Computer-Aided Software Development and Application in Physical Education in Colleges and Universities

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Abstract. In this paper, we study computer-aided software in college physical education, and design and develop and apply the software. The new computer-aided teaching system, with the help of computer and network technology, is designed to meet the school's hardware conditions and specific learning conditions by adapting the teaching mode to local conditions and materials. The system is mainly divided into administrator user modules, teacher user modules, and student user modules. According to the analysis of different users' needs, the detailed design of each sub-functional module, as well as the system interface, is carried out to realize the functions of adding, deleting, querying, reporting, modifying, batch exporting, and statistical analysis of physical fitness test information, to meet the personalized needs of school teaching management and students. Finally, after the operation test, the physical fitness test management system of students in agricultural and forestry colleges and universities can run smoothly, the system interface is concise and simple to operate, which can optimize office efficiency and save manpower, and meet the purpose and requirements of system development, which is of great significance to promote the Information of physical education management.

Keywords: physical education teaching; computer-aided software; development and application
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1 INTRODUCTION

With the continuous promotion of teaching reform in higher education institutions, the concept of quality education is also being optimized, and students' cultural knowledge and physical health level have been emphasized [1]. The national physical fitness standards provide theoretical

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guidance for physical education in schools and detailed indicators for assessing the physical fitness of young people, as well as the rules for assessing the development of education in each region. At present, many institutions of higher education are still using manual and semi-information methods to manage information related to physical education, and have not established their own information teaching management system for physical education [2]. The workload of physical education information management is large and repetitive, and the efficiency and accuracy of manual management operations are low, which reduces the effect and role of teaching management and hurts the process and quality of promoting the construction of campus management informatization.

Management information systems, often abbreviated as MIS (management information system), have strong stability, effectiveness, and operability. At present, the value of management information has been generally recognized by society and the use of management information in educational management is increasing, and its main purpose and use are to store and manage data and improve the efficiency of school offices. Professor Young [3] has made some breakthroughs in this field. The information system designed and developed specifically to meet the needs of physical education teaching and the current situation of physical test score management in higher education institutions can therefore match its own physical test score management tasks and properly and effectively serve managers and students, thus meeting the needs of physical education-related information management. The establishment of the physical test score management system is the optimal solution and inevitable choice to change the traditional physical education test score calculation and management, which can bring many positive effects to the school's teaching management, including more accurate and effective assessment of students' physical test scores, simplify the management and reporting of physical test scores, effectively reduce the manual workload and error rate, avoid the waste of human resources, improve the efficiency of each role in the physical test score management in agricultural and forestry colleges, and simplify the operation process. It can also improve the efficiency of each role in the management of physical fitness test results in agricultural and forestry colleges, simplify the operation process, and get more accurate information. Also, it can visually reflect the distribution of scores of all grades, majors, and individual subjects. The physical education test score management system is a modern information technology-based system platform that can quickly integrate and manage physical education information indicators.

There is no way to complete the tasks set by the teacher. As time goes by, students' interest in learning becomes increasingly depressed. Eventually, this will cause students to have no interest in learning, always do something unrelated to the class content during class time, fail exams, and other undesirable phenomena. To train high-quality applied talents who can adapt to social production and construction, the ability of the future profession they are engaged in within the limited time in school. It is very inevitable to develop new learning paths under the normal teaching sessions.

2 CURRENT STATUS OF RESEARCH

With the development and popularity of microcomputers, Treff et al. have also set off a boom of using computer-assisted teaching [4]. Kubiyeva et al. [5] have developed a unified plan and implementation rules for online education, which has enabled not only the networking of basic education but also most forms of professional online training.

Computer-assisted teaching is to carry out various teaching activities with the assistance of computers, to discuss learning contents with students in the form of dialogues, to arrange teaching process, to conduct lectures and tutorials, and to use computers to help teachers in teaching. Solomon and Endozo [6] pointed out that physical education multimedia CAI is a good auxiliary tool in physical education, which is popular among students in physical education because of its strong interactivity, rich content, intuitiveness of technical actions, and accuracy. Refaat [7]

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pointed out that a questionnaire survey was conducted on the backbone teachers of multimedia technology in 57 colleges and universities in 27 provinces and cities in China, and the results showed that 31.25% of college physical education courses have adopted multimedia-assisted teaching, 15.63% of college physical education courses have adopted network-assisted teaching, and 68.75% of colleges and universities have made plans to train physical education teachers. Cioruța and Lauran [8] have started to pay attention to multimedia teaching and network teaching, and some institutions have started to try to use multimedia technology, which indicates that the usage rate of multimedia and network-assisted teaching will increase rapidly when teaching physical education courses.

Multimedia-assisted teaching has been popular in colleges and universities, but the research results of scholars have been mostly confined to the discussion of theories and practical applications of multimedia, which are limited to theoretical teaching, and the application in art teaching is still lacking and insufficient, and the research is conducted in the aspects of learning motivation, learning interest, and teaching and training of sports techniques and tactics. This paper discusses the current situation of online education from the hardware support environment, system composition, key technology, and education object of the online education system.

3 DESIGN OF COMPUTER-AIDED SOFTWARE DEVELOPMENT APPLICATION FOR PHYSICAL EDUCATION

3.1 Computer-Assisted Physical Education Software Development

The development of system design objectives facilitates the maintenance of the business integrity of the management system. By analyzing the business processes of the system, a management system is designed to meet the physical education needs of our school. The process of applying the system ensures the integrity of the business process and provides a quick and correct response to the ongoing business, while also ensuring that the business is standardized. The functional modules were designed to make the business processes fixed, thus standardizing the flow of business, and preparing the system for perfecting future system functions, and making the system more practical. Using the top-down analysis method, the system module is divided into several sub-modules according to the functions, and then each sub-module is then refined and designed, while at the same time ensuring that each module is relatively independent and complete, with simple interfaces and a clear structure. Modularity can facilitate the division of labor among developers, improve team efficiency, and prepare for later maintenance and testing [9].

Development rules should be drawn up before the system is designed and developed so that problems can be handled in detail and mistakes can be avoided. To ensure that the system can be tested at all stages of the development process, and can be maintained in time when errors and shortcomings are found. The information technology industry is developing very fast, and only if the management system has good extensibility, it can ensure that the management system works well, meet the real needs, and continuously optimize its functions. Developers should design the system according to the special requirements of users and improve the flexibility of the system. It needs to ensure its good flexibility in the design and development process. System stability is determined by factors such as system structure, system instructions, system software, and hardware composition configuration error. Maintaining the stability of the management system is the most critical step in the design and development process. Because of the independent and interconnected nature of the modules, it will not affect the use of other modules during the subsequent system testing and maintenance, as well as the subsequent expansion and development of functional modules, code modifications, and deletions.

Designing numerous functional modules allows dividing the physical fitness test management system into several parts and solving different problems and needs one by one by implementing

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the functions of each part. This simplifies the complex student fitness test management system and finally completes all the design, as shown in Figure 1.

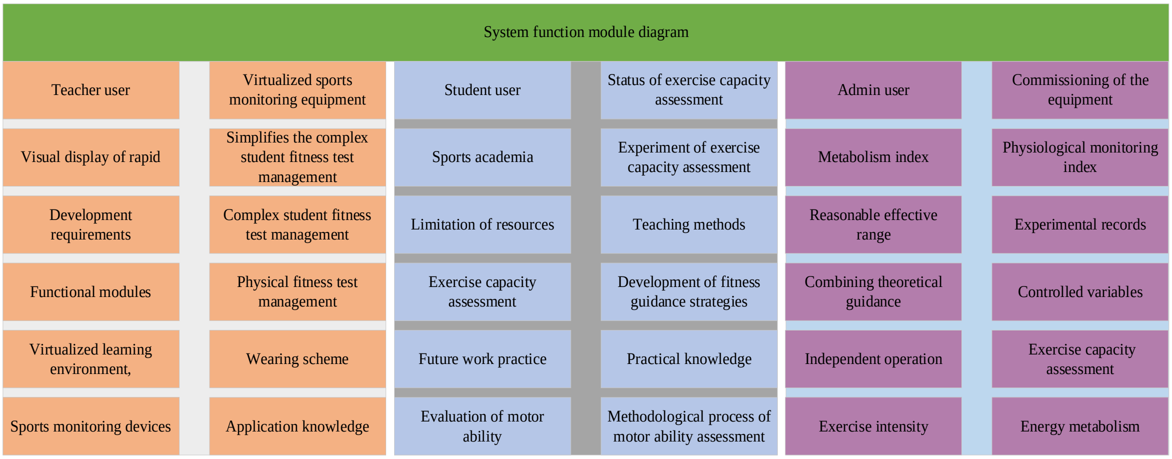

Figure 1: System function module diagram.

The virtualized sports monitoring equipment can realize the visual display of rapid disassembly and assembly of parts and components, and can be repeatedly operated so that students can more intuitively and three-dimensionally understand the components and working principles of sports monitoring equipment such as telemetry gas metabolizer, pedometer, heart rate meter, etc.; in the virtualized learning environment, the system can also show the wearing scheme and usage of sports monitoring equipment for people with different characteristics. In the virtualized learning environment, the system can also show the wearing scheme and usage of sports monitoring devices for people with different characteristics, and the learners can deepen their understanding of the application knowledge of sports monitoring devices by completing the wearing and other operations of sports monitoring devices under the guidance of the system, which will lay the theoretical foundation for the next sport's ability assessment experiments.

Although the role and status of exercise capacity assessment have been gradually recognized and valued by the sports academia, the experiment of exercise capacity assessment has not played a full role in changing this situation due to the limitation of resources, class time, and teaching methods. On the one hand, this discourages learners' interest in learning and makes it difficult for them to understand the positive role and importance of exercise capacity assessment in the development of fitness guidance strategies; on the other hand, the lack of practical knowledge makes it impossible for learners to apply their knowledge in their future work practice.

In the motor ability assessment module, the learners learn the methodological process of motor ability assessment and the calculation and evaluation of motor ability. The interactive operation mode of the virtual experiment can link many difficult points of the motor ability assessment experiment, and the combination of theory and operation can effectively improve the practical operation ability of the learners in the motor ability assessment. In this module, it is necessary to first complete the review of the previous module, i.e., to complete the dressing and commissioning of the equipment; then observe the changes of heart rate, gas metabolism index, and energy metabolism index of the subject in the exercise state, and control the exercise intensity in time to ensure that the physiological monitoring index of the subject is in a safe and reasonable effective range; finally, assess the exercise ability of the subject according to the experimental records. Therefore, this module attaches importance to the strengthening of learners'

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practical ability and improvisation ability, combining theoretical guidance, controlled variables, and independent operation, so that learners can complete the content and process of exercise capacity assessment in an interactive experimental situation, and deepen learners' knowledge and control of physiological indicators, exercise intensity, energy metabolism, and assessment process.

3.2 Experimental Design of Software Application

The pre-experimental test was conducted for two classes of students one week before the start of the experiment, and the test content was basic badminton techniques and basic teaching ability. The forehand serve and forehand hitting high balls required 10 consecutive hits to the backcourt between the singles serve line and the doubles serve line, and the forehand kill ball required 10 consecutive hits to the middle and backcourt area. The basic teaching ability is mainly evaluated based on the practical ability of analysis and problem-solving scoring standard in the "Reference Standard for Scoring Basic Teaching Ability of Physical Education Majors". The experimental class adopts multimedia-assisted teaching: organize to watch the video of complete movements, and explain and analyze with the video. The video of the newly taught action was played in the order of complete action - single action - slow action, key decomposition, freeze-frame - prompt points - complete action - reproduction. Explain one by one, so that students leave a deep trace of action in their brains and initially form a complete and correct action representation. Students and the teaching video are corrected and compared with each other and with each other.

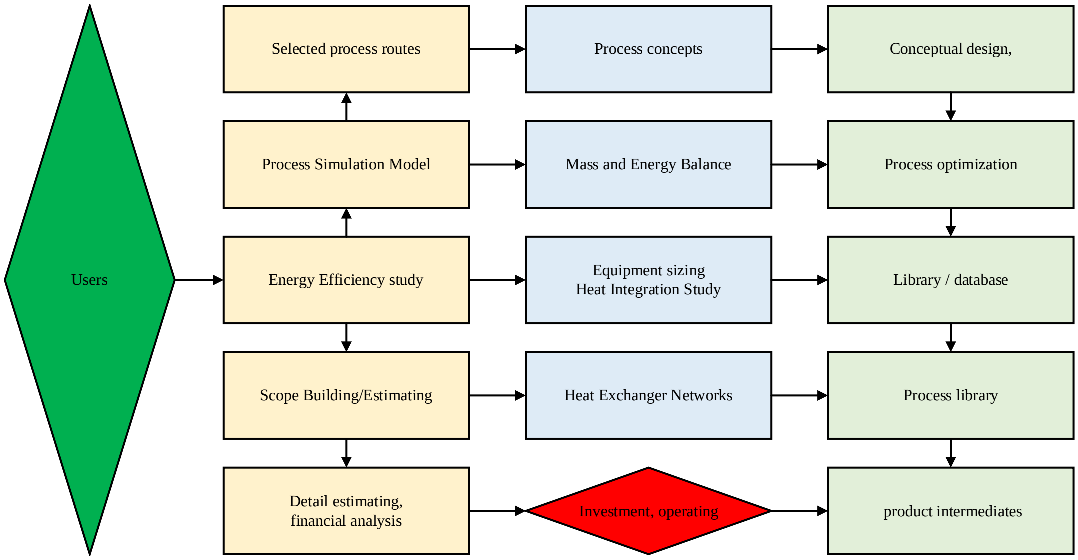

Figure 2: Experimental flow design.

The testing content of management systems is generally divided into system operation testing, testing of a functional interface implementation, and performance testing [10]. The bugs appearing in the operation of the system are analyzed and improved by executing tests. Finally, regression testing is performed, i.e., the system is tested after the completion of fault repair. Regression testing is an effective way to verify whether there are new faults in the maintained system, so the system should be regression tested several times during the design and development process. After testing, the system is made to have better stability and continuity, as shown in Figure 2.

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Black-box testing, also known as functional testing, treats the programs to be tested as unknown black boxes. The focus of black-box testing is the opposite of white-box testing; black-box testing does not focus on the intrinsic features of the program as well as the architecture; it focuses on examining the functionality of the application system. The tester knows the functional effects that can be achieved by this program, but not how it is achieved. Test cases are test descriptions of the modules in the system that document the testing process and results. In this system test cases are divided into user information module test, teacher side module test, and student side module test.

Based on the existing historical information, the information is mined to create a document. Database technology is an important part of the system design, and a reasonable database design is related to the execution efficiency of the system. Establishing a reasonable database design should minimize the amount of data access and ensure the integrity and consistency of data. The database in this system is managed and maintained for two users, the operation object administrator, and the teacher. The administrator is responsible for the management of teacher users and department information. Teachers are responsible for teaching resources, assignment management, online test, online question and answer, student management, and other data information.

4 ANALYSIS OF RESULTS

4.1 System Performance Test Results Analysis

According to the system test case design plan for the "human exercise ability assessment and fitness path design" virtual simulation experimental system for testing, a total of 48 test cases, test report as shown in Figure 3. Among them, there are 18 user interface test cases, 20 functional test cases, and 10 performance test cases, and the passing rate is 100%, which indicates that the system has passed the application test well and can be put into teaching application, as shown in Figure 3, the satisfaction of the test subjects to the virtual experiment of "Human exercise ability assessment and fitness path design" is high, and the average score is above 4.

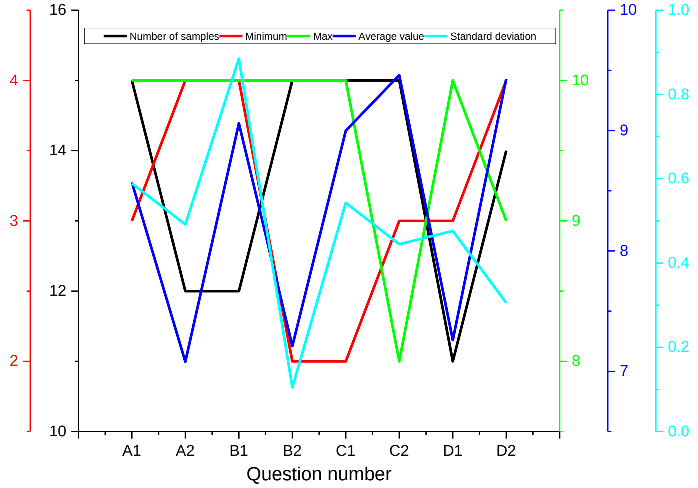

Figure 3: Descriptive statistical analysis.

The above analysis shows that the virtual simulation experiment system has gained good satisfaction and acceptance; the evaluation feedback from four perspectives of interactivity.

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According to Figure 4, we can know that the teaching model of the teaching video is mixed, and we can see through the Rt-Ch diagram that the point falls close to the practice and dialogue type area, so we can diagnose that the lesson is biased toward the mixed teaching of practice and interaction. The system can give the analysis results to the teacher or the teaching and research group in about 10 minutes, which provides a technical guarantee for effective evaluation, sharpening, and research of the lesson and promotes the professional development of the teachers themselves.

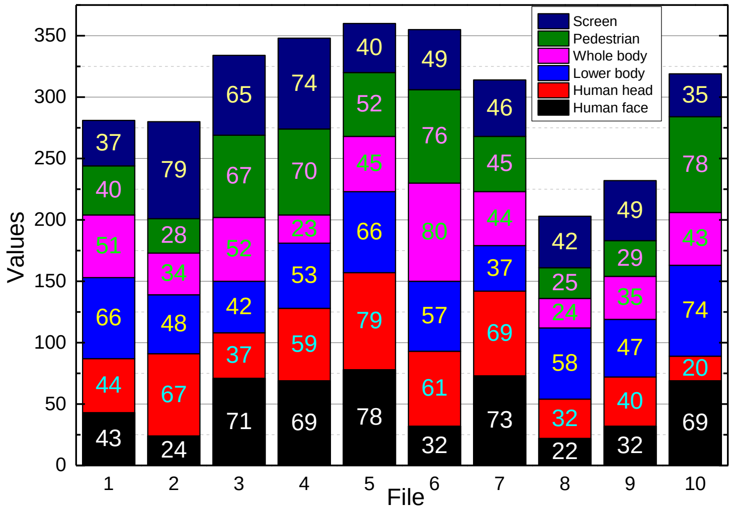

Figure 4: Factor detection data.

The practice is the best way to test the system. To verify the generalization ability of the system, I started to build my dataset from the beginning of the system development. A video dataset of 5000 lessons was created. After completing the dataset, a large amount of data was applied to the development and testing of the system. In terms of application practice, 20% of the dataset was selected as a test set. The test set was divided into several groups, one for every 25 videos. A new sample of teaching videos was randomly selected for testing. There were 10 samples in the first category of microgrid classrooms, 10 samples in the second category of general classrooms, and 5 videos in the third category of lecture hall environments; each category was divided into 3 videos in Easy, 4 videos in Medium, and 3 videos in Hard; each category had 3 videos in 1080p size. These three categories include 9 secondary school subjects, all of which were randomly selected.

The test set sample of 20 groups was continued to be tested against the system prototype. The summary results of the data are shown in Figure 5. The accuracy rates all remained largely above 84%. Only three test sets had error rates in the range of 10%-16%. This is also in a reasonable range. Therefore, the system is judged to have good generalization capability.

Further analysis by sampling frame sequences should be a section of hybrid teaching mode. Based on the detailed observation of frame images, it is clear that there are some problems in the shooting angle of this class, mostly shots of students practicing, and the probability of teachers appearing on the screen is low, so the detection data is biased more towards student behavior, which eventually leads to errors in the analysis results. No matter it is the video analysis of real-time classroom or the video analysis of quality class, the system can effectively feedback the teaching mode and other data, and get the diagnostic report of classroom intelligently and quickly. The application value of the system is remarkable and worth promoting. First, there is room for improvement in the speech-semantic analysis. As we all know, it is relatively one-sided to analyze

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video from a visual perspective alone, and the human brain's processing of information is a mixture of video and audio processing. Therefore, in terms of the Bayesian causal network determination model, there should be simultaneous determination functions or methods for speech and vision, especially dichotomous discrimination between teacher corpus and student corpus, so that we can more accurately determine whether it is teacher behavior or student behavior. However, given that the theory of high-level semantics is still to be studied, the implementation is difficult. I will also continue to explore hard to make a better teaching pattern recognition system by fusing the information in both auditory and visual aspects for determination.

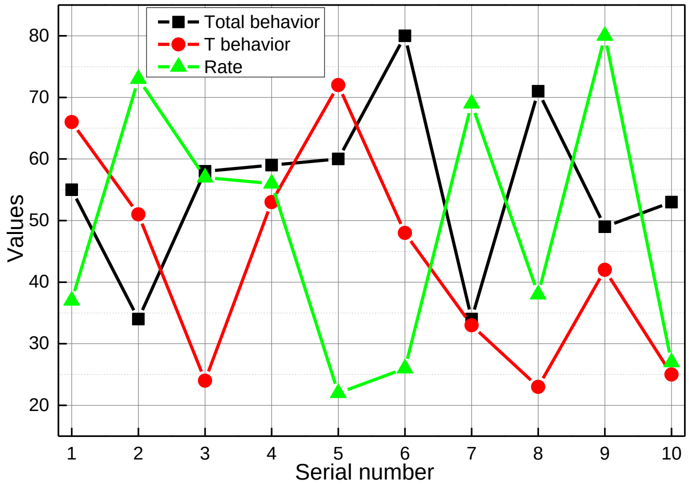

Figure 5: System test comparison.

4.2 Analysis of Application Experiment Results

According to Figure 6, it can be concluded that both micro-teaching mode and traditional teaching method can play a certain effect on the T-run test performance, but the effect is not significant, and there is no significant difference between them.

After the independent samples t-test was conducted for the pre-, mid-, and post-test data of the experimental and control groups, it was found that there was no significant difference between the test scores of the control and experimental groups at each experimental stage. It can be concluded that both the micro-teaching mode and the traditional teaching method can improve the T-run test scores to a certain extent, but the improvement effect is not significant and there is no significant difference between them. From the above data, it can be concluded that after 12 weeks of training, the experimental group's performance on the ball was improved more than that of the control group, and the experimental group's performance improved faster in the first 6 weeks than in the last 6 weeks, showing a trend of fast and then slow change; the control group's performance on the ball tended to grow steadily with little change. This verifies that the micro-teaching mode has a better training effect than the traditional teaching model.

As shown in Figure 7, after 12 weeks of training, the experimental group's dribbling and shooting performance improved more than the control group, and the experimental group's training effect improved faster in the first 6 weeks than in the last 6 weeks, showing a trend of fast and then slow change; the control group's upside-down performance tended to grow steadily and the change was not significant. After the SPSS data analysis, thus verifying that the micro-lesson combined with the flipped classroom teaching model achieved better results than the traditional teaching method.

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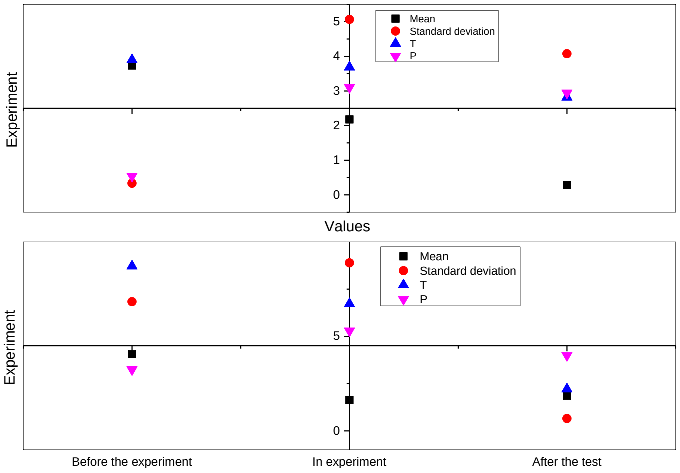

Figure 6: Comparison of the experimental and control groups before, during, and after the T-run test.

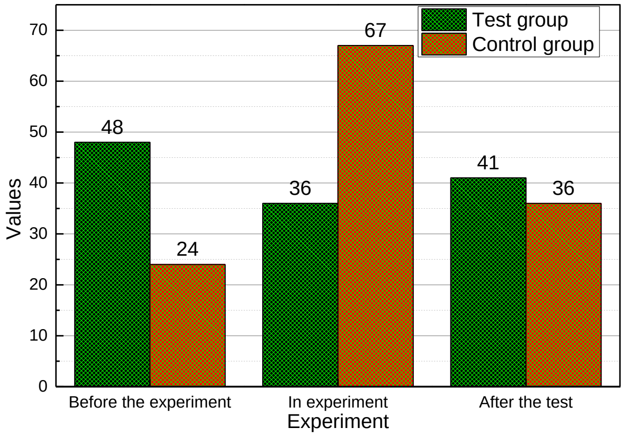

Figure 7: Trend of mean value comparison before, during, and after the experiment.

To observe and compare the effect after the experiment, the distribution of the number of students in the experimental class and the control class between the standard and the technical evaluation of the forehand serve after the experiment was statistically analyzed, as shown in Figure 8. The figure shows that the excellent rate of the experimental class and the excellent rate of the control class were 24% and 8% respectively; the good rate of the experimental class and the control class was 60% and 40% respectively; the pass rate of the experimental class and the control class were 8% and 40% respectively; the failure rate of the experimental class and the control class were 8% and 12% respectively. The percentage of the experimental class failing to meet the standard for the forehand lob was 8%, and the percentage of the control class failing to meet the standard for the forehand lob was 12%. It can be seen from Figure 8 that the excellent rate of the experimental class and the excellent rate of the control class were 8% and 0% respectively; the good rate of the experimental class and the control class was 60% and 24% respectively; the pass rate of the experimental class and the control class were 32% and 64% respectively; the pass rate of the experimental class and the control class were 32% and 64%

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respectively. The failure rate of the experimental class was 0%, and the failure rate of the control class was 12%.

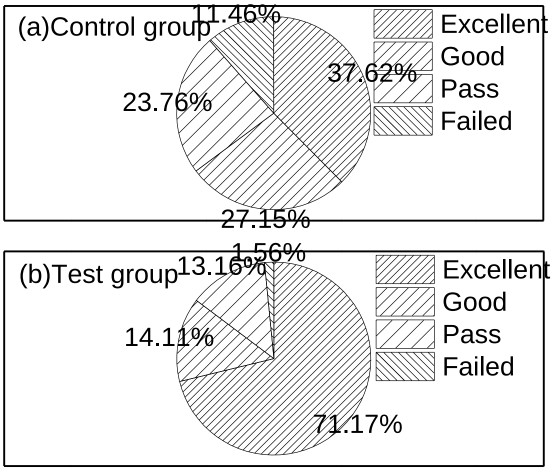

Figure 8: The number interval between the experimental class and the control class after the experiment.

5 CONCLUSION

This paper analyzes the functional requirement analysis, feasibility analysis, and non-functional analysis of the auxiliary teaching system by using a case diagram from the teaching demand of the school. The administrator subsystem is responsible for daily maintenance of the system; the teacher subsystem is responsible for teaching resource management, student management, homework management, online question and answer management, online test management, grade management, etc.; the student subsystem is responsible for online learning, homework, online test, online question, and answer, etc. Using container technology to build the experimental environment, abandoning the traditional virtual machine technology, resources can be replicated and the experimental environment can be loaded in seconds, greatly reducing human labor and saving waiting time. The management of Docker is achieved through the port allocation policy and the method of opening and stopping containers as well as the replicability of images. After this system is put into use, it further accelerates the pace of campus informatization, improves the efficiency of the school's physical test score management department, and not only saves time but also reduces the errors that occur during the physical test score statistics.

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