need for autonomous learning, can provide more people with opportunity to learn and study, with teachers and other students to study between synchronous or asynchronous communication, strengthen the study and communication between students and teachers and information feedback, Teachers can make appropriate adjustments to teaching tasks according to students' feedback, so as to cultivate students' ability of collaboration and communication.

This paper mainly through the analysis of the current development of the auxiliary vocal music teaching system design, design and implementation of a set of functions more perfect, good stability based on computer visualization auxiliary vocal music teaching system. First of all, the vocal music teaching auxiliary system needs analysis, mainly including the overall overview of the system development, clear development direction of the system, and then according to the needs of the system will be subdivided into functional modules, clear each user role, for the system design and implementation to provide the corresponding basis. Then, according to the system requirements and analysis results, the functional modules of demand analysis are designed in detail, and the design process of the system is introduced in detail from four aspects: system technical architecture, application system functional architecture, system detailed functions and system database. Thirdly, in the realization stage of the system, according to the system requirements to obtain and analyze the results of the stage and the detailed design results of the system, the screen shots of the main functions of the system and some core codes are displayed, so as to introduce the realization of the system functions. Finally, in order to avoid excessive errors in the future operation of the system, functional tests are also carried out on the system.

2   RVISUAL VOCAL MUSIC TEACHING MEANS RESEARCH AND APPLICATION ADVANTAGES

Visual vocal music teaching is modern information network technology and multimedia technology, which can make the abstract content in the traditional teaching mode change into more visual images to guide students to analyze and study, that is, vocal music teaching change into visual teaching content. Is called the visualization of music teaching, therefore, the corresponding teaching content must set image sound image animation film and television, and other multimedia

elements into an organic whole, so that the students can be illustrated in the learning process of dynamic and static combination, can through the image of the animation and the contents of this abstract images more intuitive to observe and to experience. Visual teaching can effectively reduce the difficulty of students' understanding and improve their learning effect. The traditional vocal music teaching mode, the teacher through the classroom explanation, let the students in the classroom memory, and then you can master as much as you can understand. However, sound is fleeting, if the content of the class is more complex, and the students' memory is not strong, and they will have less knowledge and skills in the process of after-class practice. Banerjee and Murthy [4] mentioned that this is an important reason why many students feel it is difficult to learn relevant knowledge and skills under the traditional teaching mode and the learning effect is not high. However, with the application of visual vocal music teaching means, whether multimedia or network technology, students can use these devices to save the knowledge learned in the classroom, so that students continue to watch after class, and then according to the content of the classroom teacher explained training and improvement. At the same time, in the visualization state, students can compare their own performance in class according to the guidance of teachers and the characteristics of their own learning process, so that students can take themselves as a reference to guarantee the after-class training effect more effectively. Therefore, the application of visual teaching means in vocal music teaching makes vocal music teaching to present the continuity feature, which plays a very important role in reducing the difficulties in the process of students' vocal music learning and improving the quality of students' learning and training. It is precisely because of this advantage that visual teaching method has been widely used and spread.

In the process of explaining the theory and practical experience, the teachers of traditional vocal music teaching mostly make students understand the corresponding content deeply as far as possible through oral explanation, and train with their own basic conditions in the process of continuous understanding and feeling and experience. However, the teaching effect of this teaching mode is very limited. The teaching time is limited, and teachers have limited time to explain the relevant content over and over again or in infinite depth, which is not conducive to reducing the difficulty of students' learning process. Borgbjerg [5] mentioned that teacher's energy is limited, on the other hand, such as for vocal music teaching process to guide students to master the correct breath way, through the theoretical interpretation of the first enable students to understand the content of the corresponding, then teachers to action demonstration to all students, to enable students to more accurately grasp the corresponding breathing techniques, so as to make the teaching to get the corresponding results. However, the teacher's energy is limited, and repeated theoretical explanation and time demonstration is not realistic, which requires students to quickly and accurately grasp the relevant content and essentials according to the teacher's limited explanation, otherwise the difficulty of training will increase. In visual teaching mode, it effectively avoid the defects above, with the aid of the application of the information network and multimedia equipment, teachers can produce electronic courseware, through the electronic courseware in the classroom to the students show the corresponding theory and practice skills, and the electronic courseware can guide the student to carry on the storage, combined with their own needs to watch at any time. In this way, teachers only need to explain theory and practice to students once in class, so that students can practice themselves in combination with visual courseware after class. This method not only saves the students' classroom learning time, but also saves the teachers' energy, comprehensively improving the classroom teaching effect and quality and promoting the progress teaching level. We cannot do without the support of science and technology in the process of comprehensively improving the level and quality of education. And the information technology network technology and multimedia technology will promote the progress and development of vocal music teaching level. And years of practical application results also fully shows the visual effect in the process of vocal music teaching method in the application and value, so the process of development in the future we will further firm pace of development, relying on science and education to better promote the application of visualization of vocal music teaching means, make the visualization of vocal music teaching produces the value of even more

significant. , on the other hand, in the education process of the construction of the information age, information technology and the integration of education is the inevitable trend of era development, so the future will also with the aid of the application of the information technology education field realize the goal of education in the knowledge resources digital three-dimensional plane resources, application for Internet resources in the field of education, for the application of knowledge map will be more widely, Will also use these advantages, more effectively fill the brain of students, lit the wisdom of students. So the development of visualization of vocal music teaching method is fit strategy relying on science and education, as well as the basic spirit of the education informatization development plan and direction, in the course of future development will be more effective to get countries and education institutions, also will have a more significant results for vocal music education, and value, and its broad application prospect and development of the heavens and the earth will be infinite.

3   DEMAND ANALYSIS

3.1   Feasibility Analysis

Design and implement a computer visualization system for vocal music teaching, the system must meet the needs of online teaching and practice between teachers and students. The feasibility of the system will be studied from three aspects: technology, economy and operation.

Technical feasibility: the system plans to use B/S (Browser/Server) mode for construction, so that we can choose the current site production field more mature solutions, so as to get more technical support. Sampaio [6] mentioned that the three software combinations of PHP, MySQL and Apache are initially selected to develop and set up to effectively reduce the economic burden of the project. On the other hand, due to the large number of users of open source software, there are many ready-made solutions of the system. Relying on the strong community support of these software at home and abroad, if there are difficult problems in the process of making a system architecture, we can quickly find the corresponding solution, without spending too much time to explore. This way, you can focus more time and effort on building the system instead of wasting time on unnecessary implementation details. It can be foreseen that there will be no technical obstacles in the implementation architecture of the system, because all the technologies have passed numerous practical tests and are quite mature. Therefore, from the technical aspect to open, a system in line with the requirements is completely feasible. Economic feasibility: When designing and implementing a system that meets real needs, economic accounting must also be calculated. If the cost is too high and the results are too low, then designing and implementing such a system is not worth the cost. The cost of the system mainly comes from two aspects: hiring designers and developers, and purchasing hardware and software equipment. Specific to this system, excluding design and development personnel costs, the main cost will be concentrated in the purchase of hardware and software equipment. Because open-source software is used for system development, there is no need to buy expensive software. In this way, you only need to buy enough servers and bandwidth to meet the development needs, and this cost for a good use of the school teaching system, is fully worth paying. Therefore, economically, it is feasible to design and implement a system that meets the requirements. Operation feasibility: at present, no matter in the personal computer or in the mobile terminal such as the mobile phone, the browser can be seen everywhere. In colleges and universities, no matter students, teachers or teaching administrators, it is very easy to operate the browser to access the Internet. And the browser is just a basic tool to use this system, so, from the user's point of view, the system does not exist to use obstacles. Therefore, from the point of view of operation, it is feasible to design and implement a system that meets the requirements.

3.2 Summary of Demand

The system will focus on the actual needs of users in the vocal music teaching system. The specific needs are described as follows:

In the registration process, the registration submission method is the same for different users, who need to choose their own identity types (including administrators, teachers and students) to use the system during registration [7]. Review mechanism is different, different types of personnel registration should be reviewed by different relevant personnel. The administrator's registration application is reviewed by the top administrator, the teacher's registration application is reviewed by the administrator who has been approved. Students' application for registration will be reviewed by the teacher in charge of the corresponding class according to the information of the class they fill in. Users should be able to use the account and password corresponding to their own identity to log in to the system for operation and can log out at any time. After logging in, users should be able to view their personal information in the system and modify certain items (such as phone number, email address, personal address, etc.). Users should be able to change their passwords at any time at their own will as permitted by the system security and confidentiality rules. Plus, the user is looking it up. When looking at relevant information, you can use a convenient search function. From the point of view of teachers, teachers can upload previous teaching videos, or delete their own uploaded teaching videos; Teachers can assign homework for students in different classes and class hours according to the teaching situation and check students' reception and submission of homework at any time [8]. Teachers can also comment on the homework submitted by a student and mark students' homework. At the end of the semester the teacher can query a student's work according to the class submit the situation, and check the scores of their homework and export the statistical table of students' homework scores; the teacher can also export a summary of the scores of all students in the class. If the teacher's time permits, the teacher can check the student's message and answer the student's question. From the student's point of view, students can view the uploaded content of their courses. Teaching video; Students can also view the homework assigned by the teacher of the course. For the homework that needs to be submitted for feedback, students can also submit text or audio and video feedback according to the corresponding homework requirements. Students interact with teachers through the online chat function provided by the system. Students can leave a message to the designated teacher to ask questions and see the teacher's answer to the message. From the point of view of the backstage management personnel, the management personnel add, delete, change and check the information of departments, majors, classes, teachers and students. The department and major of the class can be set; for teachers, they can set their departments, and for students, they can set their classes.

3.3 Functional Requirements

According to the requirements described above, the following system requirements will be analyzed and mined. Through multi-angle and multi-directional analysis, the functional requirements of different types of users of the system will be presented completely and clearly.

Through the analysis of the above requirement description, we can get three human-oriented nouns, namely "manager", "teacher" and "student", which are obviously involved in the interaction with the system and users of the system. From the perspective of information flow, outsiders who are not registered with the system are also likely to initiate system requests and interact with the system. However, due to the limitation of the system's authority, the external personnel who are not registered in the system can only access some unimportant pages of the system, and cannot use the core functions provided by the system [9]. Therefore, in fact, the external personnel do not get the permission to interact with the system, so they are not real users of the system. Therefore, the participants of the system can be determined as follows: 1. System management personnel: use the system to manage departments, majors, classes, teachers, students, etc. 2. Teacher: use the system to upload teaching videos, assign homework, answer questions for

students, etc. 3. Students: study by playing teaching videos, view and submit homework, chat with teachers, leave messages and ask questions to teachers, etc. After determining the participants of the system, it is necessary to further define the interaction between the participants and the system, and describe the interaction between the participants and the system. The system use case diagrams are shown in Figure 1 and Figure 2.

Through the above analysis, root identified the participants of the system and their related functions. In general, the system acts as a bridge, taking advantage of the all-weather, borderless characteristics of the Internet, connecting [10]. And in which play a key role, of course, is the practical function provided by the system. Therefore, clear system should provide the function is a very key step in the process of system design and implementation. For all users, the system must provide basic functions such as logging in, changing passwords, modifying personal information and exiting the system. For the management personnel, the system needs to provide its department management function, professional management function, class management function, teacher management, student management function, so that it can fully perform the responsibilities of the system administrator. The most important thing for teachers is to ensure that they can provide students with enough learning materials, manage students' work systematically and in detail, and answer students' questions when appropriate. Therefore, it is necessary for teachers to upload teaching videos, assign homework, correct homework, and answer online questions and other functions. Students, on the other hand, mainly focus on functions related to their studies, such as watching teaching videos, submitting homework, and raising their doubts to teachers. Therefore, the system should provide corresponding functions to meet the basic needs of students.
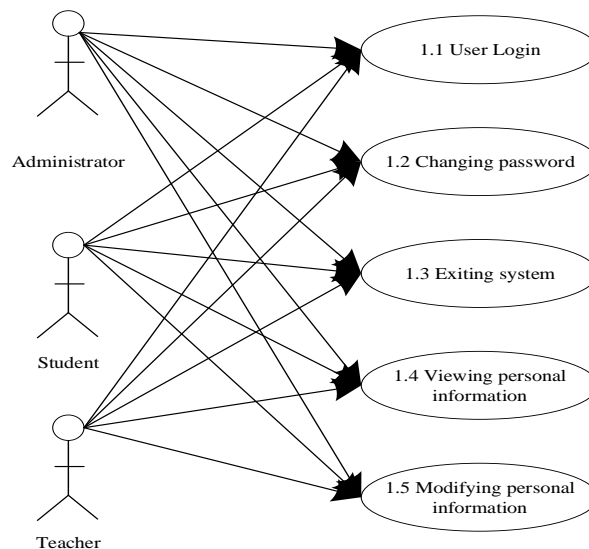

Figure 1: Digital System common use case diagrams.

3.4 Non-functional Requirements

Generally speaking, the following non-functional requirements need to be met to ensure that the system can meet the needs of daily use: (1) Easy to use: the system should have a unified user interface and operation mode, so as to reduce the time spent by users in learning the use of the system and achieve the effect of getting started quickly. (2) Rapid response: according to the actual situation of the school, the system needs to meet the requirements of supporting more than 100,000 visitors per day, allowing a maximum of 1,000 people to be online at the same time, and controlling the response time within 1s. (3) Easy maintenance: the system should be easy to

maintain, and it can be relatively easy to modify and expand the existing functions of the system when necessary.
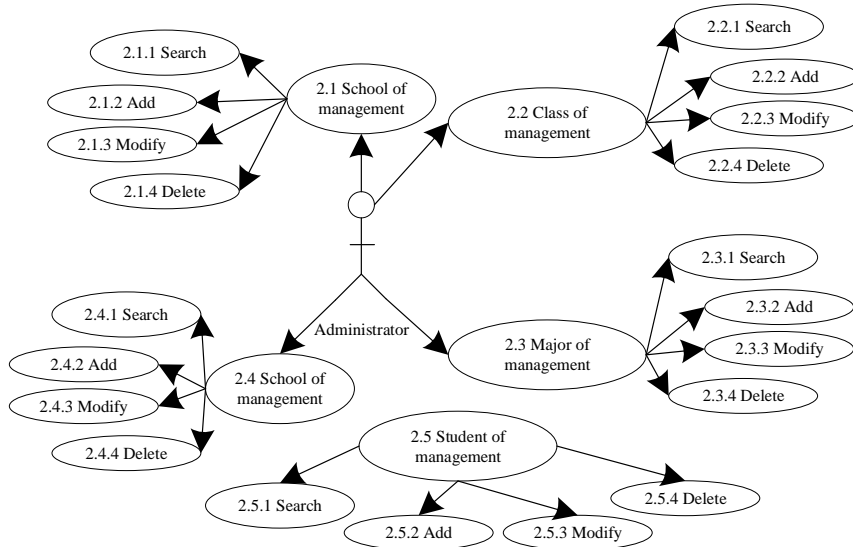

Figure 2: Manage staff use case diagrams.

4   SYSTEMATIC DESIGN

Computer-aided design techniques and methods are used to draw analysis drawings. After determining the basic principles to be followed in the overall design of the system, the structural design of the system can be started. The main goal of the system structure design is to divide the abstraction level of the system and determine the function module division of the system. After the interpretation of demand analysis, the system can be preliminarily divided into three levels: database layer, business logic layer and UI presentation layer [11]. These three levels pass on information to each other, constituting a complete system.

The common way to implement data persistence layer is to implement Object Relational Mapping (ORM), that is, to realize the mutual Mapping between objects in Object language and entities and relationships in Relational databases. Because ORM provides similar functionality, but its internal implementation mechanism is really complex, it is not worth the cost to develop ORM persistence layer yourself if it is not necessary. As a practical matter, I chose to use the database abstraction capabilities provided by the ThinkPHP framework directly. ThinkPHP provides a complete database layer operation API, can be used directly for the business logic layer, developers to do is when there is a need, in the Model layer to define the data access function for the call to achieve the data access operation of the package, complete the mission of the data persistence layer. The overall model design chart of system is shown in Figure 3.

The vocal music teaching module mainly focuses on professional voice practice, and users can modify the results of singing in real time to form the correct pronunciation, so as to realize the real interactive teaching mode. The singing scoring module mainly builds the singing model through the original singing audio, selects the comparison parameters of volume, pitch and breathe, then compares the extracted singing audio parameters with the original singing model parameters, and finally gives the corresponding evaluation and opinions according to the matching degree of the two.
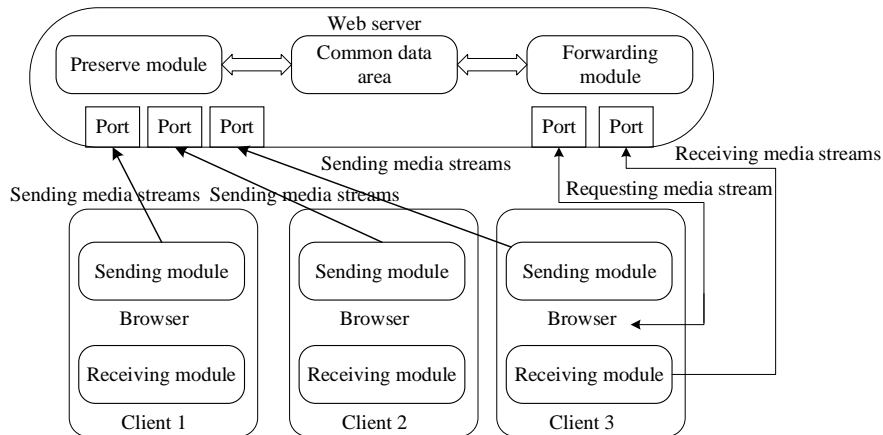
Figure 3: Overall model design chart of system.

This set of teaching mode, pay attention to the specific implementation of vocal music theory, realize the integration of theory with practice, take the way of training system combined with individual guidance, use "one to many" silent practice for students to lay a solid foundation, with each of the students "one to one" teaching way of singing skill and singing style, save the teachers, to save time, speed up the students' success, Improve the vocal music teaching level, solve the music art colleges and universities, especially teachers and comprehensive universities expansion brought by the imbalance of the ratio of teachers and students dilemma, fill a number of gaps in vocal music teaching. The reform of vocal music teaching mode depends on the understanding and thinking of the subject of vocal music education by art educators, who have the courage to break through the framework of traditional vocal music teaching, and carry out bold innovation of teaching materials, teaching methods and teaching modes in traditional vocal music teaching under the guidance of critical thinking. For vocal music teaching system engineering construction and Chinese vocal music scientific, systematic, standardized, practical development to make positive contributions. Vocal music teaching is a scientific, artistic, technical, theoretical and contemporary teaching activity. It is an indispensable application oriented subject course in normal and non-normal music colleges and universities [12].

The client uses the design idea of sending a request. The process is as follows: The user can choose whether to allow others to view the local media, and if so, the local media is sent to the server. During this process, the server listens on the server port assigned to the user, and if any streaming media arrives, it adds a record to the hold array. If the local users to view other media information, so to apply to the server, the server after receiving the application, in keeping the array to find the existence of the requested media, if present, is from port real-time replication media pack and go to request the media users, and real-time broadcast on the client. The basic structure of visual intelligent management system includes graphic system, database, model base, knowledge base and inference machine. The structure of auxiliary vocal music teaching management system is shown in the Figure 4.

5   SYSTEM TEST

The testing of the system includes functional testing, overall testing and performance testing. According to the requirements of practical teaching, aiming at the teaching characteristics of signal and system course, such as strong mathematical dependence and abstract concept, this paper studies the teaching content of vocal music course by using Matlab visualization tool, puts forward

the classification visualization teaching method under the virtual experiment environment, and analyzes some visualization teaching cases.
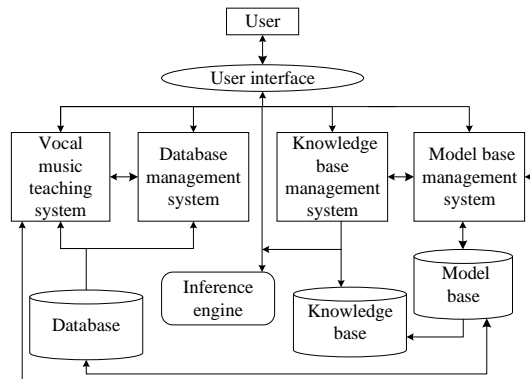

Figure 4: Visual vocal music auxiliary teaching system structure.

The method to problems in virtual experiment environment, task driven as the breakthrough point, strengthening theory, practice, and provides an intuitive and autonomy learning environment, the system has a cross-platform, modularity, class B/S structure. It is beneficial to cultivate students' practical ability and meet the requirements of students' comprehensive quality training. The comparison of vocal music learning efficiency in different education systems is shown in Figure 5.
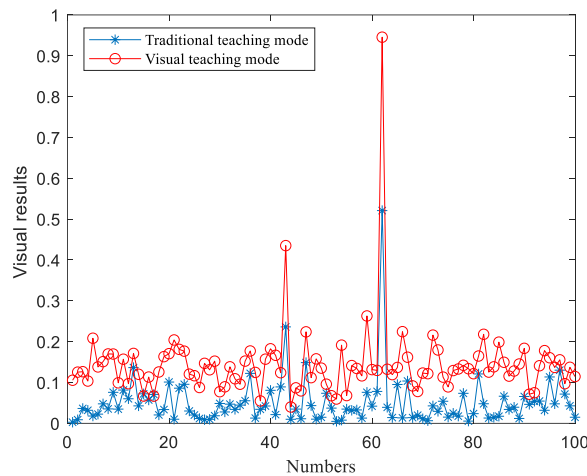

Figure 5: Comparison of vocal music learning efficiency in different education systems

System not only realizes the algorithm of computer graphics, visualization, and the algorithm implementation process dynamic demonstration, abandon the past teaching software simply repeat the textbook content production way, let the learners in learning algorithm directly or structure, the implementation process of "see" algorithm from the concrete vocal music in the animation to understand algorithm, can alleviate the teacher blackboard writing, It can also vividly display music modeling and performance abstract, different types of vocal music algorithm, reduce the difficulty of knowledge itself, help learners to understand various algorithms. In addition, systematic reform of the traditional vocal music teaching with a richer form of sensory defects, is conducive to stimulate students' strong interest in learning, so that music learning into practice. Therefore, the software is of great significance in teaching and promotes the transformation from

traditional teaching mode to modern teaching mode. The box visualization of vocal data is shown in Figure 6.
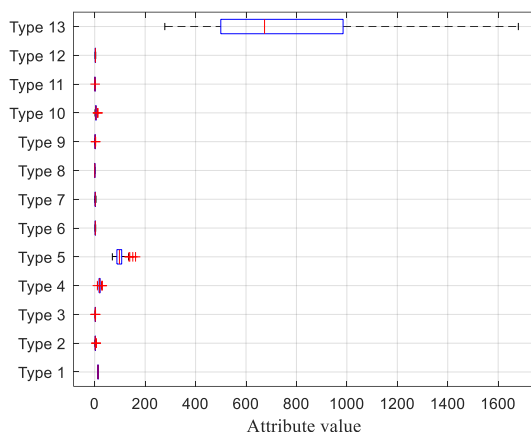

Figure 6: Box visualization of vocal data.

This system contains some excellent works completed using computer graphics knowledge. These works are interspersed with the body of knowledge to make students feel the importance of learning the subject well. If you feel that the topics are done before, but also through the SOCKET technology to complete the online discussion area and message board function teacher put forward the request of updating the question bank. If you have a problem, you can also log in the discussion area and discuss it with your classmates and teachers. There is no distinction between teachers and students and they can discuss freely. And teachers can add some new questions to the original test bank for students to practice when appropriate. Computer graphics is the study of computer generation, processing, display and output graphics. The key of graphics teaching is how to show the generation of graphics to learners in a more vivid and intuitive way so that learners can better understand the theory and algorithm of computer graphics. Through the test of each module of the system, the final test results verify the concrete realization process of all the functions of the system, and ensure the stable operation of each functional module in the system. Core modules including piano sub-modules, music editor preview and save the son module, the module, the music score display control module, the score of the audio processing module functions are implemented, provided technical support for music classroom teaching, simplify the procedure of the teacher's teaching, at the same time reduces the difficulty of the students study and practical application. The schematic diagram of data visualization results is shown in Figure 7.

6   CONCLUSION

Vocal music teaching is a complex system engineering, computer visualization technology can provide powerful help for vocal music teaching. Through the computer visualization technology, can let vocal music professional teachers and students and researchers with a visual way, intuitive "look" into the music sound ontology what they care about pitch, timbre, dynamics and the dynamic change process of various parameters, such as speed, and can adopt corresponding analysis statistical algorithms to compare with their ideal target. This objective and accurate auxiliary teaching model can undoubtedly provide them with good subjective evaluation reference and learning cognitive feedback. Visual vocal music teaching has its own advantages and characteristics, for improving the quality of vocal music teaching to expand the field of vocal music teaching, for the realization of classroom vocal music teaching lasting effect, effectively save time and save human and material resources and other aspects have a very important role and value.
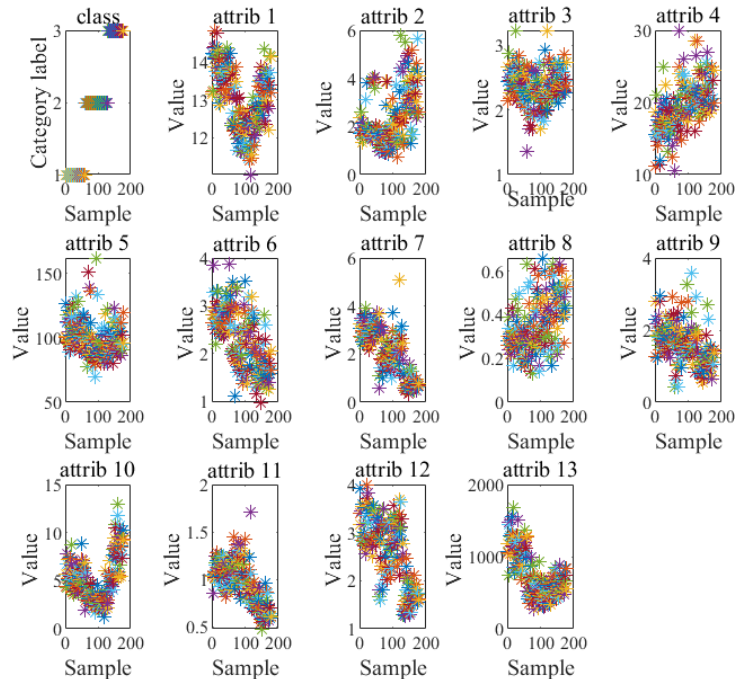
Figure 7: Schematic diagram of data visualization results.

At the same time, with the help of science and education to rejuvenate the country and education information age development plan, visual vocal music teaching will also have a broad prospect of development, so we should strengthen the construction of visual vocal music teaching steps, make visual vocal music teaching more obvious application, promote the quality of vocal music teaching to get more effective improvement. From the macro perspective of discipline development, if computer-aided visualization can gradually become the public knowledge base of music discipline, it will have important strategic significance for promoting the long-term development of music performance, musicology theory, music creation, music acoustics and other surrounding related disciplines and even the whole art discipline. It is believed that with the deepening of people's understanding of this field and the continuous improvement of the overall level of music art education, computer visualization aided analysis will play a more important fundamental role in vocal music teaching and research.

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