

The Research and Discussion of Teaching Mode of “MCU and PLC”

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Abstract— “MCU and PLC” is an important innovative professional basic courses set by automation professional of my school, the course covers a wide range of subject, strong in comprehensive and practicality, teaching difficult. In order to improve the teaching quality of the course, culture the independent thinking and innovation ability of students, we use three-dimensional teaching model, optimize the class, after-school and experimental to build a complete teaching platform; significantly improve students’ disquisitive and practical ability. This paper provides some experience for improving the quality of teaching, to meet the need for personnel training.

Keywords- MCU; three-dimensional teaching model; teaching quality; teaching method

The principles and application of MCU and programmable logic controllers are two professional basic course of automation professional. MCU is an embedded computer integrated most of the computer module, theoretically based on Microcomputer Principle; programmable logic controller is a digital computing operating system designed for industrial environment applications, theoretically based on Digital Circuit. There are both difference and considerable overlaps between these two specialized courses at the covering of point of knowledge. To enhance students' ability of exert automation expertise neatly and expand students' knowledge, we combined these two professional courses as a professional basic courses from 2008. Through learning this curriculum, students will master the architecture, the command system, external interface technologies and the basic design of systems of MCU and PLC, and lay a solid foundation for further learning of other professional courses of measurement and control.

As an innovative professional basic course of automation, “MCU and PLC” course covers a wide range of subject, strong in comprehensive and practicality. The teaching of this course would both train the students a broad theoretical basis, and develop independent thinking and problem-solving ability, to lay a solid foundation for future works of measurement and automatic control in industrial fields. How to improve the quality of teaching, to develop students' independent thinking and innovation capability, has become the urgent problem of the course teaching. This paper conducted in-depth discussion from the set up and organization of the teaching mode, teaching content, teaching methods, and experimental of the courses. This paper will provide experience for improving the quality of teaching, and to meet the need for personnel training.

I. THE RESEARCH OF TEACHING MODE OF “MCU AND PLC”

Teaching model is the teaching activities structure which selected in accordance with the teaching practice by teachers under the guidance of teaching philosophy to achieve teaching objectives. The mode of teaching is the combination of teaching content, teachers, students, teaching resources, is integrated support environment constituted by instructors, learners, learning content, information resources, and reflected stable program of teaching and learning activities. “MCU and PLC” is an innovative professional foundation courses covers a wide range of subject, strong in comprehensive and practicality. On one hand, the theoretical basis of the course is clear, the theoretical basis of MCU is Microcomputer Principle, the main knowledge points include: the number system and code system, assembly language, the principle of data storage and information exchange, the work principle of counter, display, and keyboard, the theoretical basis of PLC is digital circuits, the main knowledge points include: ladder, combinational and sequential logic control, counter; the other hand, the knowledge of the course apply widely, develop apace, not only has a large range of types and models, rapidly changing, but also application increasingly wide range, new knowledge and new technologies continue to emerge, but teaching time in class and resources are limited, how to solve the conflict between teaching plan and development of students' interest; how to solve students difficult in independent innovation, too few do-it-yourself opportunities in experimental teaching; how to ease the contradiction lead by teaching resource constraints and technology is developing rapidly to backwardness and lack of teaching content, has become the problems to be solved of the research and exploration of “MCU and PLC” teaching mode. In order to solve these problems, we should innovate the classroom teaching mode, breaking the teacher-centered, uniform standards Tim duck-teaching model, establish a three-dimensional teaching model which is student-centered, in line with the syllabus requirements, respect for individual differences, encourage self-learning, independent thinking. This three-dimensional teaching model should contain three main components: inspiring Classroom Teaching, researching extracurricular self-study, experimental teaching links theory with actual. Three teaching focus difference, the Classroom Teaching focuses on explain basis theory, not only "full" and "transparent", but also stimulate students' interest in scientific research;

extracurricular self-study focused on the students' interest to guide students in the free academic atmosphere, full use of electronic resources of the school, in order to compensate for the limitations of the teaching resources; experiment Teaching focused on students hands-on ability, introduce the independent design experiments to guide students' independent innovation combined with theory and practice in the basic experimental teaching.

II. OPTIMIZATION OF TEACHING

The three-dimensional teaching model is a combination of classroom, after-school and experimental. How to optimize these is the key issue to achieve the three-dimensional teaching mode.

A. Optimization of Classroom Teaching

Classroom Teaching is the core of the three-dimensional teaching mode. In Classroom Teaching, we should not only complete the requirements of the curriculum, but stimulate the enthusiasm of students to learn at the same time. The famous educator Socrates once said, "The most effective approach to education is not to tell people the answer, but to ask them questions. Education is not indoctrination, but the lighting of the flame." In order to stimulate students' interest in the classroom teaching, we concerned about students' participation and experience of teaching activities, using a large number of heuristic-based teaching methods, guide students' interest and questions in scientific issues step-by-step. For example, in the explanation of the principles of the A / D, we compare the common weighing process with A / D conversion process, guiding students the basic steps of the A / D: quantization, encoding. We compare the principle of balance weighing with hourglass timing, guiding students understand the structure, principles, advantages and disadvantages of the step A / D and integrating A / D.

In teaching activities, we fully exert the role of the curriculum group, help and learn from each other, sharing resources, and enrich the teaching content through multimedia courseware and other means of information.

B. well-designed research project to stimulate the interest of students in after-school learning

After-school learning is an important part of the three-dimensional teaching model. Famous ancient Chinese educator Confucius once said: " Without learn how could I make a difference? Without thinking how could I harvest it?" UNESCO said in report "Learning to Live --- today and tomorrow of the world of education" that "Today, we focus on the principles of self-learning of the process of education and learning, rather than on the traditional pedagogy of teaching principles". As a teaching mode fully exerts the role of the student, self-learning mode should get adequate attention. "MCU and PLC" has extensive and deep knowledge, new knowledge and new technologies continue to emerge. How to extend the traditional classroom to extracurricular to solve the contradiction between wide and deep in student learning is the main problem. In the teaching practice, according to the needs of the teaching content, refer to the questions in National Undergraduate Electronic

Design Contest, we carefully designed research projects, and improve the evaluate criterion of the course, organize expand learning after school, guide students make full use of the teaching resources, improve the quality of teaching in the free academic atmosphere via cooperation, mutual assistance and take full advantage of the school's electronic resources. For example: the electronic alarm clock, calculator, keyboard, simple waveform generator, frequency meter, thermometer, automatic titration device and so on. This can be used as the subject of self-study. Through these studies, students can master the display, keyboard, interrupt, timing and other aspects of knowledge, and at the same time they can also learn the knowledge of the system design.

C. improve the experimental teaching, increase students' ability of theory contact practice

The experimental teaching is an important part of the three-dimensional teaching mode. By experimental teaching, students can improve their theory contact practice ability; on the other hand can also check the results of the teaching. Because the less class and limited experimental conditions of experiment teaching, many teachers worry that students do not have the ability to complete independently, they often prepare a comprehensive experimental project, even experimental program, which is neither conducive to the students' hands-on ability, nor conducive to enhance students' interest in experimental teaching. In the teaching practice, we adhere to the combination of experimental teaching and after-school study subjects, introduce self-designed experiments in the basic experimental teaching, only released the experimental conditions, the purpose of the experiment and the experiment content, rather than publish the experimental project, and abolition of the traditional standardized experimental teaching mode in independent experiments, comprehensive judgment based on the experimental difficulty and achievements. In independent design experiments, the students think independently, explore freely as a group, to stimulate students' enthusiasm for learning, and develop their sense of innovation and practical ability. For example, in the current MCU experiments, we used 4 +1 experimental program, which means each group can select four basic experiments from the seven basic experiments and completed a self-designed experiment. Independent design experiments can be selected from the given six experiments or custom. Through this arrangement, we not only ensure the teaching plan of arrangement, but also to meet the needs of students' interest in self-development.

III. TEACHING PLATFORM

MCU and PLC technology develop rapidly; we should update teaching content constantly. Through accumulate teaching practice and reference excellent teaching materials at home and abroad, curriculum group prepare and published two textbooks for teaching, each include multimedia learning courseware, comprehensive tutorial electronic lesson plans, and some other electronic information, especially the textbook "MCU theory and application system" published by Electronic Industry Publishing was welcomed by the

numbers of university, such as Shandong University, UESTC and other as textbook, multiple printing and issue over ten thousand. To improve the experimental teaching links, we must improve the experimental platform construction. Course group has homemade MCU-based experimental platform, and write the experimental teaching textbook "51 micro-computer and its applications", perfected the PLC basic experiment platform, and write the teaching textbook "modern control technology PLC experimental". Continue to combine the needs of the construction of teaching textbook, the test platform construction and teaching practice. In addition, due to the content of MCU and PLC courses significant increase relative to the previous courses, the doubt of students also an increase significantly, how to answer questions from students as soon as possible while fully mobilize the students' self-learning enthusiasm is a problem curriculum group must face. The curriculum group mainly used method of web answer, let students discuss after question, then comment by the teacher, and concluded as electronic documentation at last, so that not only satisfy the self-learning, answer and needs of cooperation and mutual assistance between peer; but meet the demand of communion in teachers and students, the Q & A is no longer limited by time and space; nor result in a substantial increase in the extracurricular workload of teachers.

IV. IMPROVE AND PERFECT OF ASSESSMENT METHODS

MCU and PLC courses both culture students' broad theoretical foundation and independent thinking and problem-solving ability in practice, so from 2010, we reform the evaluation of "MCU and PLC", usual results accounted for 10%, experimental results accounted for 15%, 15% of the after-school grades, final written test accounted for 60%, evaluate students' learning comprehensively. Usual results can be evaluate from classroom attendance, classroom discipline, usually jobs and other assessment; afterschool results mainly evaluate from the use of network answering and course design; experimental results mainly evaluate from the completion of the basic experiment and independent experiments; final written test assess students on the basis of knowledge. Through reform, the student evaluation system is more perfect, so as to further promote the students' enthusiasm of self-learning and theory contact practice.

V. TEACHING EFFECTIVENESS

Through the construction of three-dimensional teaching model, we make full use of the resources, research topics closely follow the development of Electronic Science and Technology, reform experiment and teaching, combine

classroom teaching with experiment teaching and after-school self-link closely, gradually strengthen the two main role of teaching activities, guide students active participation in teaching activities, continue to introduce the latest achievements of the electronic technology in teaching practice and improve the quality of personnel training.

"MCU and PLC" using a three-dimensional teaching model, substantially increase in the research and practical ability of students, lay the foundation for students to further participate in the multi-level scientific and technological innovational activities. According to the statistics of past two years, more than 85% of the students participate in the electronic design competition and achieved outstanding results, attend this course. Each year student organized 5-8 research teams, complete 3-5 high quality study report, one of them is applying for national invention patent.

The three-dimensional teaching model substantially increased the enthusiasm of the students of the teaching activities and the satisfaction of teaching. According to the statistics of the past two years, every year 5-8 students participate in the construction of the experimental platform, the teaching satisfaction substantial increase, teaching evaluating grade point average of 90 or more points. In addition, the curriculum group guidance undergraduates participate in 3 national scientific and technological innovation projects, guide three teams of students participate in the "GE Intelligent Platform 2010 Automation Control Design Competition".

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