

# The Innovation of Distance Education System of Craftsmanship Based on Artificial Intelligence Technology

Liwen Sun<sup>1a\*</sup>, Jianying Tian<sup>2b</sup>, Lina Guo<sup>3c</sup>

e-mail: <sup>a</sup>54601036@qq.com; <sup>b</sup>499508628@163.com; <sup>c</sup>1169177225@qq.com

Applied Electronics Department Shandong institute commerce and technology Jinan, Shandong, China

**Abstract**— Craftsman spirit has always been a fine tradition of our country. Our education needs to implement the concept of craftsman spirit education to students, so that students can have the basic qualities of talents in the new era under the cultivation and influence of craftsman spirit. The intelligent teaching assistant, intelligent teaching platform and other intelligent devices or systems developed under the support of artificial intelligence (AI) technology are more and more applied to classroom teaching, which can realize intelligent teaching management, evaluation and other functions, and play a role in promoting the optimization of teaching. Therefore, in order to improve the effect of craftsman spirit education, this paper develops a craftsman spirit distance education(DE) system with the help of artificial intelligence technology. With the application of artificial intelligence, it innovates the teaching management, teaching evaluation, teaching environment and teaching resources of craftsman spirit. This paper proposes three test schemes for the bandwidth consumption test of the system. It is found that the average network bandwidth traffic of the three schemes is 26.74KByte/s, 51.46KByte/s, and 129.70KByte/s, respectively. Because of the different test contents of each scheme, the bandwidth traffic usage is different. In addition, the use of artificial intelligence for courseware on-demand timing and work progress management can realize the information management of craftsman spirit distance education.

**Keywords**-Artificial Intelligence Technology, Craftsmanship Education Philosophy, Distance Education, Teaching Assistant

## 1 INTRODUCTION

AI-based DE platform has great potential and strong appeal, and has always been popular among teachers and students. In recent years, the rapid innovation of AI technology has made it possible to use various forms of teaching images, teaching pictures, and teaching audio on the DE platform. At the same time, open DE system has become the new trend of DE, so that more and more people can enjoy the quality of educational resources, is the direction of the unanimous efforts of the education sector in recent years.

AI has made great breakthroughs in the field of education. By sorting out the educational applications of AI technology at home and abroad, some scholars believe that the educational applications of key AI technologies are divided into three categories: AI teaching systems, AI teaching robots and AI teaching software. Experts and scholars at home and abroad have mostly focused on the impact of AI on educational change and the study of practical

application of AI in education [1]. Craftsmanship DE is a way for the masses to present the attitude and quality of down-to-earth, hard-working, and excellence in the new era through this type of education, exuding a unique charm, and passing on the wealth of craftsmanship to make our nation even better [2]. Due to the new features and demands emerging from the development of DE platforms in the era, it has become necessary to re-examine and improve them.

This paper first introduces the concept of craftsmanship and the dissemination of craftsmanship in DE, then elaborates AI technology to promote innovation in DE, then proposes that data security needs to be ensured to build a craftsmanship DE system, analyzes the teaching functions of DE system based on AI technology, and finally tests the bandwidth data usage of the system and implements the system class timing and assignment progress management functions.

## **2 BASIC OVERVIEW**

### **2.1 Craftsmanship and DE**

"Craftsman" is the source and noumenon of "craftsman spirit". To be exact, craftsman spirit comes from refining and condensing the good characteristics and excellent qualities of craftsmen. This kind of spirit has gone through time and turns without fading, and it is more and more full of vitality and vitality. Craftsman spirit is a kind of attitude and quality that people show. They pursue higher quality in their study and life, study hard, constantly surpass the original level, and then create new things. These behaviors and practices reflect the connotation of craftsman spirit [3-4].

In today's era, the active role of the network is inevitably indispensable to achieve the maximum spread and development of culture. We need to create a distance network teaching environment for spreading craftsmanship, use the new media network to actively guide mainstream thoughts, promote the main theme of society, popularize the Party's ruling ideology and philosophy of governance, and spread advanced culture, which is conducive to shaping a healthy network environment [5]. To promote the spirit of craftsmanship, such as broadcasting some cultural propaganda films like "Great Artisans", so that people can deeply feel this spirit, expand its social influence and highlight the charm of "craftsmanship".

### **2.2 AI Boosts the Innovation of DE of Craftsmanship**

#### **2.2.1 Teaching management**

AI supports DE management by analyzing and calculating students' learning conditions based on dynamic learning process data. Teachers can use the feedback from interactive devices in students' hands to make targeted management of students' learning and discipline. After the classroom teaching of craftsmanship education, teachers can view the classroom teaching analysis reports such as the correct answer rate and the number of snatches of students' understanding of craftsmanship in the background of the system. Based on the analysis report, teachers carry out teaching management decisions based on data analysis. The teacher side can view and control the student side tablet at any time, and supervise the use of student learning discipline in real time to make teaching management more efficient [6].

### **2.2.2 Teaching evaluation aspect**

The intervention of AI in teaching evaluation is a timely feedback evaluation based on the collection and analysis of personal data generated by students at all stages of learning. AI is more diverse in terms of evaluation subjects in facilitating teachers' teaching evaluation. Students who have questions or inspiration about craftsmanship can express their understanding of craftsmanship education by sending pop-ups to the comment section, liking and supporting the evaluation. AI teaching devices realize the evaluation of students by intelligent devices through voice recognition, intelligent criticism and other technologies.

### **2.2.3 Teaching resources**

AI has a significant impact on teaching resources through accurate data mining of learners' behavior. In the process of distance teaching with the help of smart teaching devices, teachers organize students to generate new ideas through discussions and exchanges, which result in interactive generation of resources [7]. In terms of resource organization, personalized teaching resources that match the students' situation are quickly distributed to the learning terminals. For students' specific knowledge weaknesses, corresponding teaching resources such as exercises and videos are pushed accordingly.

### **2.2.4 Teaching environment**

With the technical support of AI, the teaching environment will show the trend of living and more in line with the cognitive characteristics of students. AI teaching equipment, equipped with portable interactive tools for teachers and students that can interact in real time, creates an interactive teaching environment for teachers and students. Students interact with teachers using functions such as quizzing, pop-ups, and spatial messages in intelligent learning devices, while teachers interact with students in the form of random questions and personalized resource pushing to achieve remote online teaching [8].

## **3 AI TECHNOLOGY-BASED CRAFTSMANSHIP DE SYSTEM**

### **3.1 System Security Design**

Data security is the core of a software system, so to ensure the security of data is the core requirement of a system. Nowadays, with the continuous development of information technology, data leakage, hacker attacks and other causalities pose a threat to the security of data. The security requirements of data also determine whether the system can bring risks to users and losses to system management and maintenance in daily operation. A large amount of student information is involved in the DE platform, so we need to strengthen data security management [9-10].

The data of the DE platform is transmitted back and forth between the server side and the client side to ensure data transmission security. In the process of data transmission, each data reading and writing should ensure the legitimacy of data sources by means of identity verification. All data reading, modification, editing, etc. must be operated by authorized users only. Unauthorized users who obtain the data may cause leakage, tampering, destruction, etc., or use the data for illegal purposes [11]. The data transmission process in the DE platform

must ensure data confidentiality. ElGamal algorithm is a more common encryption algorithm for digital signatures, where the signed information is  $M$ . For a random number  $k$ ,  $k$  and  $p$  are mutually prime, calculate.

$$a = g^k \pmod{p} \quad (1)$$

Then solve  $b$  using the extended ElGamal algorithm.

$$M = xa + kb \pmod{p-1} \quad (2)$$

The signature is  $(a, b)$ , at which point the random number  $k$  can be discarded.

### **3.2 Application of AI Technology in DE of Craftsmanship**

#### **3.2.1 Courseware on-demand**

The courseware on-demand function is one of the core functions for students' learning. Students will see their own craftsmanship education courses offered in that semester after logging into the DE platform, and they no longer need to complete their learning activities through their personal computers, but can directly watch them online through their cell phones by clicking on the video courseware.

Students watch the video resources of the courseware online through the mobile client. After the video courseware executes the on-demand operation, the system will automatically detect the current network environment, if it is in a poor network environment will prompt the user whether to agree to play the video in the traffic environment, if it is detected in the WIFI environment, it will connect the video directly.

#### **3.2.2 Lesson Timer**

The courseware timing function is to record the length and history of students' learning video courseware. Online learning is different from the traditional classroom learning mode. In order to better monitor students' participation in learning, the school includes courseware learning as part of the assessment of students' performance. Depending on the size of each video courseware, students must study at least 95% of the total courseware length according to the teaching regulations to be considered as having completed the learning requirements of this courseware [12]. Since the learning behavior of students during the learning process can be interrupted due to the network environment, hardware environment, and personal factors, the learning process can be interrupted. After the interruption of the learning process, students' learning behaviors are saved and recorded so that students can complete the last incomplete learning process when they study again. In this way, according to the cumulative length of learning time of students' on-demand courseware, the system will give feedback to students whether they have completed the learning requirements or not, and in this way monitor students' participation in courseware learning.

#### **3.2.3 Assignment progress management**

The assignment progress management function is mainly an auxiliary function module to supervise students' learning. For distance craftsmanship education courses, teachers design assignments differently. Teachers may design assignments in each chapter, or may design

assignments in combination with certain chapters. And each assignment is designed according to the course schedule, so students have to do the assignments at different time periods. If there are too many small assignments there will be bad management problems and students can't keep track of their progress in completing the assignments. Therefore, it is necessary to design the assignment progress management function. Both teachers and students can use the assignment progress management function. Teachers can check which students are not completing their assignments on time through the assignment progress query, and then send supervisory reminders to remind students to complete their assignments on time. Students can view their unfinished and missed assignments through the assignment progress query, and then complete the assignments in time within the specified study time without affecting the teacher's assignment review process and avoiding grade accounting due to incomplete assignments.

## 4 SYSTEM TESTING AND IMPLEMENTATION

### 4.1 System Bandwidth Consumption Test

The experiment simulates three test scenarios to test the server's memory, CPU consumption and uplink bandwidth and downlink bandwidth.

#### 4.1.1 Test environment configuration

The DE system environment configuration includes server-side software and hardware-related configurations, and the server-side uses IBN's ultra-thin server with the following specific hardware and software configuration parameters are shown in Table 1:

**Table 1.** Server Configuration

Hardware environment				Software environment	
Name	Model	size	Number of pieces	Name	Versions
CPU	E5606	4	3	Operating System	Ubuntu
Memory	DDR3	4G	6	Application Software	Big Blue Bttton
Hard Disk	SAS10K	40G	2	Database	Redis
				PHP Environment	LNMP

#### 4.1.2 Testing schemes

There are three main specific test scenarios for DE systems.

Option 1: Audio + PPT presentation + chat (simulating a teacher teaching with audio), this test simulates a teacher sharing audio, opening PPT presentation, all students as listeners, and others except the teacher set to mute, students occasionally send chat messages.

Option 2: Audio + PPT presentation + chat (simulating a teacher asking questions and students answering), this test simulates a teacher and a student opening the microphone at

the same time, with other students set to mute, the teacher opening the PPT presentation, and students occasionally sending chat messages.

Option 3: PSC video + PPT presentation + chat (simulating a teacher teaching with video), this test simulates a teacher sharing a camera (camera with its own microphone), selecting a resolution of 320\*240, other students muted, the teacher giving a PPT presentation, students occasionally send chat messages.

The bandwidth data usage for the three scenarios tested is shown in Figure 1, with T denoting the teacher and S denoting the student.

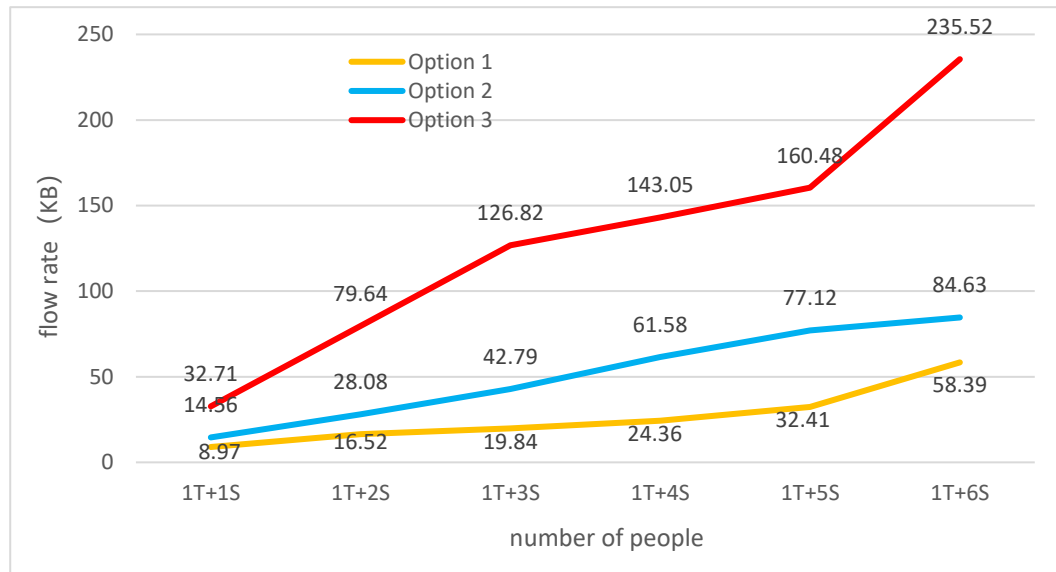


Figure 1. Bandwidth usage

From the network traffic data collected during the test, the average network bandwidth traffic for Scenario 1, Scenario 2 and Scenario 3 is about 26.74KByte/s, 51.46KByte/s and 129.70KByte/s.

After the student's microphone is silenced, if he/she speaks into the microphone, his/her audio traffic will still be transmitted to the server side, i.e., it will still occupy the server's upstream bandwidth, just that it will not be sent down to other nodes, i.e., it will not occupy the server's downstream bandwidth. The server will send audio traffic to the teacher and the server side will output video traffic.

## 4.2 System Implementation

### 4.2.1 Implementation of courseware on-demand and timing functions

The courseware timing mainly includes the functions of timing and history recording. After students enter the mobile client, they perform the operation of "on-demand courseware" to participate in the learning, and after the operation of "exit courseware", the system will automatically collect the played hours of the video courseware related to craftsmanship, and at the same time, the system automatically generates a history of courseware learning. Learning history. The learning duration will be temporarily stored in the local database of the mobile

client, and the client will be automatically refreshed when the student enters the mobile client next time, and the data of the courseware timing will be transferred to the server to complete the data update operation. After the update is completed, the server side will compare the actual learning time of the courseware timing with the learning requirement time of the courseware, and compare whether the learning requirement of the courseware specified in the teaching plan is completed. If it is completed, the comparison result will be returned to the student's mobile client with the message "Learning requirements have been completed", if not, the message "Learning requirements have not been completed" will be returned. Figure 2 shows the courseware on-demand timing process.

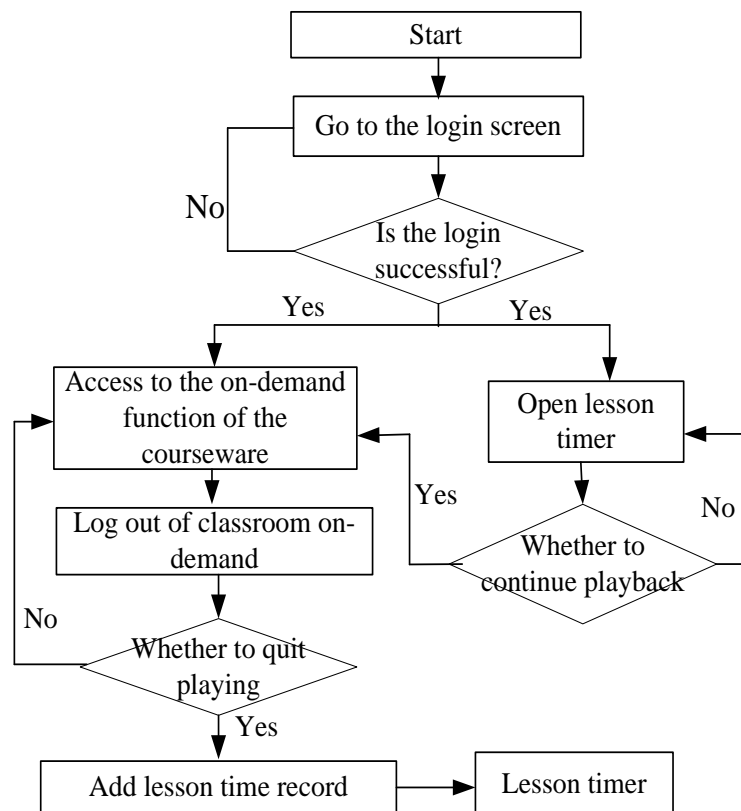


Figure 2. The process of class on-demand and timing implementation

#### 4.2.2 Realization of assignment progress management function

The assignment progress management function is not only the main way for teachers to supervise students, but also an important function for students to check their learning progress. After logging into the server side of the DE platform, teachers can enter the assignment progress management module and then use the query function to query and filter the data of students who have not completed their assignments, select the data of students after the query and execute the "Supervision Reminder", and the system will automatically send the selected students who have not completed their assignments a message to remind them to do their

assignments in time. The system will automatically send a message to the selected students to remind them to do their homework in time. After students log in to the client of the distance learning platform, they will see the reminders sent by teachers and open the reminders to see the assignments that teachers remind them to complete in time. Students can also directly query the incomplete assignments, and the system will return the incomplete assignments queried and then complete the assignments in time according to the query data.

## 5 CONCLUSION

AI technology oriented DE system of craftsmanship allows teachers to get rid of heavy teaching work troubles and realize intelligent educational feedback through the creation of educational scenarios supported by the intelligent era. Through the research, it is obtained that AI technology is an effective means of intelligent learning mode for DE, where people can access a large number of learning resources about craftsmanship and implement intelligent management of learning progress.

## FUNDING

General Project of Shandong Educational Science Planning Innovation Literacy, Phased achievements of "Research on the infiltrating cultivation path of skilled innovative talents in higher vocational colleges with craftsmanship spirit" Project No.: 2022CYB329

## REFERENCES

- [1] Neeraj Gupta, Mahdi Khosravy , Saurabh Gupta, Nilanjan Dey, Ruben Gonzalez Crespo: Lightweight AI Technology for Health Diagnosis of Agriculture Vehicles: Parallel Evolving Artificial Neural Networks by Genetic Algorithm. *Int.J. Parallel Program.* 50(1): 1-26 (2022).
- [2] Soyea Lee, Junseok Hwang, Eunsang Cho: Comparing technology convergence of AI on the industrial sectors: two-way approaches on network analysis and clustering analysis. *Scientometrics* 127(1): 407-452 (2022).
- [3] Muhammad Karam Shehzad, Luca Rose, M. Majid Butt, Istvan Z. Kovacs , Mohamad Assaad, Mohsen Guizani: AI for 6G Networks: Technology Advancement and Standardization. *IEEE Veh. Technol. Mag.* 17(3): 16-25 (2022).
- [4] Nathalie Miebach, Bruce Donald Campbell , Francesca Samsel: Nathalie Miebach: Sculpted Data Infused With Craftsmanship. *IEEE Computer Graphics and Applications* 42(1): 7-16 (2022).
- [5] Mesut Ozonur, Hatice Sancar Tokmak, Tugba Yanpar Yelken: DE students' structured query language achievements and attitudes toward web-based instruction: Second Life versus the Enocta learning management system/adobe connect. *Comput. Appl. Eng. Educ.* 30(4): 1132-1144(2022).
- [6] Roberto Douglas da Costa , Gustavo Fontoura de Souza, Thales Barros de Castro, Ricardo Alexandro de Medeiros Valentim, Aline de Pinho Dias: Identification of Learning Styles in DE Through the Interaction of the Student With a Learning Management System. *Rev. Iberoam. de Tecnol. Del Aprendiz.* 15(3): 148-160 (2020).
- [7] Tomohiro Saito, Yutaka Watanobe: Learning Path Recommendation System for Programming Education Based on Neural Networks. *Int. J. Distance Educ. Technol.* 18(1): 36-64 (2020).



- [8] Hakan Cetin, Azmi Turkan: The Effect of Augmented Reality based applications on achievement and attitude towards science course in DE process. *Educ. Inf. Technol.* 27(2):1397-1415 (2022).
- [9] Sinan Keskin , Murat Cinar, Omer Demir: A quantitative content analysis of Turkish state universities' official websites in terms of their preparedness and actions during emergency DE in the early phase of the COVID-19 pandemic period. *Educ. Inf. Technol.* 27(1): 493-523(2022).
- [10] Laura Menabo , Grace Skrzypiec , Alessandra Sansavini , Antonella Brighi , Annalisa Guarini : DE among Italian Teachers: Differences and Experiences. *Educ. Inf. Technol.* 27(7): 9263-9292 (2022).
- [11] Rafael R. Sola-Guirado, Guillermo Guerrero-Vaca, Oscar Rodriguez-Alabanda: Teaching CAD/CAM/CAE tools with project-based learning in virtual DE. *Educ. Inf. Technol.* 27(4): 5051-5073 (2022).
- [12] Sittipan Yotyodying, Swantje Dettmers, Kerstin Erdal, Kathrin Jonkmann: Educational usage of Facebook and academic achievement in distance university students: Mediated by basic needs satisfaction. *Educ. Inf. Technol.* 27(4): 4905-4924(2022).