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DESIGNS AND APPLICATIONS OF COMPREHENSIVE PRACTICE COURSE TEACHING IN ELECTRICAL SPECIALTY

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ABSTRACT

the experimental course is an effective way to master and verify the theory for electrical engineering students. For electrical appliances professional teachers, how to design the experimental courses and guide students to learn through experiments is an important aspect of teaching work. In this paper, the course of the realization of the electrical professional students at home and abroad were analyzed. Based on the characteristics of the specialty courses, the teaching system of the comprehensive practice course of electrical specialty was realized, and the application of this design was tested in the case of the combination of theoretical knowledge, the design of the experimental teaching includes the curriculum arrangement, practice site design, practice equipment condition and many other aspects, the curriculum teaching design in this paper also takes the actual situations of the curriculum course content into account. The results show that the practical teaching designed in this paper can basically meet the practical content of electrical professional students, and the design of the electrical practice system can complete the students' practical requirements too.

1. INTRODUCTION

Practice is the sole criterion for testing truth. Students of electrical specialty need to learn a lot of theoretical knowledge. If they do not apply the theory to practice, the knowledge is difficult to produce. Practical training can not only strengthen the theoretical knowledge of students but also can find problems from practice to guide further study (Wu, et al. 2011) [1]. Wuxiao pointed out that at present the teaching goal of higher education mainly includes the student's experience and ability to understand the theory of knowledge and can produce understanding through practices, on the basis of the theory of operation ability and through the study of theory and practice and thus they learn to use this knowledge to solve practical problems, learning through the rigorous academic attitude. It can be seen that the practice in the realization of curriculum objectives is in great importance, if there is no practical course, a lot of teaching objectives are impossible to complete (Liu, et al. 2012) [2]. Liu Yang, who pointed out that the current college teaching contents should more focus on the theoretical knowledge and basic skills of learning, and the emphasis on the practice of students is put less attention personally. If we can combine theory with practice at the same time, through the practice of consolidation theory, it will be easy to strengthen students' understanding of knowledge (Zhang, et al. 2009) [3]. Zhangxinzhong who pointed out that we put the emphasis on basic knowledge and basic skills in learning, at the same time we should not ignore the cultivation of students' innovative and practical, so in the actual teaching process, in addition to the traditional teaching content arrangement, we should also have comprehensive teaching practice which has challenges (Yang, et al. 2010) [4]. Yangzong pointed out that for the arrangement of curriculum practice, we should pay attention to strengthen students' weak knowledge, which can link the actual learned knowledge through the practice teaching, in the process of mastering theory and skills, it is necessary to have a detailed understanding of the focus of current researches and the specific processes, and through the practice to cultivate the ability of thinking and to solve the corresponding problems in specific work by using the ability. The paper designs the corresponding practice teaching scheme which is for electrical professional courses of relay protection relay device core processing components of DSP and PLC control circuit programming on the analysis of current electrical majoring course arrangements, and from point to area it analyses and designs teaching designs of other courses in electrical engineering practice curriculum. For the DSP and PLC course contents of the experimental teaching design, this paper emphasizes the study and design of the overall objectives of this course, under the premise of mastering the theoretical knowledge and basic operation skills, we let students choose the original operation specifications and consolidate the knowledge and find the problem finally through the experiment.

2. STATE OF THE ART

2.1 Electrical specialty course design and Current situation of Practice Course

Electrical professional course consists of two parts: basic courses and professional courses of Electronic Information College, table 1 is the electrical engineering curriculum of a college, the numbers are pre-professional courses, courses with A is electrical power system and courses with B is electrical building professions, those are the different applications of electrical engineering specialty. What we can see from table 1 is that courses of electrical specialty is highly practical, and the course of the electrical specialty has great practical connection. Arranging the practical lessons of verification can help students to understand and grasp the theoretical knowledge, they also can use the theoretical knowledge and basic operation skills to solve practical problems. In this course, the practice of electrical control technology arrangements is about 8 hours, there is another choice to do the experiment, and these experiments are strong-operational comprehensive experiment (Zhang, et al. 2013) [5]. Zhang Xinyue pointed out through the investigation that students believe that these comprehensive experiments change the inherent acceptance and understanding of the concept of knowledge, and a more effective way can be used to carry out the study of the content of the curriculum. After learning theory, it can effectively exercise the students' creative thinking and comprehensive thinking through the corresponding supporting experimental class exercises (Sun, et al. 2010) [6]. Sun Yang who argues that we should not merely care results and ignore the process and change experiment mode of single results for practice courses of college students, so students should learn through practice rather than receive knowledge passively and simply from the teacher.

Table.1 Electrical professional curriculum

Serial number	Name	Class hours	Teach	Experiment
01	Electromechanics	68	60	8
02	Power eletronics	68	60	8
03	PLC technology	80	68	12
04	Eletric control technology	80	70	10
A1	Computer technology	46	40	6
A2	Motion control	46	40	6
A3	Eleteic engineering	60	42	8
B1	architecture electric	60	42	8
B2	The power and lighting	46	40	6

A comprehensive practical course can make students develop the ability to make use of the existing knowledge to carry out the problem inquiry and do self-study, and it also can cultivate students' ability to operate independently. The process requires students to design experiments, select experimental equipment, arrange the experimental steps, solve the problems, make analysis of the experimental results, and make experimental reports from experimental results, this process on the cultivation of students' ability is not limited with one aspect, it involves the theory and skills, self-learning and so many aspects of the ability to exercise. If the experiment is carried out in the form of a team, it will also be good to train team cooperation ability of students.

2.2 Content of DSP experiment course

DSP is the core component of the micro relay, and the related digital signal processing technology is an important course in electrical engineering. This course mainly explains how to change things into digital signals, and how to extract useful information from the use of mathematical algorithms and then apply it to the actual problem of electronic processing (Liu, et al. 2012) [7]. This course need to rely on the experimental course of the auxiliary teaching in a large extent, which makes the abstract theoretical knowledge become easier to understand and master. Figure 1 is the structure of the experimental system of the DSP curriculum, which requires students to input current and voltage signals at the beginning of the experiment. The converter voltage range of DSP internal components is 0 ~ 3V, which requires students must alternate current through signal processing in the input current and voltage and change value that DSP converter can accept. Students need by their own design and modulate circuit to complete this requirement (Fig.1). The system consists of the five parts, various parts of the work from left to right were acquisition circuit, digital signal processing, using the mathematics algorithm to process DSP circuit, establishing output, and displaying the DSP circuit information through the liquid crystal. If a failure occurs, it will show the fault information.

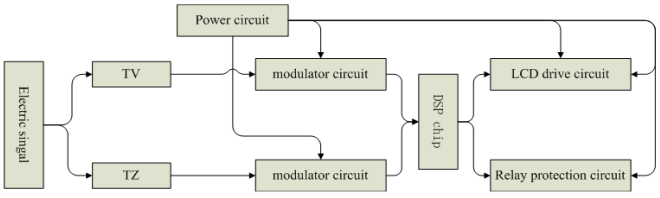

Fig.1. System block diagram experiment requirement

2.3 Content of PLC experiment course

PLC is a programmable logic controller, which embeds machine program, makes logic operation, controls machine sequence, makes timing, and gets computer arithmetic instruction, and it makes input or output operations through digital and electronic operation (Zhang, et al. 2009) [8]. In 1970s, the first programmable controller was developed and was applied to the actual production through the corresponding test. With the development of computer technology and electronic and electrical technology, the programmable logic controller has been developed from the simple logic operation to the digital signal and electronic information processing, and its application scenarios are constantly expanding. Because the external structure of PLC processor is simple and the internal procedures can be variable and easy to expand, students in learning this piece of knowledge, if not matching the corresponding practical courses, it is difficult to understand the characteristics and applications of PLC for students (Yang, et al. 2013) [9]. Figure 2 is the system experiment content of PLC course contents, this system can realize the understanding of PLC programming controller system (Fig.2), and enable students to understand the control circuit that is often used in the PLC controller system. In the design of the corresponding experimental program, through the PLC controller it can complete the control operation of the motor circuit. In the electronic control input and output operations, we need to use inverter to deal with the voltage, current and electronic signals, and students are able to achieve the frequency control operation of the electronic control, which achieves integration of frequency converter and control of the machine and then feedback time information by the touch screen.

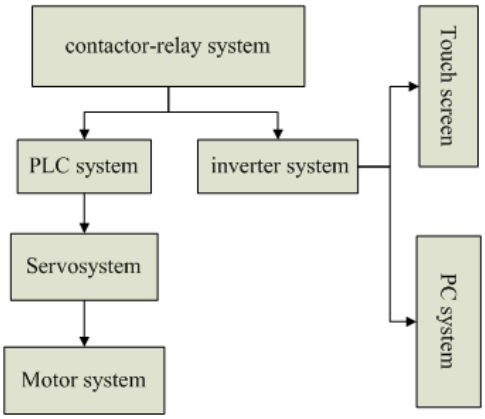

Fig.2. System block diagram experiment requirement

3. METHODOLOGY

3.1 Subject designs of practical teaching

Professional practice teaching of Electrical specialty allows students to understand the basic knowledge of the premise and enables students to master the skills and professional thinking through practical lessons (Qian, et al. 2010) [10]. Only the practical curriculum arrangement is reasonable, can students do hands-on operations by using the contents of the design course and get the experimental data and come to the conclusion. Because electrical and electric course are rigorous subjects, so in the experiment it not only requires the rationality of the experimental curriculum but also requires the safety and scientific of the self- design experimental process.

Practical teaching arrangements should first understand the teaching goal and change the concept from theory to application (Yang, et al. 2006) [11]. Table 2 is an experimental time schedule of a college, from which we can see the teaching tasks and objectives of the arrangement, and the proportion of different tasks reflects the focus of the profession. In the practice of electrical specialty curriculum arrangements, we need to understand the teaching objectives and choose appropriate teaching methods and teaching design system according to the different courses. In the process of teaching, we can achieve teaching goals by explaining while doing demonstration, and finally we can let the students operate personally to consolidate the contents of the study and the basic experimental principles.

Table.2 The teaching task and requirements

Task	eligibility requirements	Time
hardware circuit design	Write circuit transfer function	9
Debugging of hardware circuit	The output dc communication	10
software programming	Perform the function of the corresponding	11
system debugging	procinfo	12

Doing experiments can establish students' understanding of the reality and the expansion of the field of vision. Electrical major is the subject that is applied to the specific operation, if there is no light on the theoretical analysis of the actual problem solving ability, it cannot be counted as the

completion of teaching objectives. Practice course aims to let students into the laboratory and understand the specific use of related equipment, in operation they can master practical skills, have personal contacts and learn broadening their horizons through the practice courses.

3.2 Design of DSP practical teaching system

The design of DSP practice course should be based on the hardware and software of DSP controller. The design and debugging of DSP hardware system first need to input current and voltage, and through the acquisition circuit and transferring function, the theoretical analysis of the input is able to meet the requirements of the scope of the converter (Gao, et al. 2012) [12]. Then the students choose the experimental equipment including the circuit boards, electronic components and experimental tools, and then test the operation of the circuit to see if there will be a short circuit phenomenon. After the test, the corresponding electronic components are welded to the circuit board according to the design requirements, and the power supply is switched on to test circuit board is suitable for the power supply or not. Testing the whole system to see if it meets the requirements of the modulation signals and then do the trip tests to observe whether the relay can be a reliable relay trip (Li, et al. 2013) [13]. Observing the experimental results and asking the teachers to instruct to verify the whole system is in line with the requirements. The software mainly points for the trip system and feedback system, trip system is completed through the relay protector, which is embedded into the corresponding software to make function expansion in the relay, it is processing and computing the program based on the algorithm of logic. Feedback system is realized based on the liquid crystal display technology, if we want to achieve the liquid crystal display, first of all we need to solve the problem of display loading, which requires students to select loading system according to the test requirements. This program mainly includes driver, font design and configuration of the display, the executive function, and the feedback of operations of the whole system. The practice of software is designed to train logical thinking ability of students, and in the process of participating to understand the implementation process of the process, and through the combination of software and hardware to train students to coordinate the ability to solve problems. In Figure 3, the electrical professional students are doing curriculum content practice under the guidance of teachers (Fig.3).

Fig.3. Electrical major students' practice

When the experiment was finished, the students wrote the experiment reports according to the experimental results. Students described the experimental designs and the principles of the circuit, then they wrote the corresponding functions and obtained experimental results under the premise of the detailed analysis of the curriculum, combining with the principles of theory system and the corresponding framework of design system.

3.3 Design of electrical control system

Technology advances, so that we can further design and transform electric, and it can be efficient to meet the actual production needs. The primary goal of electrical control system design is to construct the corresponding drawings and data according to the requirements, in the premise of verifying rationality and enforceability it realizes the control device according to the drawings and data, which manufactures the system met the design of nest test (Xie, et al. 2011) [14]. The whole experiment should be a process of manufacture, debugging and maintenance. The design of electrical control system is based on the selection and application of the corresponding traditional systems and programs, this design is not a fixed method or mode, the design of the system to complete the same implementation may be different. For the basic principles of design, under the understanding of the basic performance of the equipment, combine with the characteristics of the equipment to design programs, and then do tests according to the experimental requirements. On the premise of meeting the production requirements, the design of the control circuit is as simple and practical as possible and is in line with the current mainstream design and design standards. Taking the cost into account, in the completion of the same goal with different design options, we first choose the one whose numbers of experimental components of the program are less, and the selected type of components should be the standard parts. We need to reduce the power supply of control circuit, we also should control the length and number of wires, and simplify the circuit control process and reduce the failure rates from the theory to improve the reliability of the circuit. The hardware condition of a system is an important condition for the system to operate normally, and the selection of components should be reliable and have anti-interference ability, which ensures the safety of the control circuit (Liu, ret al. 2007) [15].

4. RESULT ANALYSIS AND DISCUSSION

Students' acceptance of the results of the experiment is divided into four stages: the acceptance of hardware, the acceptance of the software, the acceptance of the whole system and the acceptance of the report of the experiment. For example, the DSP curriculum practice courses get the results as shown in Figure 4, the software part of the test is qualified (Fig.4)

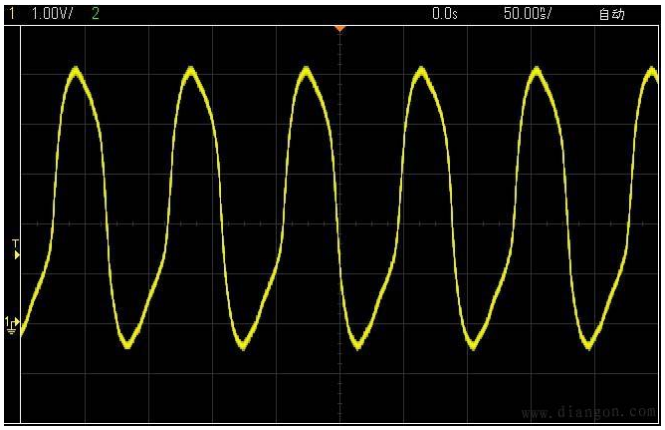

Fig.4. Software testing results

The acceptance of the hardware part is mainly tested through the experiment of the waveform to determine the operation of the circuit is in line with the requirements of the sinusoidal AC waveform, which is mainly used to indicate the overall state of the circuit. The qualified standard of the software part is to display the current on the liquid crystal display. Voltage, waveform and other parameters. After the system is running, the system is able to display the overall operation of the circuit. Experimental report is mainly to see whether the report clearly shows the experimental process, and there is no binding theory and rigorous analysis of the design of the whole system and related reasoning is tight, and last we can get the conclusion based on the experimental phenomena.

5. CONCLUSION

Practical teaching can clearly demonstrate the complex theoretical knowledge, through the practice students can not only learn and test the relevant knowledge but also cultivate the ability to solve the problem of multi. This article from the specific electrical professional practice courses makes extension and analysis of the electrical professional practice teaching design through the specific curriculum designs and discussions. Through the experiment, students are able to preliminary master DSP and PLC and other professional courses related to the basic experimental process and methods, which cultivates students' independent thinking ability and creative thinking ability, and in the after part it gives the acceptance criteria for the related experimental results. Through the acceptance of the students' experiments, problems can be found from it and we can not only give correct advice but also cultivate the ability to solve problems of students. For the same goal of electrical specialty, you can use different design schemes, this paper also gets the specific principles and methods on electing schemes through the analysis, students can design arrangement of scheme and make further expansion according to the standard. But this paper deals with the experimental content is just a small part of the whole electrical profession, and some method is not fully applicable arrangement to other

practical teaching designs, although the main ideas are the same, in the specific application it is still need to be adjusted according to the actual situation.

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