Research Article

Construction and Optimization of Artificial Intelligence-Assisted Interactive College Music Performance Teaching System

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This research focuses on the relationship between artificial intelligence technology and music performance in colleges and universities and explores the application of artificial intelligence technology in music teaching. At the same time, it explores the deficiencies of existing computer-assisted language learning software and systems through questionnaires and interviews and also proposes solutions, such as further understanding of theories, enhancing learners’ confidence, and stimulating their interest in learning. The results of this research will help to improve the application of online intelligent human-computer systems in music teaching and provide dynamic support for improving the quality of music teaching and talent training in colleges and universities.

1. Introduction

The outstanding feature of the music performance major is performance. Whether students are studying vocal music or various instrumental music and dance, the core goal is to become a performer who can perform onstage. From the perspective of professional training goals and students’ future career directions, the music performance major cultivates applied and compound talents. After graduation, students’ main destination is social-cultural groups and relevant departments of enterprises and institutions. They are engaged in not only art performances but also the organization, guidance, planning, and implementation of art activities, which requires them to understand and be familiar with the characteristics, methods, procedures, details, etc., of music performances and related work, and also have the corresponding workability. Therefore, in the construction of the practical teaching system of this major, the first point is to firmly grasp the characteristics of the major and highlight the performative characteristics of practical teaching activities.

The fundamental purpose of music teaching in colleges and universities is to cultivate students’ ability to perform music, but the level of music performance that students actually master at present cannot achieve the desired effect. With the rapid development of Chinese society and the continuous enhancement of international exchanges, skilled music performance has become particularly important, which has brought great challenges to music teaching in colleges and universities. In today’s British music teaching, traditional teaching methods can no longer meet the needs of contemporary society for comprehensive talent training. In recent years, the rapid development of artificial intelligence technology has brought new opportunities for the modernization of music teaching, which provides new opportunities for the creation of an intelligent music teaching environment. At present, a consensus has been reached on the importance of artificial intelligence technology applied to teaching systems. Guided by the integration of information technology and curriculum, it is of great practical significance to conduct research on the application of artificial intelligence technology in college music teaching. Based on the above background, this paper needs to solve the following three problems: (1) What problems exist in the current music teaching in colleges and universities? (2) The interactive relationship between artificial intelligence and
music teaching; and (3) the specific practice of artificial intelligence in music teaching in colleges and universities.

For the above three questions, some scholars and education experts have already conducted research. For the first question, Huang et al. have preliminarily studied the advantages, disadvantages, and innovations of various college music teaching models [1]; Rebecca et al studied the problems existing in the teaching of music performance in colleges and universities in our country [2]. For the second question, Guoliang studied the relationship between artificial intelligence and music teaching [3]. For the third question, Kun et al. studied the application of artificial intelligence in the field of music teaching. This paper mainly studies the relationship between artificial intelligence and music teaching by discussing the current problems in music teaching in colleges and universities and improves the application of artificial intelligence in music teaching. These misconceptions have been in the consciousness of students and some teachers for a long time. With the development of artificial intelligence, scholars have begun to study how to use artificial intelligence to solve the problems encountered in music teaching. The application of artificial intelligence technology in music teaching starts from artificial intelligence and the problems it intends to solve and explores the application of artificial intelligence technology in music teaching around the relationship between artificial intelligence and music teaching. However, there are also many problems with artificial intelligence in university music teaching. Based on the research of the above scholars, the author believes that artificial intelligence can effectively solve the problems in music teaching, but at the same time, there are also some problems in the application of artificial intelligence in music teaching. This paper mainly aims at the shortcomings of artificial intelligence in music teaching and proposes solutions to improve the confidence of learners to stimulate their learning confidence and further improve the application of artificial intelligence in music teaching.

2. Related Work

In nature, living things live according to the principle of “survival of the fittest.” In 1975, the random search algorithm proposed by Professor Holland from the United States used computers to solve intelligent analysis problems according to the survival law of nature which is the most effective method. The genetic algorithm (GA) was first proposed by John in the 1970s. The algorithm was designed and proposed according to the evolutionary laws of organisms in nature. It is a computational model of the biological evolution process that simulates the natural selection and genetic mechanism of Darwin’s theory of biological evolution. It is a method to search for the optimal solution by simulating the natural evolution process. The algorithm converts the process of solving the problem into a process similar to the crossover and mutation of chromosomal genes in biological evolution through mathematical methods and computer simulation operations. When solving more complex combinatorial optimization problems, better optimization results can usually be obtained faster than some conventional optimization algorithms. Genetic algorithms have been widely used in combinatorial optimization, machine learning, signal processing, adaptive control, and artificial life. Each chromosome in the genetic algorithm corresponds to a solution of the genetic algorithm. Generally, we use the fitness function to measure the pros and cons of this solution. So the fitness from a genome to its solution forms a map. The process of the genetic algorithm can be regarded as a process of finding the optimal solution in a multivariate function. It can be imagined that there are countless "mountains" on this multidimensional surface, and these peaks correspond to the local optimal solution. And there will also be a "mountain" with the highest altitude, and then this is the global optimal solution. The task of the genetic algorithm is to try to climb to the highest peak, instead of falling into some small peaks. In addition, it is worth noting that the genetic algorithm does not have to find the "highest mountain." If the fitness evaluation of the problem is as small as possible, then the global optimal solution is the minimum value of the function. Correspondingly, what the genetic algorithm is looking for is "the deepest valley." The principle of the genetic algorithm is to express the set of problems to be solved as “groups.” Before solving the operation, some of the “groups” are assumed to be the solution sets to be sought, and these initially identified solution sets are placed in the environment of the problem. Through the principle of survival of the fittest, new groups are continuously generated through operations such as combination, exclusion, and mutation, and they evolve continuously until the obtained “group” meets the expected value, that is, the optimal solution to the problem. The solution of the genetic algorithm starts from the initialization and randomly selects a subset from the whole population as the initial population. During the running process of the algorithm, the size of the population does not change all the time. An individual is each specific element in a population. Fitness is the degree of adaptation of the individual to the external environment. In order to measure the individual, the function of measuring the fitness is called the fitness function. According to this function, the survival law of nature is reflected. Coding is because the algorithm cannot directly process the parameters of the problem space, and it needs to be converted into a space set that the computer can recognize according to certain rules. The workflow of its algorithm is shown in Figure 1.

Among them, selection, crossover, and mutation are the genetic operators of the algorithm. Selection is to keep the individuals with strong adaptability in the group and eliminate the individuals with low adaptability; crossover is to replace a part of the structure of the individuals according to certain rules and then obtain new individuals; variation is performing a specific operation on a gene value in an individual to generate a new individual which is the most important means to improve the global search ability of the genetic algorithm.

3. Basic Baseline for System Construction

The basic idea of the construction of the practical teaching system of the music performance major according to the
characteristics and training objectives of the music performance major, combined with the actual requirements of the society, the practical teaching system of this major should at least contain the following basic links:

1. The practical link in the basic course: the most basic course in the music performance professional curriculum system is the professional basic course. The basic curriculum settings of each college include music theory, solfeggio, harmony, polyphony, musical analysis, Chinese music history, foreign music history, and national folk music. The teaching objectives of the basic courses of music performance should be the trinity of basic knowledge, basic theory, and basic skills. That is to say, the teaching tasks of these courses should not only enable students to master the basic knowledge and basic theory of music discipline but also carry out basic skills. Training and the organic combination of the three can lay a solid professional foundation for students. Among them, there is a flexible space for basic skills. From the perspective of the construction of the practical teaching system, these courses must become an integral part of the construction of the practical teaching system, and the development of the practical link should be strengthened in the curriculum planning. There are two main forms: one is exercise practice, that is, the relevant content in the course is repeatedly practiced through exercises so that students can form solid skills and skills on the basis of firmly grasping the relevant knowledge theory. For example, the music theory course, which involves the formation of intervals, mode tonal analysis, time value division, chord construction, etc., requires a large number of exercises to enable students to master relevant theories and knowledge and form basic skills for future music performance practice to lay the foundation. The second is the appreciation of works. Courses with a strong theoretical nature, such as Chinese music history and foreign music history, still need to expand the practical space. For example, some schools set the music history course as Chinese (foreign) music history and work appreciation, which is actually an organic combination of the practice of music appreciation in the teaching of music history courses. Even if the name of music appreciation is not clearly indicated in the course title, the practice of music appreciation should be combined with specific content in actual teaching.

2. The practical link in the skill and skill course: in the course system of the music performance major, the core course is the skill and skill course, such as Chinese and foreign instrumental music, vocal music, piano, dance, ensemble, chorus, and piano accompaniment. In such courses, it is a practice-oriented course in itself, and the basic goal of its teaching is to enable students to master relevant skills and skills to perform complete musical works [4, 5]. And if it is not enough to stay at this level, the ultimate goal of mastering and using the corresponding skills and techniques should be implemented onstage performances. The setting of practical skills and skill courses also needs to be developed from two aspects, one is the penetration and strengthening of performance factors in the teaching of traditional skills and skill courses, and the other is the appropriate expansion of other related auxiliary skills and skills courses [6, 7]. From the perspective of cultivating students’ practical ability, the teaching of traditional skills and skill courses requires the penetration of performance elements first and also to ensure the development and improvement of students’ artistic practical ability to meet the needs of stage performances. This
requires strengthening the design training of facial expression language, body language, and emotional expression in the teaching process so as to enhance the admirability of the works in the process of interpretation so that they can achieve the effect of both form and spirit, touching people's hearts [8].

Second, it is necessary to create opportunities for students to practice practical exercises, such as regular professional reports, final professional examinations, and second classroom activities for practical demonstrations. The expansion of other auxiliary skills and skills courses is mainly to add some elective courses according to actual needs, such as makeup, program hosting, recitation, and pronunciation [9]. On the one hand, the setting of such courses can expand students' professional ability and enhance the adaptability of social work. On the other hand, it can effectively assist the study of other professional courses, and to a certain extent, it can help students' personality development [10].

(3) Independent practical links as practical teaching is getting more and more attention. Some schools generally set up independent practical teaching links in the process of formulating talent training programs for their majors, such as the second classroom activities of each semester, art practice weeks, professional apprenticeships, professional internships, and graduation reports (or graduation concerts). This link has a certain nature of comprehensive training, which plays a better role in cultivating students' professional practical ability [11–13]. The most critical part of this link is to strengthen the design and strengthen the implementation. The so-called strengthening design is to serialize, standardize, and even quantify the independent practice links. The second classroom activities should be carried out in close cooperation with the teaching of professional courses [14]. Art practice week should be arranged for at least one week per semester. They should run through the whole process of professional teaching, which requires overall planning and design to avoid randomness and randomness of activities. Low-level repetition ensures the scientific nature of practical training; the so-called strengthening implementation means strengthening the management and guidance of all practical teaching links and completing the corresponding practical training content according to plans and standards [15].

(4) Practical links in comprehensive art activities The so-called comprehensive art activities mainly refer to practical activities characterized by actual stage performances, which require students to mobilize all professional knowledge and abilities, and exercise and improve on the real stage of the campus and society. It is a professional practice activity as well as a social practice activity, and it is a bridge for students to go from the campus to the society. This should be a stage performance-type three-level practical activity system; that is, relying on the art stage, the three-level art practice activity system of professional basic practice, professional development practice, and professional improvement practice is unified. Professional basic practice art activities mainly refer to the art practice activities related to the teaching of professional courses [28]. For example, professional report concerts are held regularly, and professional examinations are held in the form of concerts every semester. The stage has become a platform for students to show their professional learning achievements, and the learning of single professional skills has become a comprehensive stage performance [16]. Using the skills and techniques learned in the classroom, we also need to carry out high-level artistic practice activities. The stage has become a rare opportunity provided by the social teaching, corporate culture construction, and performances in certain themed cultural activities carried out by local governments and local media. Such activities involve a wide range of activities, rich in content, high comprehensive level, and quality requirements, and truly achieve social integration, which is a comprehensive test and experience for students' professional level [20].

The artistic activities of professional improvement practice mainly refer to the practical activities of selecting some outstanding students to participate in high-level professional competitions. A unique advantage of the music performance major is that there are various art competitions in all walks of life every year, such as the annual national college student art exhibition activities, various art competitions held by the cultural department of the provincial education department, and media at all levels [21]. Professionally, it is a rare opportunity provided by the social stage for practical teaching work. It can be combined with such activities to carry out high-level artistic practice activities, such as holding trials.

The above are the basic construction ideas for the construction of the practical teaching system for the music performance major. The author tries to build a comprehensive and applicable professional practice teaching system through this design, which not only highlights the core professional characteristics of art performance but also includes other related work content; if the specific planning
and implementation process can be scientifically designed and arranged reasonably and can fully mobilize the enthusiasm and initiative of students to carry out corresponding work in an all-round way and can strengthen management and assessment, then we will be able to achieve music. The performance major aims to cultivate applied and compound talents with a solid professional foundation, excellent basic skills, outstanding professional practical ability, and adapt to the needs of social and cultural development and construction [22].

4. System Design

4.1. Design Principles. The design of the teaching system should not only meet the needs of current school teaching but also be able to adapt to the needs of future development as the school expands over time.

(1) Scalability. The school is the cradle of cultivating talents for the country. With the continuous development of my country’s economy and science and technology, society has put forward higher requirements for talents [23]. Therefore, schools have to keep changing with the needs of the society and put forward new requirements for the teaching system, which requires the teaching system to be continuously expanded in terms of functions to meet diverse needs.

(2) Security Teaching Is a Very Serious Matter. Students’ teaching information, especially exam results, needs to be stored in student files, which raises higher requirements for the security of information storage and transmission in the teaching system.

4.2. System Functions. For the entire teaching system, teachers and students, teaching materials, classes, grades, and evaluation form a complete teaching management process [24]. Therefore, the teaching management system mainly focuses on several elements of the teaching process. The developed intelligent teaching system mainly has the following modules. The specific functional structure is shown in Figure 2.

Among them, teacher management is mainly to manage and maintain teachers’ basic information, scientific research, teaching, and other information; student management is to manage and maintain students’ basic information, rewards, punishments, etc.; at the same time manage the information and maintenance [25]; performance management is the management and maintenance of students’ test scores, reexamination scores, and other information; teaching quality management is a quality evaluation management system formed based on students’ evaluations of teachers and expert evaluations; course management is that each teaching subject intelligently arranges courses according to its own teachers, students, teaching environment and other factors, so as to achieve the optimal allocation of teaching resources from the perspective of cultivating students’ practical ability, the teaching of traditional skills, and skills courses [23]. First of all, the penetration of performance elements is needed to ensure that students’ artistic practice ability can be developed and improved to meet the needs of stage performances. This
requires strengthening the design training of facial expression language, body language, emotional expression, etc. [26] in the teaching process, so as to enhance the admirability of the works in the process of interpretation, so that they can achieve the effect of both form and spirit and touch people’s hearts. Second, it is necessary to create opportunities for students to practice practical exercises, such as regular professional reports, final professional examinations, and second classroom activities for practical demonstrations. The expansion of other auxiliary skills and skills courses is mainly to add some elective courses according to actual needs, such as makeup, program hosting, recitation, and pronunciation. On the one hand, the setting of such courses can expand students’ professional ability and enhance the adaptability of social work. On the other hand, it can effectively assist the study of other professional courses, and to a certain extent, it can help students' personality development [26, 27]. There are many genetic algorithms, including diversity-enhanced genetic algorithms (Figure 3), simple genetic algorithms (Figure 4), and multiobjective genetic algorithms (Figure 5).

4.3. Database. The teaching management database is mainly used to store basic information such as teachers, students, grades, and textbooks. Some information appears repeatedly in different tables. In order to maintain the integrity and stability of the data information, the data items of the data table are designed. The main data items of each data table are as follows:

![Simple genetic algorithm diagram](image.png)
5. System Implementation

5.1. Course Scheduling Management. Class schedule is the top priority of a school. Schools should effectively integrate resources such as teachers, classrooms, classes, courses, and time to achieve the best configuration. The class schedule is to find the optimal combination problem under the condition of relatively limited resources. Regardless of the school, there are several constraints to avoid when scheduling classes.

(1) A teacher can only take one course at a certain time.
(2) A classroom can only arrange one course at a certain time.
(3) A class can only take one course at a certain time.
(4) The number of people in a certain class should be less than the capacity of the classroom. For the elements of class, course, classroom, time, and classroom, the mathematical formula is expressed as follows:

Class collection: \( BJ = \{ bj_1, bj_2, bj_3, ..., bj_a \} \)
Course collection: \( KC = \{ kc_1, kc_2, kc_3, ..., kc_b \} \)
Classroom collection: \( CR = \{ cr_1, cr_2, cr_3, ..., cr_c \} \)
Time collection: \( SI = \{ sj_1, sj_2, sj_3, ..., sj_d \} \)
Classroom collection: \( JS = \{ js_1, js_2, js_3, ..., js_e \} \)

The problem with the class schedule is the Cartesian product of the above five elements, \( PK = BJ^* KC^* CR^* SI^* JS \). It is necessary to find a set that satisfies the constraints in PK, that is, the result of the class schedule. Here, a genetic algorithm is used to solve the problem of course scheduling, and each individual in the PK set is regarded as a course scheduling scheme. All the course scheduling schemes are taken as the initial population, and the population is operated to get the optimal results.

5.2. Teacher Management. For the teacher module, not only the basic information of teachers is maintained but also the statistics of teachers’ information, statistics on the workload of teachers in the school, analysis of the proportion of teachers with different professional titles in the school, statistics on the number of teachers of all ages in the school, and information on teachers’ scientific research details. The teacher management module can help the teaching management department to analyze the information of teachers and provide first-hand information for the school to carry out teaching, professional title evaluation, and introduction of talents.

6. Conclusion

Using artificial intelligence technology to design and study the teaching system, we explain in detail how to use the genetic algorithm to manage the course arrangement. Functionally, the teaching system can meet the teaching needs of various types of colleges and universities. This paper studies the application of artificial intelligence in college music teaching. Traditional teaching methods are very fundamental, so teachers often spend most of their time explaining basic music theory while students are often busy taking notes. Teachers do not release various tasks to attract students’ learning, resulting in a small number of students who are not interested in learning and remain silent in the classroom. Therefore, in order to change this phenomenon, teaching should adopt new teaching methods. The task-based teaching process is task design, warm-up, pretasks, tasks, reporting, and assessment. These tasks are often accomplished through interaction between students. In doing so, students can put what they have learned into practice. Combined with the definition and basic characteristics of artificial intelligence, use teaching methods to combine artificial intelligence with music classroom teaching, explore the benign relationship between music teaching and artificial intelligence, and promote teaching and talent training. As
the integration of information technology and music courses continues to accelerate, artificial intelligence has brought new opportunities for music teaching. In order for students to learn music well, we need to create a free environment. Our music class cannot be limited to the ordinary class mode to complete the learning. A relaxed and active atmosphere must be created. Rooting information technology such as artificial intelligence in music teaching practice, and giving full play to its technical advantages and cutting-edge features, can promote the quality of teaching and improve the level of talent training while achieving better development of artificial intelligence technology.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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