Teaching Method of Electronics and Automation Course Based on CAD Technology

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Abstract. Taking improving the teaching effect of electronics and automation courses as the starting point, and aiming at cultivating students' professional ability, a hybrid practical training teaching mode combining virtual and real is constructed, which solves the problems of many course knowledge points, limited classroom personnel and equipment, difficult practical teaching, and teaching effect. It can fully mobilize students' learning initiative, improve students' interest in learning, and achieve good teaching results. Based on computer-aided technology, this paper builds a quality monitoring system for the construction of electronic and automation courses in colleges and universities. By strengthening top-level design, we formulate methods for evaluating teachers' teaching quality; focus on scientific and practical results, and establish a course construction quality monitoring index system. evaluation indicators. In the specific implementation process, the evaluation system will be continuously improved, and the standardization and standardization will be gradually realized.

Keywords: computer-aided design; automation courses; teaching programs.
DOI: https://doi.org/10.14733/cadaps.2023.S4.133-144

1 INTRODUCTION

In 1946, the world's first computer was successfully developed, the emergence, development and wide application of the computer, the development and change of human society has played a great push, it makes human began to enter the computer teaching application era. With the gradual maturity of computer technology, especially the development and improvement of multimedia technology, network application technology and data compression technology, it provides a broader background for the development of modern computer-aided instruction system [1].

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The connotation of CAI concept has also been expanded and extended more than in the early days. In a broad sense, CAI refers to a teaching organization form in which the computer information technology is used as a teaching tool and means to affect teachers and students in the process of teaching activities in order to better complete the teaching objectives, improve the teaching effect and develop the comprehensive quality of students. With the rapid development of information technology, the content and form of CAI become more and more abundant. In recent years, CAI mainly relies on the teaching platform of network (such as campus network teaching system which simulates Internet in LAN, Internet remote auxiliary teaching system platform) and the development and editing platform of multimedia auxiliary teaching software based on component thought, which has gained great development. In 1946, the world's first computer was successfully developed. The emergence, development and wide application of the computer greatly promoted the development and change of human society. It made human beings begin to enter the application era of computer teaching. With the gradual maturity of computer technology, especially the development and improvement of multimedia technology, network application technology and data compression technology, it provides a broader background for the development of modern computer-aided instruction system. The connotation of CAI concept has also been expanded and extended more than in the early days. In a broad sense, CAI refers to a teaching organization form in which the computer information technology is used as a teaching tool and means to affect teachers and students in the process of teaching activities in order to better complete the teaching objectives, improve the teaching effect and develop the comprehensive quality of students. With the rapid development of information technology, the content and form of CAI become more and more abundant. In recent years, CAI mainly relies on the teaching platform of network (such as campus network teaching system which simulates Internet in LAN, Internet remote auxiliary teaching system platform) and the development and editing platform of multimedia auxiliary teaching software based on component thought, which has gained great development. Computer-aided teaching is convenient and used in many places. Akhtar et al. [2] used computer-aided systems to monitor course learning and predict students' futures based on the results. Bentounsi et al. [3] used a meta-analysis of the effects of computer-aided instruction on students' attitudes towards science and mathematics. Li et al. [4] designed a sports network management system using computer aided instruction.

However, at present in China, there are still many difficulties in the teaching of electronic and automation courses in many colleges and universities, which cannot meet the actual needs of teaching, such as the lack of experimental equipment. During the experiment, there are many damages to the experimental equipment and devices, which affect the normal opening of the experiment. The amount and time of experiments are difficult to meet the needs of students, and many of the content that students are interested in cannot be tested. Students can only complete the experimental steps prescribed by teachers in the specified time, which is not conducive to improving students' interest in learning. There is no experiment for students with good ideas, which limits the enthusiasm of students to explore new knowledge and the cultivation of innovation ability [5]. The experiment content is subordinate to classroom teaching, there are many confirmatory experiments, and the content is monotonous, which is not conducive to cultivating students' experimental ability and innovative thinking ability. Scientific application of computer aided technology teaching software to assist experimental teaching can better overcome some difficulties existing in current experimental teaching. Thakkar et al. [6] used CAD technology to start from the course of artificial intelligence and automation, and obtains some important teaching methods. Camburn et al. [7] created mind maps using computer-aided techniques that can be used in electronics and automation courses.

2 THE BASIC IDEA OF AUTOMATIC CURRICULUM SYSTEM

In view of the present situation of CAD/CAM teaching, many schools and teachers have carried on the corresponding exploration and thinking. The author based on teaching ability and systematic curriculum design concept, in-depth college classroom teaching of professional ability, to the

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enterprise to talented person's demand as the guidance, analysis of typical post professional ability, and in accordance with the optimization of the main content of this course, teaching mode and teaching material knowledge, etc., to improve the electrical and automation based on the technology of CAD course teaching present situation, Achieve the expected teaching effect [8].

Explore from two aspects of teaching content and project setting. In terms of teaching content, typical work tasks of enterprises are selected as the main content of teaching based on the new knowledge, new technology and new technology of enterprises, and technical backbone of enterprises are employed to participate in teaching design and teaching practice. According to the difficulty of the course content, the theoretical teaching and engineering practice will be carried out step by step in the order from simple to complex. In terms of project setting, the limitation of scattered knowledge points is broken through, and the drawing software is divided into multiple teaching modules, with typical parts as project tasks, which changes the situation that students lack systematic knowledge due to incoherent classroom teaching and operation practice and inconsistent content [9].

In the process of teaching, we have changed the teaching mode to improve students' interest in learning by task-driven and information technology, and changed the situation of teachers teaching more, students practicing less and teachers leading students. With the help of the learning platform, teachers make or select classic learning videos and simulation animations. In the form of flipped classroom, students first learn online, and then select key content to be taught offline according to the data analysis of the platform, leaving more time for students to practice. In order to improve the enthusiasm of students, the group as a unit to carry out mutual help activities, cultivate the spirit of unity and cooperation of students, temper the quality of students, firm students will, improve the comprehensive quality of students.

Positions that are highly compatible with electronics and automation courses include: product designer, CNC machine operator, cartographer, equipment maintainer, etc. The results show that the core competencies required by these positions are: drawing recognition ability (parts drawing and assembly drawing), processing technology analysis ability, THREE-DIMENSIONAL modeling design ability, NUMERICAL control machining programming ability, numerical control machine tool processing and operation ability, etc. Therefore, in the CAD course teaching process, it is necessary to focus on cultivating students' ability of map recognition, THREE-DIMENSIONAL modeling and NUMERICAL control programming and processing, and pay attention to the connection and comprehensive application of professional knowledge with other disciplines [10].

On the basis of electronic and automation curriculum construction and teaching reform, the teaching team will continue to draw lessons from the competency-based serial inquiry project teaching method, and further standardize and refine the learning situation (project), in order to enhance students' sense of learning gain. According to the latest requirements of the curriculum, ideological and political elements will be integrated into the teaching process in the future, such as mechanical manufacturing craftsman spirit, rigorous and serious work style. At the same time, the joint venture master skills relevant to the nc studio, organize collective lesson preparation and teaching, let the school teaching and more closely the enterprise production, enterprise training ability request the school for feedback to expectations of the enterprise, constantly improving the quality of teaching, between schools and enterprises to construct ecological closed-loop benign course.

3 TEACHING REFORM AND PRACTICE OF COMPUTER SOFTWARE ASSISTED AUTOMATION COURSE

In order to meet the electrical and automation engineering certification requirements, develop a computer aided teaching as a professional course, key construction and demonstration by implementing "raise an organic whole, complementary, inside outside class and race promotion" of the curriculum system, cultivate students flexible application of auxiliary tools such as computer software the ability to solve the problem of complex automation engineering, design and

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automation devices and research The ability to research and develop automated products and processes, as well as the ability to control and manage automated production, enables students to have good professional ethics and social responsibility, and to be engaged in technology development, product development, production management, sales and other jobs in engineering design, automation engineering and related fields after graduation.

3.1 Build an Automated Curriculum System

In engineering education professional certification with the backdrop of the new engineering construction, laying solid foundation course constantly in recent years, the professional teachers improve courses and practice link, we have achieved the goal of automation through theory teaching and practice to strengthen students understanding of basic knowledge and professional knowledge, to lay a solid foundation for students' learning automation. We studied in integrated optimization of teaching resources and the similar colleges and universities, on the basis of teaching experience, pay attention to automation teaching design theory, software operation training, the combination of innovation education and practice, the integrating automation design course content for content and program design, process design, automation process calculation, workshop equipment and piping layout. Six topics of technical and economic analysis, environmental analysis and safety assessment are discussed. Meanwhile, the application of various software is strengthened to construct an automatic curriculum system of "theory and reality integrated, virtual and reality complementary, in and out of class, and competition promotion", as shown in Figure 1.

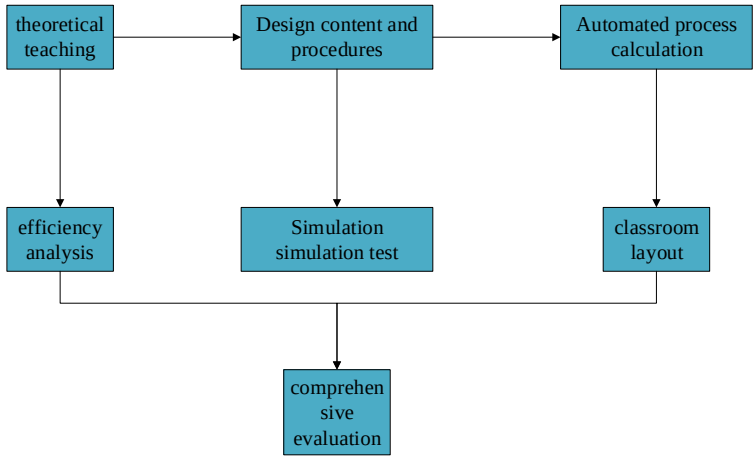

Figure 1: Computer software-based curriculum system.

The theoretical teaching content is six topics of automation course; As a comprehensive course practice, software operation training requires students to complete the design process of a project independently by using the professional knowledge and software of the pre-study courses. Innovation education mainly cultivates students' ability of applying what they learn and solving practical engineering problems. The teaching of the above three links cannot be separated from the strong support of other professional courses, especially the professional courses of automation principle, automation engineering, automation process analysis and automation process simulation.

Learning automatic design software takes a lot of time. Due to the limited class hours of existing automation courses, it is difficult for students to systematically master software operation steps and application skills through course learning. Therefore, on the basis of carefully sorting out the teaching syllabus and the teaching content of relevant courses, the teachers of this major intersperse the teaching of relevant software into the teaching of prerequisite courses. For

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example, in the course of engineering drawing and CAD, we focus on cultivating students' ability of drawing with drawing software. In the course of chemical process simulation calculation, the basic principle and application skills of Aspen Plus, system analysis software, are emphasized. In the Matlab program design course, the emphasis is on enabling students to master programming language and cultivate their ability to skillfully use mathematical calculation and optimization software. In the basic course of mechanical automation equipment, typical equipment process design, calculation and selection software are introduced. Strengthen students' system integration in the course of automated process analysis and synthesis. Optimize design consciousness, train students' grand engineering view and optimize design thinking. In addition, we are engaged in virtual simulation, practical training and innovation and entrepreneurship education. The course design and automation design competition will further strengthen the study of theoretical knowledge related to automation design and the cultivation of students' practical skills. The above measures have obviously improved the students' graduation design level and engineering design ability. Figure 2 is the flow chart of the copper sheet designed in the automation course based on CAD technology.

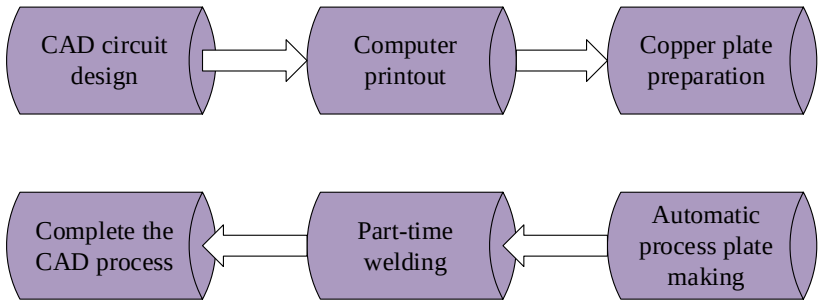

Figure 2: Plate making process.

3.2 Strengthen Students' Ability to Apply Modern Tools to Design

In recent years, with the rapid development and wide application of computer technology, modern design methods and tools are playing an increasingly important role in automation courses. Such as the use of relevant software, automatic calculation, design, drawing and other procedures can be simplified, which can not only effectively save work time and design cost, but also significantly improve the design quality and efficiency. In the new training program, students need to set up Matlab programming courses, automatic process simulation and automatic CAD courses. Through case teaching, teachers guide students to operate the software and design with the theoretical knowledge they have learned, so as to improve students' ability of engineering design and the efficiency of solving engineering problems. For example, students can use AspenPlus software for sensitivity analysis. Process analysis tools such as optimization and constraint, multi-condition analysis can be used to optimize the process, and the software can also be used to calculate the pinch point, and the integration and optimization of heat exchange network.

In addition, you can also use 3D drawing software 3Dmax, SmartPlant 3D and Solidworks, workshop and pipeline layout software Pdmax, Heat exchanger optimization design software HTRI and HTFS, risk and operability analysis software Hazopkit, technical and economic environment analysis software Aspen Process EconomicAnalyzer and GaBi, And the system optimization software Matlab, GAMS and gPROM software or software packages. In order to improve the ability of students to use this software, the use method and training content of related software are added in several advanced courses, and in the computer class of automatic design combined with actual cases, focusing on the use of various software scenarios, problems that can be solved. The

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introduction of computer software teaching in the course not only greatly meets the needs of automation design and other related courses teaching, but also effectively strengthens the students' ability to apply modern tools and software to assist automation course problems.

3.3 Virtual Simulation Experiment Teaching

The traditional automation design is based on classroom teaching, in which teachers are responsible for teaching and students are responsible for learning. This kind of pure theoretical teaching makes students feel boring and boring, and cannot effectively cultivate students' initiative and creativity in learning. In addition, this teaching method does not pay attention to classroom participation, which is easy to cause students to learn passively and memorize the taught content mechanically.

Therefore, centering on the students to follow and results oriented engineering education concept, relying on the existing resources such as virtual simulation experiment teaching center, virtual simulation technology, reform teaching methods and means, adopting the teaching mode of integration of "teaching - do" implementation "mix" of teaching content, prompting students to actively participate in classroom interaction, improve their interest in learning. In order to adapt to the requirements of new engineering construction, all students are required to choose at least two simulation experiments in the innovative experiment course. Figure 3 is a schematic diagram of the design scheme of a certain device in the CAD-based automation course.

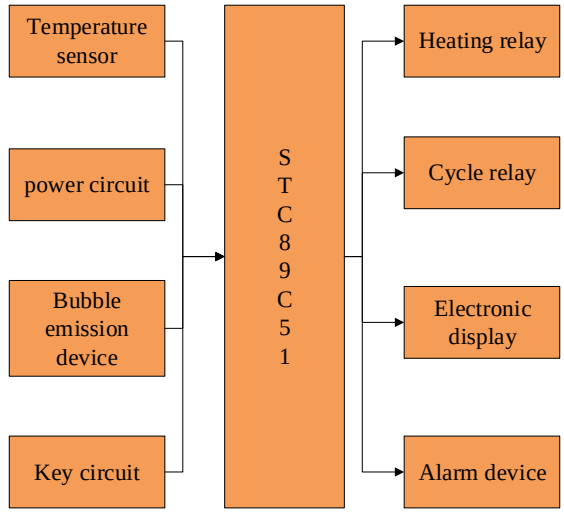

Figure 3: System solution principle.

Take advantage of the virtual simulation experiment teaching and interaction of virtual and reality, the students can in immersion learning environment, learn more about the actual methods of chemical engineering professional knowledge, and with the typical chemical unit operations, process characteristics and laws, automation of production practice, to deepen the understanding of theoretical knowledge, Improve the ability of operation, analysis and accident handling.

Traditional courses mostly adopt the teaching mode of "teacher lecturing on the platform and students learning under the platform". Although this mode can enable students to master the theoretical knowledge on the textbook efficiently, it lacks the interaction in the classroom. In this teaching mode, students tend to learn by rote, unable to fully understand the real use of theoretical knowledge, and unable to draw inferences from one another, lacking the ability to solve

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practical engineering problems. Therefore, we need to add some case teaching and practice teaching content on the basis of theoretical teaching.

In the long-term teaching process, we found that most students like to do problems, so this course adopts the teaching mode of "thematic theoretical teaching -- heuristic case analysis -- open homework strengthening", in order to improve students' innovative thinking and comprehensive ability of engineering. First, we will be teaching content integration as the design contents and procedures, process design, workshop equipment and piping layout, technical and economic analysis, environment analysis and safety evaluation, a total of five projects, make knowledge structure more clear, close together, which makes students better digest and absorb knowledge, improve students' ability to branch out, improve teaching quality and efficiency. Among them, the relationship between efficiency and practice in three aspects: process design, workshop equipment and pipeline layout, and technical and economic analysis is shown in Figure 4. After introducing the theoretical knowledge of each topic, we selected some cases that were close to real life or did well by previous students, and divided them into a number of small problems by using the sparrow anatomy method. For example, in the introduction of automation course route selection, we first introduce production methods, process selection principles and steps, process design tasks and steps; Through this interactive teaching form, teachers can guide and inspire students step by step how to use theoretical knowledge to solve practical engineering problems; Through active thinking, students not only learn how to analyze and solve problems, but also have a deep understanding of the role of different topics in the automatic course learning.

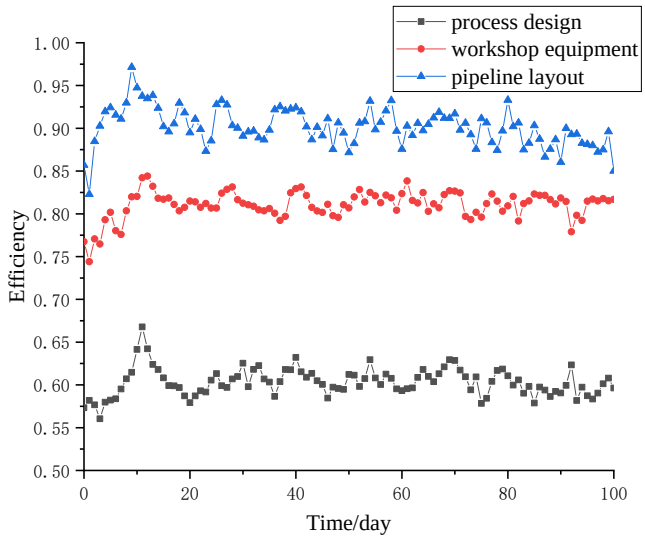

Figure 4: Course efficiency diagram.

3.4 Enhance the Innovation Ability of Automation Courses

Competition is an important tool to test the effect of education and teaching, an effective way to improve students' learning initiative and innovation spirit, and an important index to measure the quality of university education. At present, the national design competition of college students' chemistry in chemistry is considered to be China's most influential, the highest and largest design competitions, students according to the requirement of the specification, make full use of the major theoretical knowledge and computer software, site selection, analysis and comparison of different technical routes, etc. In recent years, the competition has gradually increased the

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innovation requirements for design works, and the innovation of resource utilization scheme, product structure scheme, reaction separation technology, process energy saving and consumption reduction technology, environmental protection technology, new process equipment application and other aspects have been included in the scoring standard. It can be seen that this competition is not only conducive to deepen students' understanding of theoretical knowledge, but also can train students' ability to design solutions for complex engineering problems, especially the ability to use the latest computer software to solve engineering problems.

Curriculum assessment is not only the test of students' knowledge mastery, but also the test of teaching reform and teaching quality. It is necessary to change the original assessment method of students' learning status through theoretical examination, and realize multi-level, whole-process and standardized assessment of courses by refining and standardizing the assessment method and content of each stage of courses. Using computer aided technology in the original evaluation system, the new group examination system, including periodic report, class questions, PPT defense, daily homework and the preparation of the preliminary design specification of the project. In this way, the performance of students in the automated classroom can be improved through computer aided design, and the learning ability of the course can be greatly improved. According to the survey, the best proportion of each component to examine is shown in Figure 5.

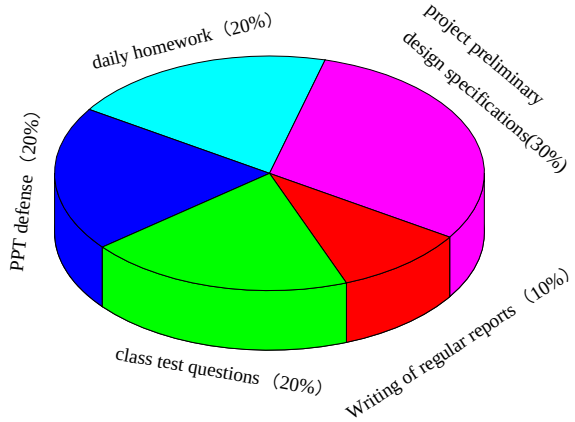

Figure 5: Pie chart of the best proportion of each part.

4 APPLICATION IN CURRICULUM TEACHING

Students should not only have a solid grasp of theoretical knowledge, but also improve knowledge application skills to promote their comprehensive ability. While computer-aided instruction focuses on cultivating students' knowledge and skills to meet the needs of classroom teaching, the following strategies should be adopted in the specific application:

4.1 Determine Teaching Objectives and Break Down Course Content

Before making the video, the teacher should carefully select the key and difficult content of teaching, divide the teaching content into different knowledge point groups, and determine the goal of each knowledge point group. According to the knowledge and ability objectives to determine the teaching ideas and methods, and then reasonably design the video content and classroom teaching plan. According to the textbook content and syllabus, electronics and automation can be divided into three modules: circuit diagram and circuit board making, circuit diagram simulation analysis and VHDL program design foundation. Teaching objectives: to master

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the method of circuit diagram design, single-layer and double-layer circuit board manufacturing, circuit simulation and analysis methods. In addition, each teaching module is subdivided into different knowledge points, and a teaching video is recorded for each knowledge point to determine the key and difficult points of teaching and create conditions for students to study independently before class.

4.2 Design and Make Teaching Micro Video

Before the teaching of electronic and automation courses, the teacher can use computer-aided design software to record micro-videos and upload them to the network or distribute them to students, who can watch them independently before class. Teaching videos should carry out in-depth analysis of knowledge points, grasp the key and difficult points, deepen students' understanding, and let students effectively learn and master the key and difficult points. In order to ensure the effectiveness of micro-video, the time is generally controlled within 5-10 minutes, preferably not more than 15 minutes. Micro video production should ensure that the time is short, knowledge is precise and few, convenient for students to use their spare time to learn independently. Micro-video production should also follow the principle of "task-driven and problem-oriented", enhance the interesting features of teaching content introduction, ensure clear hierarchy, progressive layer by layer, and moderate difficulty. Let students master the most critical knowledge in a short period of time, and lay a foundation for effective integration into classroom learning.

4.3 Carry Out Classroom Teaching to Promote Knowledge Internalization

Classroom teaching mainly through communication and discussion to answer questions, so that students can effectively master knowledge. In teaching, students should first comment on their practical work, display excellent results, encourage and enhance students' confidence, and promote mutual learning and improvement among students. Then carry out the communication and interaction of the learned content, so that students will further internalize the knowledge, improve the knowledge application skills and problem-solving ability. Can also be based on the teaching objectives and the shortcomings of students' pre-class learning, assign targeted, higher requirements of homework, let students complete in an automated classroom. Classroom learning can adopt the way of communication and discussion and practical operation. The former focuses on students' questions and teachers' explanation, timely answering students' doubts in learning, and guiding students to put forward new questions, think, discuss, sort out and summarize. The latter focuses on practical operation, allowing students to use theoretical knowledge to solve specific problems and promote students' knowledge application skills. Figure 6 is a schematic diagram of the proposed distribution of marks for automation courses in line with the above.

5 CLASSROOM ENVIRONMENT AND ADVANTAGES OF TEACHING

Electronic and automated classroom environments based on computer aided operating systems should generally include:

1) Equipped with a PC with better performance and price to meet the needs of a natural shift, so as to meet the requirements of simulation speed. To ensure safety, students do not need to configure cd-rom drive and floppy drive on their PC.

2) Use a PCServer to manage the student computer and form a local area network, so that you can install the automation software running on the computer to the hard disk through the network; Students can also transfer homework files to the server through the network and connect with the campus network, so as to further achieve the purpose of resource sharing.

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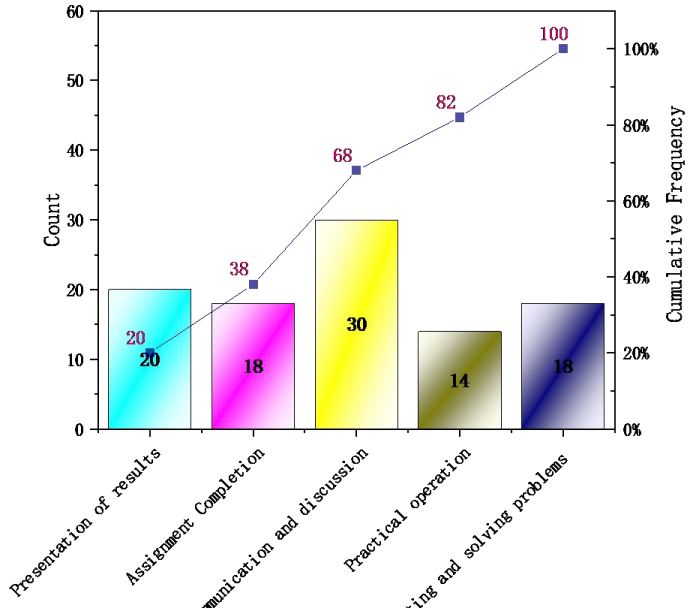

Figure 6: Automation course mark allocation.

3) equipped with microcomputer multi-coal teaching equipment: microcomputer projector, projection screen and audio equipment, so as to carry out software operation demonstration teaching, make teaching more vivid.

4) The student-centered development mode of experimental teaching is highlighted when computer aided electronic and automatic experiments are carried out. Using CAD tools can shorten the time to complete the experiment process, greatly improve the efficiency of the experiment. Because CAD tools use more accurate and closer to the actual circuit model and original device model, and equipped with a variety of common original device model parameter library, in addition to the conventional simulation, but also can simulate the influence of various technical parameters. And it can compare and optimize a variety of experimental schemes conveniently, so as to select the best experimental scheme and prepare for the actual automatic experimental design.

5) The use of CAD tools can give full play to students' creativity. All the instruments used by students in the past can be simulated by simulation tools. Facing the image on the screen, it is the same as the original instrument. Changing the options on the screen is equivalent to adjusting the instrument knob, so that there is no need to plug in and connect wires, and more energy can be engaged in creative experimental work. Figure 7 is an evaluation diagram of the role of CAD in automation courses.

6 CONCLUSION

Computer-aided design is used to enrich automatic classroom teaching resources, add new teaching means and evaluation mechanism, solve the problem of using automatic experimental equipment to implement network training teaching during epidemic prevention and control, and make it possible for the whole process of network training teaching. The use of CAD technology makes it easier to understand and master the difficulties in classroom teaching.

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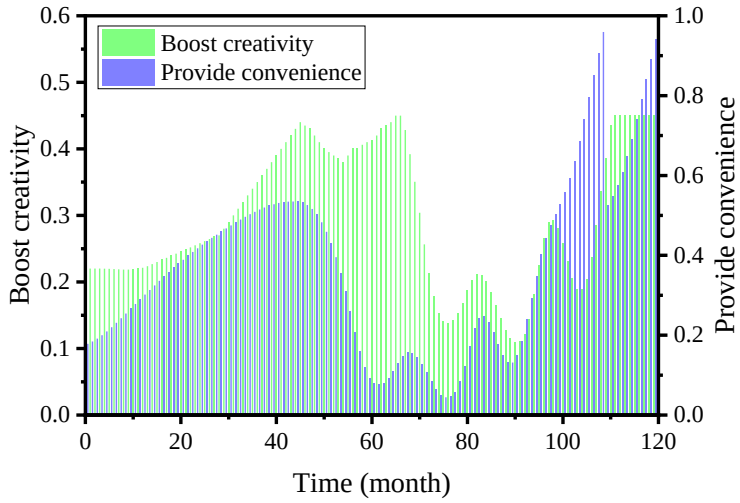

Figure 7: CAD Advantage Evaluation Chart.

The combination of remote video operation and online and offline teaching mode improves students' interest in learning and initiative to explore. This model fully integrates information technology and practical training teaching, and better implements future-oriented application-oriented and technology-skilled personnel training. In short, with the arrival of the era of big data and "Internet plus", coupled with the extensive application of the Internet and information technology, school teaching mode is quietly changing, and new teaching methods appear and are gradually widely used, which plays an important role in promoting the informatization of classroom teaching and improving the quality of teaching.

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