

Retraction

Retracted: Design and Implementation of Software Engineering Network Teaching System Based on CS Mode

Security and Communication Networks

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Security and Communication Networks has retracted the article titled “Design and Implementation of Software Engineering Network Teaching System Based on CS Mode” [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

References

- [1] T. Zhang, “Design and Implementation of Software Engineering Network Teaching System Based on CS Mode,” *Security and Communication Networks*, vol. 2022, Article ID 7436988, 11 pages, 2022.
- [2] L. Ferguson, “Advancing Research Integrity Collaboratively and with Vigour,” 2022, <https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/>.

Research Article

Design and Implementation of Software Engineering Network Teaching System Based on CS Mode

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With the rapid development of computer network technology, all aspects of human life have begun to show a trend of networking and intelligence, and the education industry is no exception. This study wants to improve the quality of classroom teaching and student performance. Through demand analysis, this paper understands the teaching characteristics of software engineering and the shortcomings of the original teaching methods and develops a comprehensive network teaching system (TS). This article introduces the framework design of the system around screenshots, electronic whiteboards, and image compression schemes; starting from three aspects of teaching courseware, exercise library, and teaching practice, it illustrates the advantages of intelligent and personalized teaching. From the experimental data, it can be seen that the excellent performance rate (score > 80) of students who study software engineering courses through the network TS after one semester is 75.56%, which is compared with the 46% excellent rate in the class using traditional methods. It can be seen that an intelligent and personalized network TS can play an excellent role in stimulating students' enthusiasm for learning and improving students' academic performance in practice.

1. Introduction

With the rapid development of science and technology in today's society, various new disciplines and new knowledge emerge in an endless stream. Accepting technology, using technology, and enjoying technology have become an indispensable part of human life. In the traditional way of education, students gain knowledge through the teacher's language, facial expressions, movements, writing on the blackboard, and operation demonstrations. This process is one-way. Due to the lack of interactive links, students often lose interest. There has been a new breakthrough in the traditional education method—network multimedia teaching. In teaching, multimedia technology is used to enrich the course content and create an immersive scene and atmosphere, make students feel substituted, increase their interest in learning, help students understand and master knowledge, and improve the teaching effect. This research provides a reference for the related research on the software engineering network teaching system.

Yalcin conducted research on computer applications in teaching materials development model engineering education. Computer network and system management education is usually constructed based on theoretical information. In his research, he provided reports on the use of virtualization technology in computer network education and defined a new generation of network training platforms. Since the topology proposed in the research involves the use of actual hardware instead of virtual hardware, this model can play a good role in guiding the intelligence of the system platform, but more practice is needed to prove the advantages of the platform [1]. Mahmoud and Hamayed began to study the language education intelligent tutoring system. He developed an Intelligent Tutoring System (ITS) to simulate the behavior of the education process. From the experimental analysis, the system can play a good effect in the teaching of primary school language courses, but the intelligence of the student model needs to be improved [2].

In recent years, the organic combination between Internet technology and education has become an important research direction for many domestic scholars. Wu

conducted research on the construction of a student model of intelligent TS based on the Bayesian network. From the experimental results, the student model has a good performance in evaluating students' cognitive ability, but there is still room for improvement in the accuracy of predicting students' learning behavior [3]. The data of these studies are not complete, and the experimental results are still under discussion, so they cannot be applied and popularized.

This study has begun an in-depth examination into the design and implementation of a software engineering network education system based on computer technology in the CS mode. The research is mostly focused on the following areas: the technology and methods utilized in the construction of a software engineering network TS in China are discussed in this article, including the client server's benefits and drawbacks, the TS's module design structure, the decision tree algorithm, and the system image compression technology. This paper introduces the database, model, and intelligent test paper functions of the system development, which are all based on the CS model. Finally, data from simulated experiments demonstrate that network teaching can improve. Finally, simulation trials show that network teaching can improve the quality of software engineering classroom teaching while also improving students' academic achievement.

2. Design Technology of Network TS Based on CS Mode

2.1. CS Mode. Now in the CS mode, the figure can be seen everywhere, such as network operating system and database management. In this mode of network structure, the link between the client and the database is directly linked [4, 5]. The execution of tasks, interface management, I/O, and message display are all performed by the client, and operations such as task execution and data processing as well as database access and client request processing are all handled by the server [6].

The advantages of the CS model mainly include the following aspects: (1) the distributed processing and centralized operation of data operations are organically combined; (2) support for massive data, real-time processing, and rapid response; and (3) higher security. Therefore, in the design of the software engineering network TS, the CS mode is a better choice in this paper [7]. Of course, this model also has some drawbacks. For example, any changes to the program require the client to make changes to increase maintenance costs, and cross-platform migration operations and upgrades and maintenance are difficult [8].

The traditional two-tier CS model is suitable for smaller scale, fewer customers, small database, low security, and use in a faster environment [9]. However, today's enterprise needs are constantly improving, the processing of data is also increasing rapidly, the process is becoming more and more complex, and the security of data is also paying more and more attention. As a result, the structure of the CS model is far from meeting the needs of enterprises, and the three-tier CS structure model has been formed invisibly and has been widely used [10].

2.2. Software Engineering TS Based on CS. Through observation, this article finds that many current online TSs have the problems of generalization of system functions and excessive system module functions, which leads to the neglect of the educational function of the system [11]. Due to the repeated construction of resources, there are still many problems in the reasonable sharing of information resources and the system interaction module. In addition, the learning feedback on the system is not timely, and multidirectional interaction cannot be realized [12]. In order to better adapt to the evolution of educational informatization, integrate high-quality educational resources, and realize the sharing of high-quality educational resources, provide students with a good learning system, provide teachers with an excellent teaching environment, and provide teachers and students with a strong teaching motivation, this paper proposes a software engineering network that adheres to the construction of educational informatization [13]. Figure 1 is the modular design framework of the TS.

The fundamental task of the TS is to improve teaching effects so that students can get a better learning experience and improve their own performance. For this reason, this article believes that teaching courseware, exercise bank, and teaching practice should be regarded as the most important part when developing software engineering network TS [14]. This system is divided into three layers as shown in Figure 1: data layer, business layer, and application layer. The TS consists of three modules: front, background, and database. The front-end module includes the teacher module, student module, and administrator module; the back-end module includes user management, log management, and information data management; the data module includes teaching materials and key points in the teaching courseware, and the question bank contains daily learning exercises questions and the question bank required for the exam, and the practical teaching module is the operation of various items that need to be carried out in daily teaching [15].

2.3. Decision Tree Algorithm. Decision tree is a learning algorithm, and its essence is to conduct inductive learning in practical activities and finally summarize the corresponding classification rules in the form of decision trees from seemingly irregular information [16, 17]. The tree structure means that the different branches of many internal nodes follow the same general rule.

2.3.1. Basic Algorithm of Decision Tree. The amount of information required satisfies the following equation:

$$I(p, n) = -\frac{p}{p+n} \log_2 \frac{p}{p+n} - \frac{n}{p+n} \log_2 \frac{n}{p+n}. \quad (1)$$

When attribute A is used as the root of the decision tree, A has v different discrete values. Suppose there are p^i positive examples and n_i negative examples in E_i .

Assuming that the training set has m samples, each sample belongs to k different classes, and E is divided into v subsets, then the information entropy formula of E satisfies the following equation:

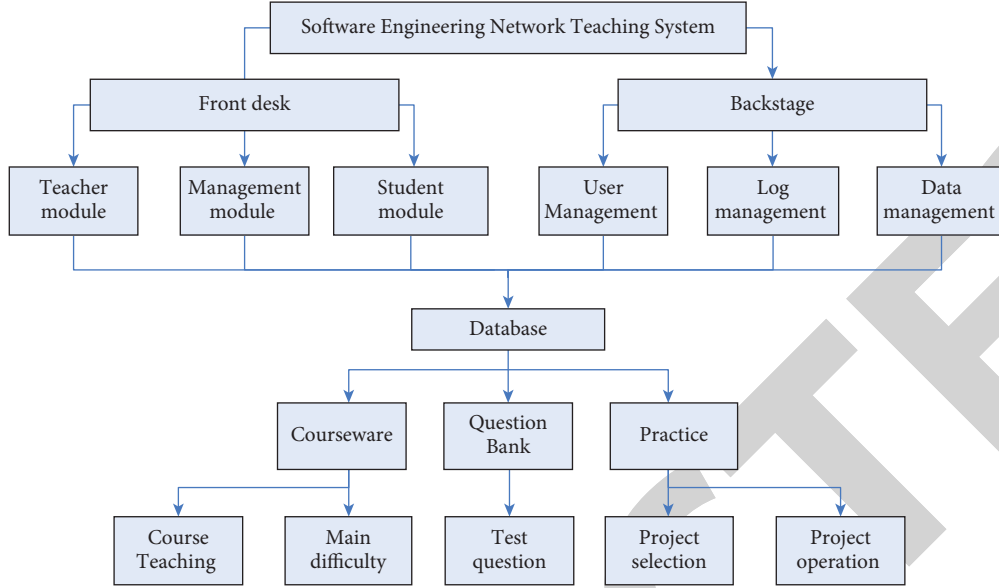


FIGURE 1: Module design of TS.

$$I(E^i) = - \sum_i^k \frac{p^{ij}}{p^i} \log \left(\frac{p^{ij}}{p^i} \right). \quad (2)$$

The expected information entropy of A and the information gain of the decision tree with A as the root node satisfy the following equation:

$$E(A) = \sum_i^v \frac{p^i}{m} I(E_i), \quad (3)$$

$$\text{gain}(A) = I(E) - (E)A.$$

The C4.5 algorithm is a complete decision tree generation system with the ID3 algorithm as the core. The decision tree is generated through two stages of tree generation and tree pruning [18]. C4.5 uses the test evaluation function at each node to select the test with the largest function as the optimal test to divide the node. Among them, the definition of information gain function satisfies the following equation:

$$\text{gainratio} = \frac{\text{gain}(A)}{\text{spliti}(A)}, \quad (4)$$

$$\text{spliti}(A) = - \sum_i^v \frac{p^i}{m} \log \left(\frac{p^i}{m} \right).$$

2.3.2. Pruning Algorithm. Trees that are completely grown according to the greedy algorithm usually have the disadvantage of “overadaptation” to the training sample set. The greedy algorithm means that when solving the problem, it always makes the best choice in the current view. That is, without considering the overall optimality, the resulting algorithm is certain. It is a local optimal solution in a sense. The greedy algorithm cannot get the overall optimal solution for all problems, and the key is the choice of the greedy

strategy. In this case, it needs to be adjusted by the pruning algorithm [19, 20]. The training set S is divided into k subsets S of equal size and disjoint each other, and the error rate e_i is obtained. The overall error rate of the algorithm can be estimated by the following formula:

$$e = \frac{1}{k} \sum_{i=1}^k e_i. \quad (5)$$

Assuming that the decision tree model is M and the training data set is S , then the definitions of coding and cost (M, S) satisfy the following equation:

$$\text{cost}(M, S) = \text{cost}(S|M) + \text{cost}(M). \quad (6)$$

Among them, $\text{cost}(M)$ is the number of bits required to encode the given model, and $\text{cost}(S|M)$ is the number of bits required to describe the data using the model [21].

2.3.3. Decision Classification Design. When constructing the learning effect decision tree, let S be a training set with s data samples, the attributes of the class label include m different values, define m different classes C_i , and S_i is the number of samples in the C_i class. Then, it is calculated that the given sample information entropy satisfies the following equation:

$$I(S_1, S_2, \dots, S_m) = - \sum_{i=1}^m P_i \log_2(P_i), \quad (7)$$

where P_i is the probability of any sample attribute class C_i in the training set. When calculating the entropy of each attribute, the information entropy of E satisfies the following equation:

$$I(E_i) = - \sum_i^k \frac{p^{ij}}{p^i} \log \left(\frac{p^{ij}}{p^i} \right). \quad (8)$$

Together, the decision tree algorithm and scientific rule classification may reflect the properties of the data with a higher learning speed and achieve scientific rule classification [22]. The decision tree method may assuredly improve the intelligence level of the system and help students study better online in the software engineering network education system based on the CS mode.

2.4. Image Compression Technology. Taking into account the network carrying capacity of the laboratory environment and the processing speed of the teacher computer, a high-speed and effective image compression scheme must be selected to process the screen information captured on the teacher computer [23]. JPEG is the English abbreviation of Joint Photographic Experts Group, and it is a compression coding standard for static images jointly formulated by the International Organization for Standardization (ISO) and CCITT. Compared with other commonly used file formats with the same image quality, JPEG has the highest compression ratio among still images, and it is also called the baseline system [24].

Huffman coding is a commonly used compression coding method, which gives a code word for each symbol to form a coding table. In addition, Huffman coding has different coding efficiency for different sources. For example, when compressing JPEG, the recommended coding table can be used for all images, or a targeted coding table can be generated according to the specific conditions of the image. In the case of uneven distribution, Huffman coding can effectively obtain a higher compression ratio [25, 26].

3. Simulation Experiment of Network TS Based on CS Mode

3.1. Experimental Background. The advancement of computer technology has changed people's life methods imperceptibly, and teaching methods have also undergone new changes. Traditional teaching is usually conducted in a face-to-face manner. The rise of online teaching breaks this limitation and connects rich teaching resources through the Internet, allowing students to experience more vivid classroom teaching at any time. Software engineering itself is a major based on computer and communication engineering. Compared with other majors, multimedia teaching can undoubtedly play a better auxiliary effect in this type of course and improve the overall quality of classroom teaching [27, 28].

Browser server mode (BS) and client server (CS) are the two most common server modes. In the research of this article, the CS mode was chosen because of its stability, flexibility, security, and access speed. Both have certain advantages. Software engineering students who use this system for learning need to complete more than a dozen courses in a few years. Installing unified teaching software in the school computer room is undoubtedly a good choice for improving classroom effects [29, 30].

3.2. Experimental System Development. Before proceeding with the system development, this article needs to analyze the requirements of the TS to understand the characteristics of the discipline of software engineering, the required teaching software, teaching tools, and so on. Students of this major not only need to master basic theoretical knowledge but also, more importantly, learn how to hardware tools, and be able to apply them to specific product development. So, it is very necessary to improve classroom practice training through the network TS.

The system developed in this paper consists of the following: teaching courseware, exercise bank, and teaching practice, combined with the hierarchical teaching concept so that students can find a more suitable learning rhythm. In the teaching courseware, students can freely download a large number of courseware and teaching supplementary materials. If they encounter problems that they do not understand, they can communicate with teachers and other students on the interactive platform. In the exercise library, the system will provide students with exercise test questions that match the teaching progress. Students can also perform simulation tests in the system by themselves. In this function, the arrangement of test papers, scoring, and answer analysis are all done through system intelligence, which effectively reduces labor costs and improves learning efficiency.

Reasonable intelligent test paper composition is important in system development. It improves the accuracy of system intelligent scoring and analyzes the average reliability of the system test paper. Set the total scores of the odd and even questions of the test to X_1 and X_2 , respectively, the number of students is N , and the correlation coefficient and correction formula of the total score after expansion meet as follows:

$$r_{x_1x_2} = \frac{N \sum x_1x_2 - \sum x_1 \sum x_2}{\sqrt{[N \sum x_1^2 - (\sum x_1)^2]} \sqrt{[N \sum x_2^2 - (\sum x_2)^2]}} \quad (9)$$

$$r_u = \frac{2r_{x_1x_2}}{1 + r_{x_1x_2}}$$

According to the relevant coefficient test table, the corresponding unknown quantity can be found. The average difficulty value P of the test paper and the average discrimination degree of the test paper satisfy the following formulas.

$$P = 1 - \frac{\bar{X}}{K} \quad (10)$$

$$D = \frac{X_H - X_L}{N(H - L)} \quad (11)$$

Among them, X_L is the sum of the test paper scores of the students in the low group, and X_H is the average sum of the test papers of the students in the high group. The larger the value of P , the higher the average difficulty of the proof paper.

3.3. Experimental System Database Design. For intelligent systems, the realization of data collection, storage, analysis, and management is very important. It does not require high-speed lanes and large-capacity databases for inventory. In the TS setup in this article, there are many forms including students, teachers, course information, homework information, and examination information. Table 1 is the student information table in the TS.

After the student completes the registration and information filling, the background will collect these data and generate the corresponding student model through the student data sheet. In the background data processing section of the system, it is important to complete the user, role, and log management as well as the data import, backup, and analysis features. Only by gathering all the data in the database can we finally establish a scientific teacher model, curriculum model, and student model through intelligent analysis and decision tree management.

4. Software Engineering Network TS Based on CS Mode

4.1. Technical Realization in Software Engineering Network TS. This article comprehensively uses IP multicast technology, GDI+ protocol, Direct X technology, and image compression technology when developing the system. In the experimental analysis part, this article will analyze the technical realization of the software engineering network TS from the screenshot scheme, the electronic whiteboard design scheme, and the image compression scheme. The practical effect of these technologies in the system is demonstrated through data comparison.

When designing the system screenshot program, this article compares the four methods of GDI screenshot, GDI+ screenshot, Direct X screenshot, and Windows API screenshot. Table 2 and Figure 2 compare the performance scores of different screenshot methods.

This article tests and scores several screenshot schemes from five perspectives: operability, processing efficiency, processing performance, image integrity, and fluency. It can be seen from Table 2 and Figure 2 that among the four screenshot methods, GDI+ and Direct X have an average of 7.927 and 7.984 in all aspects. These two screenshot methods are more mature than GDI and Windows API but still have some defects. The comprehensive scores of the improved two types of methods are increased to 8.798 and 8.85, which can better meet the needs of the system in screenshots. Table 3 and Figure 3 are comparisons of performance scores of electronic whiteboard design schemes.

With the electronic whiteboard function, teachers can use the mouse to substitute pens, make key annotations on the screenshots on the screen, or draw charts on a white background board. There are two main components of this function, namely, drawing board generation and brush function. The pressure-sensitive electronic whiteboards, electromagnetic electronic whiteboards, infrared electronic whiteboards, and optical electronic whiteboards have gradually appeared. It can be seen from Table 3 and Figure 3 that the operating speed and touch accuracy of the electronic

whiteboard have increased from the earliest 8.08 and 7.94 points to 8.81 and 8.91 points. In the research of this article, the optical electronic whiteboard used with the network TS not only operates smoothly but also has high touch accuracy, which can significantly improve the teaching experience of both teachers and students in the classroom. Table 4 and Figure 4 show the JPEG encoding effects.

The screen presentation requires a relatively high resolution and accuracy, and especially for some operability and detailed presentations, the screen resolution of the screenshot is required to be the same as the actual screen resolution of the teacher's computer. This high resolution brings natural problems. It is the increase in the amount of data. If you do not perform data compression and directly save the picture in bitmap mode, then a bitmap file with a 24-bit color and a resolution of 1280×1024 will occupy 3768 KB of storage space. It can be seen from Table 4 and Figure 4 that after using image compression technology, the storage space occupied by files is significantly reduced. When the quality parameter is 100, the volume of the target file is only 240 KB, and the image display effect is basically nondestructive. When the quality parameter is less than 60, the time-consuming image processing and the file size gap gradually shrink, but there is a clear gap in the definition. Therefore, setting the JPEG image quality parameter to 60 is a more appropriate choice.

4.2. Application Practice in Software Engineering Network TS. In order to investigate the application effect of the software engineering TS developed in this paper in teaching practice, this paper uses a systematic questionnaire to survey 200 software engineering students from six classes. The numbers of students in the six classes are 32, 30, 34, 35, 33, and 36 respectively. Figure 5 is a survey of students' satisfaction with system teaching courseware.

It can be seen from Figure 5 that 88.23% of Class C has the highest recognition and 77.14% of Class D has the lowest recognition. In the survey interviews, some students said that they are not adapted to the rhythm of online teaching and that students have a higher degree of freedom and choice in systematic teaching, and this increases the pressure of learning for some students with poor foundations. On the whole, students' satisfaction with the system's courseware teaching is 81.92%, and dissatisfaction is only 4%. The effect of the courseware system in courseware design has been recognized by most students. Figure 6 is a survey of students' satisfaction with the system exercise database.

It can be seen from Figure 6 that in the student satisfaction survey of the system exercise database, the highest recognition rate is 91.17% of Class C, and the lowest recognition rate is 82.86% of Class D. The design of the self-test system is based on VB as a database development platform. The question bank part uses the computer to realize the whole process of the software engineering test paper. The questions in the test question bank are also given according to different stages in the teaching process. From the test results, most students hold a positive attitude towards the

TABLE 1: Student information table in TS.

Field name	Type of data	Length	Description
Id	char	10	Student ID
Name	char	10	Student name
Password	char	10	Login password
Sex	char	10	Student gender
Department	char	10	Student department major
Tel	char	20	Student phone number
E-mail	var char	50	Student mail

TABLE 2: Comparison of performance ratings of different screenshot methods.

Screenshot method	Operability	Effectiveness	Processing performance	Image integrity	Fluency
GDI	6.82	7.12	6.97	7.42	7.21
GDI+	7.51	7.96	8.05	7.88	8.235
Direct X	7.63	8.13	7.92	8.21	8.03
Windows API	7.14	7.88	8.14	7.67	7.82
Improved GDI+	8.67	9.01	8.87	8.63	8.81
Improved Direct X	8.85	8.7	9.03	8.92	8.75

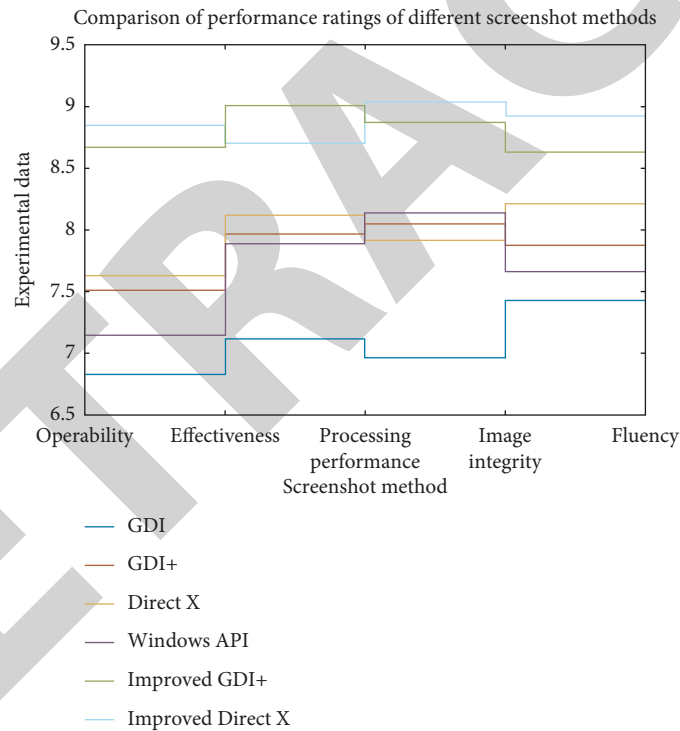


FIGURE 2: Comparison of performance ratings of different screenshot methods.

TABLE 3: Comparison of performance scores of electronic whiteboard design schemes.

Whiteboard scheme	Resolution	Calibration	Effect speed	Touch accuracy	Convenience
Pressure sensitive whiteboard	7.87	8.22	8.08	7.94	8.16
Electromagnetic whiteboard	8.15	8.4	8.23	8.55	8.31
Infrared whiteboard	8.68	8.92	8.73	9.02	9.15
Optical whiteboard	8.73	9.03	8.81	8.91	9.32

design of the exercise bank in the network TS. Figure 7 is a survey of students' satisfaction with system teaching practice.

It can be seen from Figure 7 that in the survey of students' satisfaction with systematic teaching practice, the highest recognition is 83.33% of Class B, and the lowest

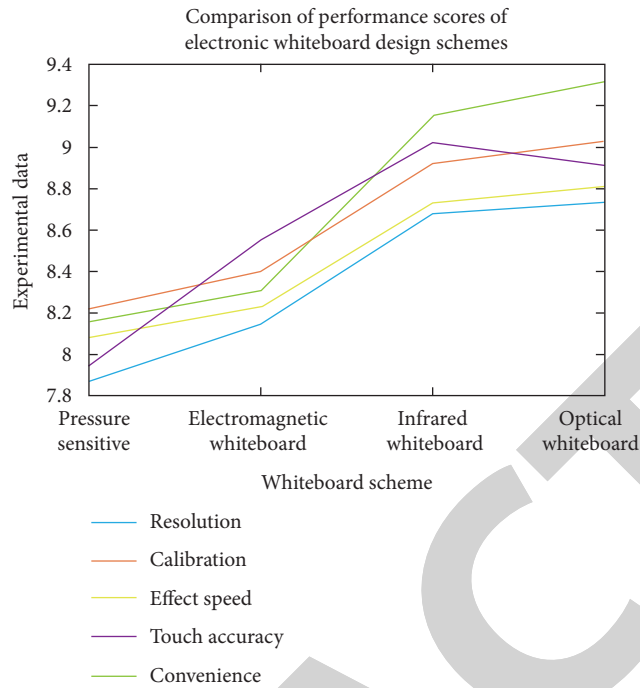


FIGURE 3: Comparison of performance scores of electronic whiteboard design schemes.

TABLE 4: JPEG encoding effect.

Quality parameter	Processing time (ms)	File size (kb)	Compression ratio
100	134	240	6.3
80	78	74	1.8
60	64	48	1.1
40	62	33	0.8
20	62	26	0.7

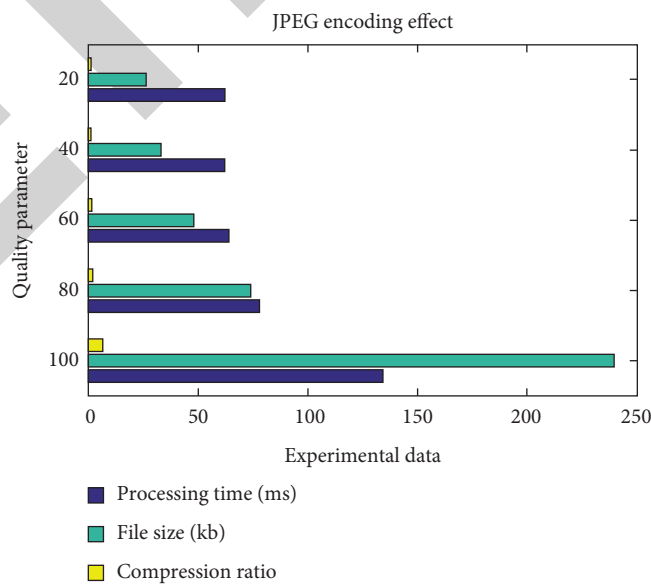


FIGURE 4: JPEG encoding effect.

recognition is 65.625% of Class A. The system practice part mainly gives some specific software engineering project descriptions, so that students, as a member of the project

engineering, can participate in it from the research in the early stage of software development to the maintenance in the later stage. Table 5 and Figure 8 show the comparison of

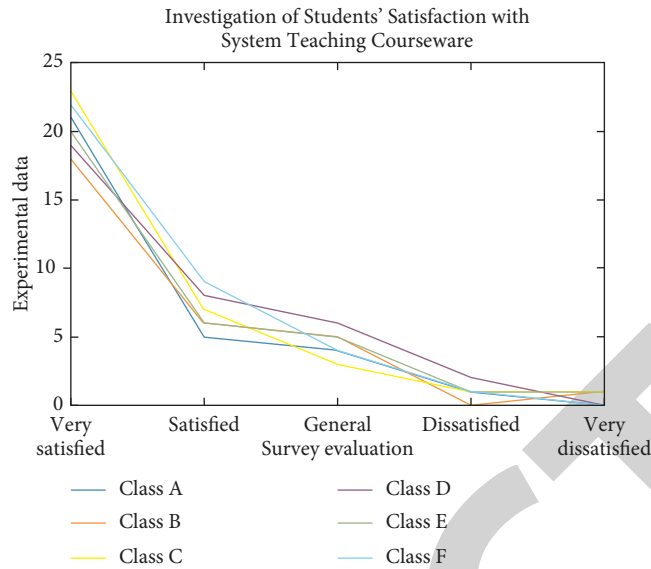


FIGURE 5: Investigation of students' satisfaction with system teaching courseware.

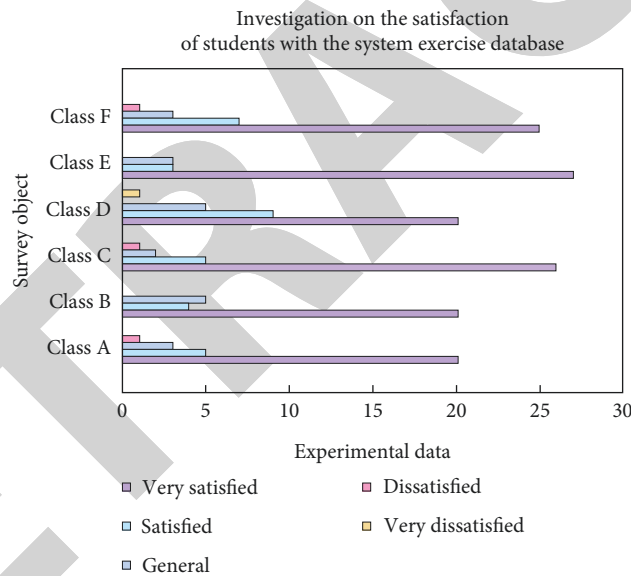


FIGURE 6: Investigation on the satisfaction of students with system exercise database.

student performance after one semester of study through the software engineering network TS. Among them, the students in groups A, B, and C received a one-semester network system teaching, which is regarded as the experimental group in this article; the students in groups a, b, and c have completed their learning through the traditional teaching mode, which is regarded as the control group.

From Table 5 and Figure 8, it can be seen that after one semester of online course teaching, the proportion of

students in the experimental group achieving excellent (score > 80) is 75.56%, and the proportion of students failing (score < 60) is 2%. The percentage of students achieving excellent results is 46%, and the percentage of failing students is 8%. Most students score in the middle range of 60–79. On the whole, in online teaching, a personalized TS can adjust teaching strategies in time and ultimately improve students' interest in learning and academic performance.

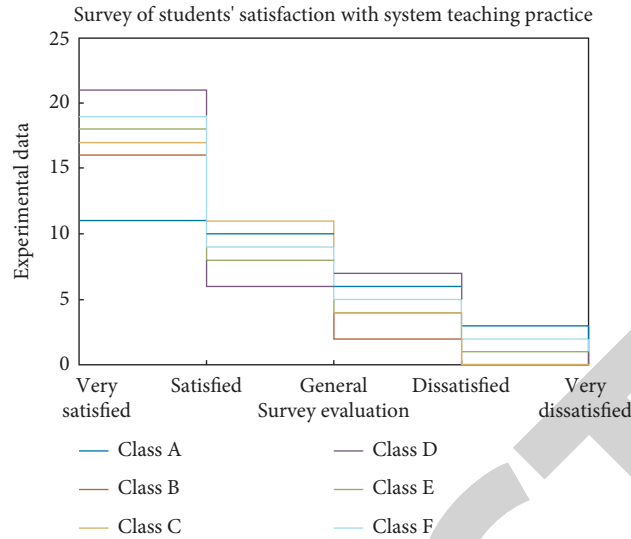


FIGURE 7: Survey of students' satisfaction with system teaching practice.

TABLE 5: Comparison of the performance of software engineering students.

	Group A	Group B	Group C	Group a	Group b	Group c
<60	1	2	0	4	3	5
60-69	5	3	2	8	9	11
70-79	6	7	11	16	14	11
80-89	28	31	26	15	21	18
90-100	10	7	11	7	3	5

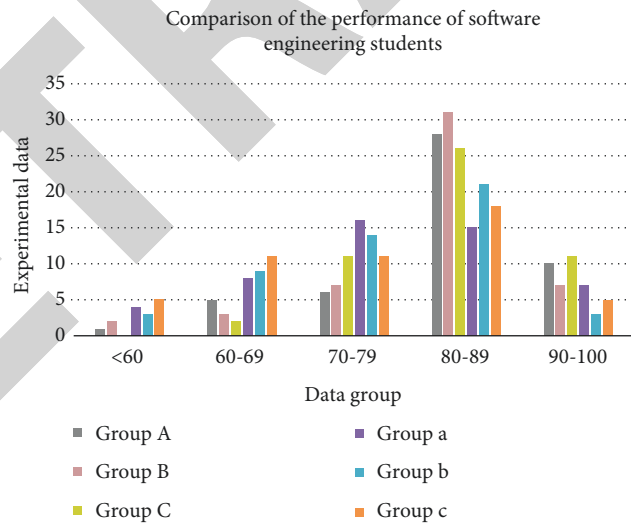


FIGURE 8: Comparison of the performance of software engineering students.

5. Conclusions

This paper has sparked a study into the technological implementation of software engineering network training. The screenshot scheme, the electronic whiteboard design scheme, and the picture compression scheme are used to assess the technological reality of the software engineering network education system. Through experimental analysis, it can be seen that the comprehensive scores of the improved

two types of methods are increased to 8.798 and 8.85. This system uses a double image buffer method to depict the mouse track. The operating speed and touch accuracy of the optical electronic whiteboard can reach 8.81 and 8.91 points. The screen image information obtained through screenshots is generally saved as a bitmap file. This kind of file has high definition, but it also takes up a lot of storage space. After testing, after image compression, in the working state of the interception frequency of 10 frames per second, the teacher's

computer broadcasts to the students on the screen, and the bandwidth occupied is about 4000 kbps, which basically meets expectations.

In order to investigate the application effect of the software engineering TS developed in this paper in teaching practice, this paper uses a systematic questionnaire to understand students' satisfaction with the system teaching courseware, exercise library, and teaching practice design. From the experimental data, students are 81.92% satisfied with the system's courseware instruction, and their dissatisfaction is only 4%; students are 87.44% satisfied with the system exercise database, and their dissatisfaction is only 2.67%; students are 77.5% satisfied with the system of teaching practice, and the dissatisfaction was 10.67%. On the whole, most students hold a positive attitude towards the system and are willing to learn courses through the Internet.

Judging from the experimental data, the research in this article has achieved a good result, but limited by various factors, the research still has some deficiencies. For example, (1) when conducting related research on system picture compression, increasing the compression ratio of screenshots requires higher system broadband conditions, which is a relatively severe test for the Internet. (2) In order to reduce system control errors and optimize packet loss management, it is necessary to further improve the transmission control scheme.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request. This article does not cover data research. No data were used to support this study.

Conflicts of Interest

The author declares that there are no conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

- [1] N. Yalcin, Y. Altun, and U. Kose, "Educational material development model for teaching computer network and system management," *Computer Applications in Engineering Education*, vol. 23, no. 4, pp. 621–629, 2015.
- [2] M. H. Mahmoud and S. H. A. E. Hamayed, "An intelligent tutoring system for teaching the grammar of the Arabic language," *Journal of Electrical Systems and Information Technology*, vol. 3, no. 2, pp. 282–294, 2016.
- [3] L. Wu, "Student model construction of intelligent teaching system based on Bayesian network," *Personal and Ubiquitous Computing*, vol. 24, no. 3, pp. 419–428, 2020.
- [4] J. R. Reich, "Design and implementation of a client-server architecture for taxonomy manager," *Software: Practice and Experience*, vol. 29, no. 2, pp. 143–166, 1999.
- [5] G. Piantadosi, S. Marrone, M. Sansone, and C. Sansone, "A secure, scalable and versatile multi-layer client-server architecture for remote intelligent data processing," *Journal of Reliable Intelligent Environments*, vol. 1, no. 2, pp. 173–187, 2015.
- [6] R. Chen, N. A. Phan, and I. L. Yen, "Algorithms for supporting disconnected write operations for wireless web access in mobile client-server environments," *IEEE Transactions on Mobile Computing*, vol. 1, no. 1, pp. 46–58, 2002.
- [7] A. Bhattacherjee and R. Hirschheim, "IT and organizational change: lessons from client/server technology implementation," *Journal of General Management*, vol. 23, no. 2, pp. 31–46, 2017.
- [8] Y. Jin, G. Kesidis, J. Shin, F. Kocak, and Y. Yi, "Impacts of selfish behaviors on the scalability of hybrid client-server and peer-to-peer caching systems," *IEEE/ACM Transactions on Networking*, vol. 23, no. 6, pp. 1818–1831, 2014.
- [9] S. Yuan and J. Hu, "Research on image compression technology based on Huffman coding," *Journal of Visual Communication and Image Representation*, vol. 59, pp. 33–38, 2019.
- [10] S. Chernyi, "The implementation of technology of multi-user client-server applications for systems of decision making support," *Metallurgical and Mining Industry*, vol. 7, no. 3, pp. 60–65, 2015.
- [11] N. Zhang, "Development and application of an English network teaching system based on MOOC," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 13, no. 7, pp. 149–151, 2018.
- [12] L. Yang, F. Meng, R. Wang, and G. Shi, "Complete mitochondrial genome of the *Salvelinus malma* sp. (Salmoniformes, Salmonidae) with phylogenetic consideration," *Mitochondrial DNA Part B*, vol. 2, no. 2, pp. 889–890, 2017.
- [13] S. Xu, C. C. Chang, and Y. Liu, "A novel image compression technology based on vector quantisation and linear regression prediction," *Connection Science*, vol. 33, no. 2, pp. 219–236, 2020.
- [14] Y. Xi and L. Dong, "Study on the intelligent evaluation system design of sports teaching," *Boletin Tecnico/Technical Bulletin*, vol. 55, no. 4, pp. 125–131, 2017.
- [15] Y. Wang, X. Zhou, and M. Zhang, "Design and research of web-based assistant TS," *International Journal of Advanced Pervasive and Ubiquitous Computing*, vol. 4, no. 4, pp. 19–22, 2017.
- [16] X. Li, H. Zhao, and W. Zhu, "A cost sensitive decision tree algorithm with two adaptive mechanisms," *Knowledge-Based Systems*, vol. 88, pp. 24–33, 2015.
- [17] J. Yang, L. Qing, W. Zeng, and X. He, "High-order statistical modeling based on a decision tree for distributed video coding," *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 29, no. 5, pp. 1488–1502, 2019.
- [18] A. Isazadeh, F. Mahan, and W. Pedrycz, "MFflexDT: multi flexible fuzzy decision tree for data stream classification," *Soft Computing*, vol. 20, no. 9, pp. 3719–3733, 2016.
- [19] Y. Wang, S. T. Xia, and J. Wu, "A less-greedy two-term Tsallis Entropy Information Metric approach for decision tree classification," *Knowledge-Based Systems*, vol. 120, pp. 34–42, 2017.
- [20] B. Khan, M. S. H. Khiyal, and M. D. Khattak, "Final grade prediction of secondary school student using decision tree," *International Journal of Computer Application*, vol. 115, no. 21, pp. 32–36, 2015.
- [21] J. Guo, B. Fung, F. Iqbal et al., "Revealing determinant factors for early breast cancer recurrence by decision tree," *Information Systems Frontiers*, vol. 19, no. 6, pp. 1233–1241, 2017.
- [22] R. Pandya and J. Pandya, "C5. 0 algorithm to improved decision tree with feature selection and reduced error pruning," *International Journal of Computer Application*, vol. 117, no. 16, pp. 18–21, 2015.

- [23] J. Ma and H. Yu, "Study on the computer desktop image compression technology based on clustering algorithm," *Paper Asia*, vol. 2, no. 1, pp. 11–14, 2019.
- [24] S. Rajendran, O. I. Khalaf, Y. Alotaibi, and S. Alghamdi, "MapReduce-based big data classification model using feature subset selection and hyperparameter tuned deep belief network," *Scientific Reports*, vol. 11, no. 1, Article ID 24138, 2021.
- [25] O. I. Khalaf and G. M. Abdulsahib, "Optimized dynamic storage of data (ODSD) in IoT based on blockchain for wireless sensor networks," *Peer-to-Peer Networking and Applications*, vol. 14, no. 5, pp. 2858–2873, 2021.
- [26] N. O. García, M. F. D. Velásquez, C. A. T. Romero, J. H. Monedero, and O. I. Khalaf, "Remote academic platforms in times of a pandemic," *International Journal of Emerging Technologies in Learning (ijET)*, vol. 16, no. 21, pp. 121–131, 2021.
- [27] Z. Lv and L. Qiao, "Deep belief network and linear perceptron based cognitive computing for collaborative robots," *Applied Soft Computing*, vol. 92, Article ID 106300, 2020.
- [28] Z. Lv and H. Song, "Mobile Internet of things under data physical fusion technology," *IEEE Internet of Things Journal*, vol. 7, no. 5, pp. 4616–4624, 2019.
- [29] D. N. Kanellopoulos, "Recent progress on QoS scheduling for mobile ad hoc networks," *Journal of Organizational and End User Computing*, vol. 31, no. 3, pp. 37–66, 2019.
- [30] Y. Huang, W. Sheng, P. Jin, B. Nie, M. Qiu, and G. Xu, "A node-oriented discrete event scheduling algorithm based on finite resource model," *Journal of Organizational and End User Computing*, vol. 31, no. 3, pp. 67–82, 2019.