

The New Ideas' Exploration in "The Principle and Application of PLC" Cultivation of Innovative Talents in Information Fields

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Abstract. According to the characteristics of strong theoretical, abstract concepts and fast technological update in the course "The Principle and Application of PLC", a series of exploration measures are improved in the content of classroom teaching, experimental training teaching, school-enterprise cooperation, school-enterprise training, and so on. They can improve students' interests in learning, bring up the scientific thinking and creative abilities, so that improve their overall qualities.

Introduction

Programmable Logic Controller (referred to as PLC) is the most commonly used industrial control device. In 1987, the International Electrotechnical Commission (IEC) gives the definition of programmable logic controller: It is a digital computing operation of electronic systems designed for the applications of industrial environment. A programmable memory is used in its internal memory to perform logical, sequential control, timing, counting and arithmetic operations etc. many operating instructions, and through digital, analog input and output, which controls various mechanical or production process. Currently, PLC has been widely used in various production machinery and automatic control of the production process which has become one of the most important, popular and widely applications of industrial control devices. It is recognized as one of the three pillars of modern industrial automation (PLC, Robotics and CAD/CAM). Along with the rapid development of PLC technology at home and abroad, many fields needs professions in this area increasing with years [1,2].

But the teaching process in recent years, it has actually become a key of how to make students not only to appreciate the fun in the boring ladder, but also to apply these theories to the actual production [3-5], which can enhance the quality of teaching in PLC theory and application, foster the skills of students. Through the reform of teaching content, teaching methods, it has obtained good teaching effect.

Adjusting the term and increasing the experimental hours, enhancing the interaction and realizing the students' collaborative learning

Full papers must be typed in English. This instruction page is an example of the format and font sizes to be used. Principle and application of PLC was offered at senior last semester in the past, students had to face the contradiction in the two-way choice of employment and preparing for the postgraduate exam. They couldn't pay attention to learn this course. So adjust the course to the junior next semester, this semester has relatively abundant time, thought is more concentrated. And experimental hours adjust from 8 to 16 hours. Which requires that partial content less associated with other sections reduces requirements, some theoretical strongly one not only wastes more and more time but also require students to prepare on the basis and as an emphasis in experimental sessions. Students realize self-understanding in the experience and practice, reconstruct one's own experiences in introspection, and then shape their strategies and modes of action. The new course characteristics can be summed up as "highlighting the process, experience and exploration". Core of

the most fundamental issue is to bring students' initiative to enable students to participate in the process. This regards the questions as clues, sets innovative experiment situation. Innovation education enters into the classroom, experiment must be done to "problem" as the main line, should be good at creating question situation in experiment teaching. Experiment teaching process should continue to recognize the problems and solve the problem in thought process, should take the problems as the main line to organize and regulate the experiment of teaching. The teaching approach should be turned teaching to mainly co-operation, created teaching situation to promote students' learning, students' autonomous learning, cooperative learning, inquiry learning as the main form. Let students participate in learning activities, experience the process of scientific research.

Perfecting the course syllabus, enhancing teachers' ability, achieving students' interactive learning

On the teaching of the principles and application of PLC, firstly teachers should penetrate into the enterprise to understand the one's development in PLC technology and its demands on PLC technology professionals. According to the investigation of above, we work out course syllabus suitable for this major. Secondly it is necessary to improve teachers' competence and performance. University takes positive actions to create conditions for the teachers to solve actual topic, increase practical knowledge to improve the ability to solve practical problems. This can transform static knowledge in the book into dynamic teaching information in the classroom and try to create an interactive teaching environment and atmosphere in the process of teaching by many ways. An interactive study can be achieved through the creation of a situation, setting up questions cleverly, discussions together, practice with your own hands and a variety of teaching methods. First of all, interactive learning arouses the enthusiasm of the students to participate in teaching. The traditional teaching mode of teachers focused only on "teaching", ignored the students' "learning". And interactive teaching pays attention to the students' principal status enable students to participate in teaching, thus arouse students' interest in learning, try to arouse all the students' enthusiasm, initiative. Second, interactive learning based on reality gives students' guidance in a timely manner in order to enhance their ability to distinguish between good and bad at the same time enhance their skills in observations issue, analysis and problem-solving. Traditional teaching mode detached from reality so that students felt this stuff is too far to be the reality and learning was useless, caused the students' learning interest to decline. Again, the interactive learning focuses on students' personality, forms a good atmosphere of communication, optimize the classroom teaching effect. Interactive teaching emphasizes teaching visualization, vitality and creates an interactive space for students. Finally, the interactive teaching pays attention to construct a harmonious educational environment. Traditional teaching only lives vicariously through your students, but the interaction is neglected in the student groups. The interactive teaching's pursuits are the joint participation, thinking together, cooperation and problem-solving.

Building the lab with the domestic well-known configuration software company, increasing the school-enterprise cooperation, realizing students' project-based learning

For a long time, as our country's higher education has given weight to theory and despises practice, and the universities of science and engineering are to cultivate academic and engineering talents, so academic engineering talents and technical talents begin to fault. Recently the society is in urgent need of a large number of the technical talents who can transform scientific and technological achievements into material products and practical production service. At the beginning of 2008, under the coordination of the Scientific Technology Research Department of NorthEast Petroleum University, automation laboratory and Real Bridge software technology limited company reached and signed a protocol about the construction of PLC principle and application laboratory. Real Bridge software technology limited company plays advantages in its "real-time database system" and "monitor configuration software". Combining the company's examples in the national "Nine Five" project, the national "863" plan, the CIMS demonstration

project, the students can take the project as the breakthrough point, change writing application pattern in the traditional teaching only for ladder diagram, and increase graphic user interface applications in the configuration software. Not only can they deepen the understanding of ladder diagram, but also realize the configuration process, it is more important to understand the practical application process that how to select input and output control point and how to achieve the action of PLC control. Each student has been the project team member, which maximizes their own subjective initiative. It's convenient for students to understand and master the professional skills and practical programming, truly reach the ideal teaching mode integrating theory with practice.

Practice has proved that the combination of teaching and production, the mutual penetration, bidirectional intervention, complementary advantages, resource sharing, and mutual benefits in school-enterprise are important ways that realize higher education and the modernization of enterprise management, promote the development of productivity, accelerate its own talent education in an enterprise, make education and production be in sustainable development. They are the beneficial practices and important initiatives to revitalize the nation through science and education, the strategy of talent powerful nation and promote the construction of harmonious society. From the university perspective, we hope to take Industry-Academia-Research cooperation relationship as ties, further strengthen the cooperation with enterprises, achieve a breakthrough and realize schools and employers' win-win cooperation".

Combining with the actual device or module, perfecting course training, achieving students' operational learning

The most important feature of The Principle and Application of PLC is "general application", because a practical industrial automation control system is often very complex, which may include machinery, electricity, liquid, gas and other content, and as the different industry, control requirements are different. Therefore, in the course of training we should take the organic combination of mechanical, electrical, electronic, hydraulic, pneumatic devices, computer knowledge and PLC technology. Gradually add the related equipment, such as a stepper motor control module, fountain simulation system module and automatic washing tank model system and so on. Then use PLC technology to achieve the relevant control system and establish a relatively complete PLC simulation training room. A good condition is created for "PLC simulation project" practice teaching. The practice teaching proves that, only through PLC simulation project of training, students can program, link the wires, simulate, debug of their own, and analyze the problems of the operation process, we can cultivate students creative thinking and comprehensive occupation ability, realize the ultimate goal of "zero distance employment" in the PLC technology applications field after graduation.

Practice teaching also teaches students in accordance with their aptitude, takes the stratified teaching which differs from one to the others. That is to be groups according to the students' learning ability, identifying each group's different training goal so that the good and poor students, in practice, can achieve the corresponding exercise and training. A certain amount of elective training projects and research topics are arranged besides the basic training projects within the prescribed time. We should let the students to choose these; the teacher should guide on-site, or supervise without guiding. This can urge the student independently to analyze problems in the experiment and practice, send a training report to teacher; teacher and student try to find a solution to the problem together. For large training projects, such as elevator, manipulator, we can also take the division teaching form, put the class into groups, tasks and goals of each group in practice are made clear by teachers, so as to cultivate the students' operational and occupational quality and ability of "actual combat".

Cooperating with the petroleum and petrochemical enterprises, improving the training mechanism, achieving students' extrapolation learning

Northeast Petroleum University is located in Daqing, this is a geographical advantages. Many

control systems in the petroleum and petrochemical enterprises in Daqing are the use of PLC control in the lower machine. In order to adapt to market changes and enhance competitive advantage, every year these enterprises organize operational ability and technical contest training of the staff, but these enterprises do not have the special sites and systematic technology guidance personnel. Make use of this opportunity, we should use teaching and the teachers resources in the laboratory of "The Principle and Application of PLC" to have a training for the employees of these enterprises. During the training, the laboratory is open all days, trainers can operate with their own hands, and students can also have profound communication with the frontline staff in the laboratory. Students can understand the importance of the PLC control, and experience practical PLC application in the communication. A intangible thrust makes students be aware of that learning this course great is not only the problem that how many scores they can get, but also a kind of "visible" and "touched" technology.

In addition, Students understand the production technology, management concept and management system of the cooperation partners through a period of professional training and theoretical study. All these students will be the one of the enterprise workers, which can effectively enhance coordination employment consciousness and social adaptation ability, make students be the qualified professional person. University can use the investment of enterprise training and technical guidance to reduce education cost; Students can contact production process in advance sooner and better and change the role from the student to the worker. This meets the demand of enterprise's growing labor and achieves a win-win situation.

Conclusion

All these measures prove that this teaching mode is feasible, it makes students from a passive, closed state to an active, open state, and the students truly become the masters of learning and the subject of teaching. Reflected in the overall teaching, the students' practical skills are increased. It is more valuable that a number of experimental schemes are proposed by the students in the experiment, which shows their consciousness of innovation and creativity. The students' employability and competitiveness are enhanced; many good students who fit with the needs of society are cultivated.

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References

- [1] Wang Yanfang. "Discussion of teaching mode in 'PLC Principle and Application'". China Power Education, 2011(10), 65-67.
- [2] Huang Shuiqiu, Zhu Huanqiu, Yang Dong. "Exploring PLC Principle and application of new ideas for curriculum development, and strive to build quality programs". Electrical & Electronic Education, 2006 28(2), 19-21.
- [3] Wu Zhongjun, Xiang Qianwen, Ji Jinghua, Yang Dong. "The use of modern educational technology to deepen teaching reform in PLC". Jiangsu University (Higher Education Research Edition), 2006 28(1), 89-92.
- [4] Zhang Jie, Zhang Zhongyan, Niu Xiao. "Open experimental teaching model" .Laboratory Research and Exploration, 2008 27(9), 136-137.
- [5] WANG Lizhong; ZHANG Weiliang; WANG Guangde. "On the Innovative Teaching Method in the PLC Courses under the New Situation". Journal of Changchun Normal University, 2011 30(5), 75-78.