Research Article

Analysis and Optimization of the Online Vocal Teaching System Based on Intelligent Computing

Luzhen Jiang

Department of Education and Modern Art, Shangqiu Institute of Technology, Shangqiu 476000, China
Correspondence should be addressed to Luzhen Jiang; jiangluzhen@sqgxy.edu.cn

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With the continuous development of science and technology, network technology has become more and more advanced and network applications are widely used in all walks of life, and vocal music teaching is no exception. The Intelligent Agent plays a unique role in networked teaching by making up for the lack of intelligence, adaptiveness, autonomy, and interoperability and interactivity in all aspects of traditional teaching. This paper introduces the knowledge of Intelligent Agent and then discusses its application in the networked teaching environment. Compared with the traditional teaching environment, the intelligent network teaching environment is more conducive to the initiative and innovation of students, reflecting the characteristics of student-centred learning and achieving a variety of functions such as teaching resource sharing, information interaction, online communication, and distance learning with the support of computer network technology. It is a new field to be explored, especially opening up a new chapter of online vocal music teaching.

1. Introduction

In recent years, the online delivery method has been growing rapidly, with more and more students and parents recognising that online education is “time-saving and geographically unrestricted” [1]. Online web-based education can balance the educational resources of different regions, allowing children in relatively disadvantaged areas to enjoy high-quality education. In order to adapt to online education, the author has also tried to teach online vocal music courses for a long period of time, and this article briefly discusses the teaching of online vocal music courses based on his teaching experience [2].

Online courses have become a major form of learning for students at all levels, and this fast and convenient way of learning has become very common, been gradually accepted, and brought convenience to the promotion of vocal music teaching courses [3]. Cloud vocal courses and cloud concerts are already being widely disseminated in 2020. The role of digital technology in vocal music teaching is becoming increasingly important [4].

Internet technology, especially the 5G media that have been developed in recent years, is a new and modern media based on the original digital technology, which is improved and enhanced by modern technology [5]. With the development of science, the transmission speed of 5G is more than ten times faster than 4G, greatly reducing the time to download high-definition course videos, and the course itself can carry a larger capacity of lesson transmission, thus bringing great convenience to the demonstration of vocal singing teaching and the improvement of classroom efficiency [6]. Through online teaching, students can save and play back what they have learned, digest and absorb it repeatedly, and delve into the organic integration of digital technology and vocal teaching, bringing convenience to the promotion of vocal teaching courses. The digital technology means to bring together the best talents and works from all over the country to form a collaborative singing and performance across the air [7]. How to combine digital technology with vocal teaching organically to achieve the innovative point of unifying online and offline teaching and to form a new model of vocal teaching activities is the key topic of vocal teaching research at present.

Vocal music lessons in higher education are a compulsory part of the curriculum for music majors and are traditionally taught in a “hands-on, master-apprentice”
2. The Integration of Digital Technology and Vocal Skills Techniques

The 5G full media are a product of the current social development and an important part of innovative technology [12]. Vocal music teaching in the era of full media needs to create new teaching methods to test and improve the technicality and singing ability of vocal music works through digital technology. In this way, we can disseminate online courses related to vocal music teaching, follow the performances and lectures of influential figures in the vocal music industry through online platforms such as Shake, WeChat Friend Circle, and Weibo, and exchange and learn from each other, drawing on the experience and methods of the master performers and applying them to our own vocal music teaching [13]. The famous singers Dai Yuqiang’s “Dai You Sing,” Mr. Yan Weiwen’s “Master Yan Makes High Students,” Mr. Shi Yijie, Mr. Liu He Gang, Mr. Zhang Ye, etc., all conveyed their vocal learning experience to vocal learners through the Internet technology, so that the majority of vocal singers can directly gain experience and methods and quickly improve their singing ability [14].

In today’s society, vocal music teaching can only be diversified to meet the current needs of talent training and to provide more opportunities and directions for students’ future employment and further education [15], under the premise of expanding vocal teaching methods, achieving all-round and multiperspective teaching, solidly promoting students’ technical skills training in stage performance and singing, using digital technology as a carrier to achieve the integration and development of digital technology and vocal teaching, and making more people aware of the forward-looking impact of using digital 5G all-media in vocal teaching to realise the systematisation of vocal teaching. More aspirants are encouraged and supported to be placed in the development of online courses that integrate digital technology and vocal teaching, so that students can better develop the integration of their studies and related knowledge [16].

Not only internal quality system construction is reflected in the policy and curriculum system of arts vocational education but also teachers for leading education and students as the subject of education also play an important role in education, strengthening the teacher talent training model and thus promoting the development of arts vocational schools. Voice teaching exploration and growth become an important guarantee of internal system construction in the new era of arts vocational institutions [17]. To this end, we need to use digital technology to identify, access, and respond to common and unexpected problems in the internal quality management of teaching in a timely and accurate manner; to react, reflect, and continue in-depth research in the first instance; and to promote the establishment of a highly qualified, innovative, and professional teaching staff. In the process of teaching vocal music, it is important to keep pace with the times, sing the voice of China in the new era, and use advanced technological means such as big data to establish a new model of sound internal quality system in art vocational schools [18].

3. Intelligent Agent Technology

3.1. Intelligent Agent Definition. Intelligent Agent technology is a distributed computing environment software intelligence technology and is a product of artificial intelligence and network technology, and it provides a distributed heterogeneous environment with intelligent applications to achieve intelligent coordination of a new computing model. An Intelligent Agent is a software package that has intelligent reasoning and decision-making capabilities and can take certain countermeasures in the face of changing environments. An Intelligent Agent is an intelligent computer program that can be subdivided into many small functional modules, making the program modular and flexible.

3.2. Smart Agent Features

(1) Autonomy: the ability to adapt to changes in the environment according to the needs of the user, to take the initiative to provide services for the user, and to make appropriate responses to the impact and information from the environment

(2) Intelligence: the ability to perceive the surrounding environment, reason and calculate intelligently, analyse the needs of the user, and accumulate experience to improve its ability to deal with problems

(3) Agent (agent): can represent the user to complete some work or agent user software and other software to communicate and contact

(4) Mobility (mobility): as a living body, able to roam across platforms on the internet to help users gather information, their state, and behavior with continuity

(5) Security: to avoid damage to the computer environment caused by malicious agents
Because the Intelligent Agent has the characteristics of professionalism, the Intelligent Agent in the network teaching system must also be MAS (multiagent system). At the same time, in order to complete a complex task, it is also possible to create multiple collaborative and cooperative agent groups to improve the system’s ability to solve problems.

4. Intelligent Agent-Based Networked Teaching Environment

4.1. The Concept of Intelligent Agent Networked Teaching. Networked teaching and learning includes the teaching of teachers and the learning of students in a networked environment [19]. The agent used in the networked teaching environment is called the network teaching agent, and the network teaching agent is an agent that assists students in their learning and can interact with them; in the networked teaching environment, it must be able to coordinate with other agent systems and make judgments and decisions on the methods and steps used by the system in different environments. The environment in which the network teaching agent system is located is the student’s learning environment, and the teaching agent system can give the necessary tutorials and tips to students at all stages of learning, which make them interact with the network teaching agent system, so that students feel that they are communicating with a living individual, thus improving the efficiency of learning and the quality of network teaching. At the same time, intelligent agents must provide teachers with an intelligent teaching environment [20].

4.2. Intelligent Agent Networked Teaching Environment System Model. The system adopts the B/A/S model, i.e., Browser/Agent/Central Server, which helps to speed up access, and the client uses the Internet/Intranet network which can provide a unified environment for complex distributed applications. The model consists of four parts: client, browser system, Intelligent Agent system, and server resource system (see Figure 1).

4.2.1. Smart Agent Web-Based Teaching Solutions. Based on the networked teaching environment of Intelligent Agent, the networked teaching solution was proposed and applied to the teaching of some courses in Shandong Trade Union Management Cadre College. The structure of the Intelligent Agent network teaching solution is shown in Figure 2.

A flowchart of the Intelligent Agent’s web-based teaching process has been designed based on the structure diagram in Figure 3.

4.2.2. Intelligent Agent Web-Based Teaching Solution Module Features. The Intelligent Agent-based web-based teaching and learning solution includes three types of users: students, teachers, and administrators. There are 8 agents involved:

(1) Student agent: It is an agent automatically generated by the system after students enter the online teaching environment; it provides an interface for students to interact with the system, selects the teaching content dynamically according to the actual situation of students, and guides students to learn independently. They can apply for tutorials from the teacher, submit assignments or request tests, interact and discuss with other student agents, and prepare for the next step of learning based on the user’s learning record.

(2) Teacher agent: it is an agent automatically generated by the system after the teacher has logged into the online teaching environment, which can simulate the teacher’s behaviour, select the appropriate knowledge to be taught to the students according to their actual situation, monitor and evaluate the students’ behaviour, and provide help and select correction methods at the request of the students, whose terminal is located in each department office [21].

(3) Administrator agent: it is an agent automatically created by the administrator after logging into the network teaching environment; the administrator agent is the organiser of the whole system, and its terminal is in each teaching management department such as the Academic Affairs Office. The administrator agent can coordinate a series of management procedures in the teaching process, such as course management, student registration management, and grade management.

(4) Management agent: the management agent is responsible for the interaction between students, teachers, administrators, and the teaching and management subsystem and records the interaction process. The management agent is responsible for registering the current learning status of individual students and triggering the teaching agent to provide personalised teaching. It also monitors and evaluates students’ learning through interactive information, giving tips, conclusions, and reference information [22].

(5) Review training agent: teaching activity itself is an interactive process, and teachers need to understand the students’ knowledge mastery and adjust their teaching methods and contents in time; students need to cooperate with teachers to master various types of knowledge and basic skills. Therefore, the review training agent provides the auxiliary learning functions of review training and automatic question and answer.

(6) Evaluation agent: teaching evaluation is a very important part of the teaching process, and the introduction of an evaluation agent in the network teaching environment can provide dynamic teaching evaluation of the whole teaching process.

(7) Exam and test agent: the exam and test agent is an agent responsible for testing students’ questions and is used to support students’ self-assessment of their current learning situation, mainly through interaction with the test bank to determine students’ knowledge level and errors. The test agent gives
(8) Extension agent: the extension agent combines the openness of the system and provides ports for the whole system to match with other systems at any time.

4.2.3. Implementation of the System. The development of Intelligent Agent applications can use a variety of distributed object building block technologies such as CORBA, DCOM, and Java RMI. The interface definition language IDL in CORBA also provides mapping to Java, C++, Smalltalk, and other languages, allowing easy interaction between objects from different platforms on the web. Therefore, the best solution for implementing an agent-based web-based teaching system is to use a combination of CORBA and Java technology. The B/A/S model is used, i.e., Browser/Agent/ Central Server. Windows XP is used, and NT is used for the server [23, 24].

5. Intelligent Agent Technology in a Networked Teaching Environment

In 2020, we used traditional computer-based teaching methods, and in 2021, we piloted the implementation of networked teaching for vocal courses using Intelligent Agent technology and are now conducting a comparison experiment between the two years of the vocal course (see Table 1).

The results of the comparison and interviews with some students show that students’ motivation to learn is significantly improved, their hands-on skills are significantly enhanced, and the difficulty of the course is intelligently adjusted according to the level of the students, so that the potential of each individual can be maximised and students can be effectively guided to learn better. It provides an effective platform for teachers to innovate in the curriculum, reduces duplication of effort, accurately grasps students’ mastery of knowledge, provides targeted instruction, improves teaching efficiency, and is welcomed by teachers [25, 26].
As shown in Figure 4, digital full media technology brings certain facilities for vocal teaching and provides modern resources for the improvement of vocal teaching techniques. There are two sides to everything, and the same is true of modern media technology. If used accurately, it can quickly improve singing skills and enhance the knowledge and techniques we learn. The Gaussian distribution of vocal learning results across students shows that the use of full media technology in vocal performance teaching methods, which includes the promotion and dissemination of vocal performance teaching methods through digital technology, makes it easier to improve teaching efficiency and enable students to acquire the latest knowledge [27].

As shown in Figure 5 for the vocal effect assessment, our students are recorded by video and audio at the beginning of their enrolment to create a record of their initial learning status. Through the intervention of digital teaching methods, students are able to realise their shortcomings and identify ways and means to solve their problems. At special instances when parents cannot be present to watch their students’ examinations, the digital network technology allows parents to see their students’ learning status at school without having

![Figure 3: Flowchart of agent web-based teaching.](image_url)

| Table 1: Comparison of 2007 computer class results. |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| **Fundamentals of computer** (average) | **Software engineering** (average) | **Assembly language** (average) | **Java language** (average) | **Visual basic language** (average) | **Network technology** (average) |
| Network technique | 82.3 | 71.2 | 77.4 | 77.5 | 75.2 | 78.2 |
| Software technology | 79.1 | 73.9 | 79.4 | 78.1 | 76.2 | 79.4 |
| Computer application | 79.2 | 72.4 | 79.9 | 78.4 | 75.2 | 78.4 |
| Animation technology | 79.5 | 72.8 | 77.5 | 74.3 | 75.2 | 77.1 |
to leave home, greatly facilitating communication between the school and parents.

In the process of learning vocal lessons in colleges and universities, vocal practice and singing songs remain an unavoidable process in vocal lessons and vocal skills are basically addressed in vocal practice pieces and songs. Due to the instability of the signal transmission or the sensitivity of receiving equipment, the transmission of information in online courses is more or less delayed. As shown in Figure 6 for the correlation of vocal characteristics in this paper, the network reception delay can be as much as five or six seconds in some cases if the student is in a different area. Vocal lessons require student singing and teacher accompaniment at the same time, in order to reduce the delay caused by teacher accompaniment of student singing.

Figure 4: Distribution of online learning outcomes of vocal students by year.
6. Conclusions

The application of Intelligent Agents in the online teaching environment of vocal music makes the teaching effect, teaching mode, and system performance much better than the traditional teaching mode, promotes the intelligence of the networked teaching environment, improves teaching efficiency, saves teaching costs, and plays a positive role in promoting the overall teaching reform and the implementation of quality education. As an auxiliary means of network teaching, the Intelligent Agent teaching system cannot completely replace the role of the teacher and the two must be combined in practical applications.

Data Availability

The experimental data used to support the findings of this study are available from the author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding this work.

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References


