

Research on Practice and Theoretical Teaching's Harmonization of "Electrician and Electronic Technology"

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Abstract. Strong practicality is one of the main characteristics of "electrician and electronic technology" and other engineering courses. But many colleges and universities also present completely separate theoretical teaching and practice teaching, which is unscientific and irrational. In order to solve this problem and cultivate students' engineering capability and innovation ability, a thinking of adjustment and reformation for "Electrician and Electronic Technology" is proposed, which is focused on the harmonization of theoretical and practice teaching. It is discussed deeply on several aspects, such as staff building, management reform, structure and content's adjusting, methods reform, especially in practice teaching. All of the measures are benefit for not only students' coordinated development of knowledge, abilities and qualities, but also the cultivation of practical ability and innovative spirit. Therefore the quality of teaching would be improved.

1. Introduction

The main role and task of the institutions of higher learning courses in the engineering is: to make the students get the necessary basic theory, basic knowledge and basic skills through the study. It is very important for the cultivation of students' project practice ability and innovation ability[1] [2].

Recently, Chinese government took improving the quality of education as the theme in 13th five-year plan of education, and came up with the idea of promoting the teaching level and university innovation personnel training ability. It put forward higher requirements in various kinds of engineering course in colleges and universities teaching. Therefore, how to further stimulate students' active learning to think under the new situation, and improve the students' ability and quality, is a question that each teacher in university must ponder.

2. Problems Caused by the Separation of Practice and Theoretical Teaching

Paying attention to practice has always been one of the most important aspects of the practical engineering course construction. Whether practical courses offer independent class, in general, theoretical teaching shall be the responsibility of the teaching and research section, while practice teaching shall be the responsibility of the laboratory. For each system, they belong to different department management and borne by different teachers. This leads to the result of separation of practice teaching and theories teaching and bring a series of problems [3].

First of all, the coordination on the teaching management is poor. Because both are not unified management, it is possible to cause that the theoretical part and practical part of the course content and schedule not consistent. Such as haven't talked about in theory course, some knowledge is required use for students in the experimental process; the teaching effect certainly is discounted.

Secondly, some engineering courses have heavy teaching tasks each semester. The number of classes is more, while laboratory resources and professional teachers are limited. Sometimes a laboratory has to undertake multiple class teachers and teaching task, so the arrangement of the laboratory is very compact. It may occur that students haven't finished the experiment; the next class is blocked at the gate of the laboratory. Sometimes teachers only can end the teaching for the next one.

Also is for these reasons, the experiment teachers energy is limited. So the reform and updates of experiment content doesn't meet the requirements of teaching in a timely manner and the verification

experiment has a large proportion. Students just record the data step by step in accordance with the experiment instruction or teacher's instructions. The whole process lacks link of design by mind and hand, opportunity of the pioneering and innovative spirit is not much. Therefore students' active learning thought can't be really mobilized, even don't mention the training of their ability and quality.

Again, teachers and students in class don't have much contact to understand the extent of the students' master of knowledge in theoretical class. On the contrary, experiment class is processed in accordance with natural classes. Then teachers can understand each student's specific learning much effectively. Due to the same class, teacher of theory and practice is not the same person; if the two teachers' communication is poor then evaluating the same students will appear deviation.

Finally, the theory class teachers often ignore the importance of engineering application in the teaching. The engineering application and innovative ability training of students are also not the main line throughout the course of teaching process. This leads to that many students don't know theoretical knowledge in practice clearly and how to apply it. Then the purpose of developing the students' engineering practical ability and innovation ability runs in the opposite direction.

3. Adjustment and Reform of Teaching

To solve the problem caused by separation of theoretical and practice teaching, engineering courses can undertake reform and explore the various channels to cultivate students' project practice ability and innovation ability, comprehensively improve the quality of talent cultivation [4]. With the "electrical and electronic technology" as an example, this reform will be taken by the practice and theoretical teaching of harmonious and unified measures mainly reflects in the following respects.

3.1 Strengthening the Construction of Teaching Staff.

Our curriculum group has taken the team construction as a basic work issue for a long time. Fellow teachers communicate in a timely manner for all kinds of problems in the teaching process, and explore to find the way to solve them. At the same time, the curriculum group attaches great importance the cultivation of excellent young teachers with a doctorate that introduced in during recent years. At present, young teachers have become the backbone of the teaching theory and practice after a period of study and exercise. Cultivation of young teachers mainly include the following.

3.1.1 Promoting the Fine Tradition "Mentoring"

There have been old teacher curriculum group of "mentoring", youth teacher "compete, study and practice" tradition of excellence. The good old teachers are chosen as teaching assistants when young teachers join the group. Teaching assistants lead the young teachers comprehensively and systematically familiar with every link of teaching as soon as possible. The practice of these measures makes the young teachers teaching theory and practice of "both hands remain hard", avoids the disconnection between theory and practice teaching. The fact proves that this way of training plays an effective role in promoting the growth of new teachers.

3.1.2 Young Teachers Participate in Curriculum Research and Reform Organization

Organization of young teachers to participate in the course of teaching reform project development activities improves the young teachers' teaching ability and the capacity of teaching content such as teaching contents, teaching methods, teaching means, experiment teaching.

3.1.3 Encouraging Young Teachers to Continue to Study and Communicate

Two young teachers of our curriculum group improve the degree of education study for a doctorate under the policy guidance. And young teachers are chosen to study in domestic colleges and universities to view and participate in national excellent course training, advanced workshop, teaching competition. The purpose of these measures is to keep in touch with the domestic and foreign universities, learn from each other and communicate, update their concepts, expand the horizons.

3.2 Reform of Teaching Management.

Theoretical teaching and practice teaching of the course are unified by the course's teaching and research section management in order to solve the problem mentioned above. The teaching of theoretical and practice are responsible by the same teacher in each class. This method improved the

original teaching situation between practice and theory, and ensured the continuity of the teaching and the teaching quality. On the one hand, the teacher can be flexible and determine this course practice teaching schedule; on the other hand, the teacher explains content on their own in theory to guide students applied to the practice. This makes students much mastering of knowledge, strengthens the communication between teachers and students, which play a role for both in work and study.

3.3 Adjustment of Teaching Structure and Content.

The teaching content is selected according to different requirement of different majors. Therefore this course could be divided into several categories on the basis of majors [5]. Theoretical teaching course is further compression in order to strengthen the practicality and advancement of teaching content. At the same time as a percentage increase practice teaching. Trial of moving theory class to the laboratory may help students understand the knowledge and improve their practice ability.

3.4 Reform of Practice Teaching.

Practice teaching plays an important role in the cultivation of the students' engineering practice ability and innovation ability. The following is some measures.

3.4.1 The Reasonable Arrangement of Experimental Contents

Our curriculum group edited and published "electrical and electronic experimental course" [6].

①A part of must be done experiment projects are set up in the normal teaching section of the experiment in order to satisfy the basic teaching requirements. Then a part of the selected experiment project is set up at the same time from the perspective of expanding and improving students' ability. This is used to meet the needs of students interested in specialty and continue to develop, so as to promote the cultivation of innovative talents and growth.

②The same principle is followed in the design of a single experimental content of the project. We not only set up to do the basic experiment content, but also choose experiment content part for students to improve and expand.

③The students' independent study and development reflect more fully in the comprehensive application and a higher level of activity in the project of science and technology. Students can customize the experiment project, complete the form and don't do the unity of the rigid requirements. The scope for research and innovation is more. Level of performance is shown in fig. 1.

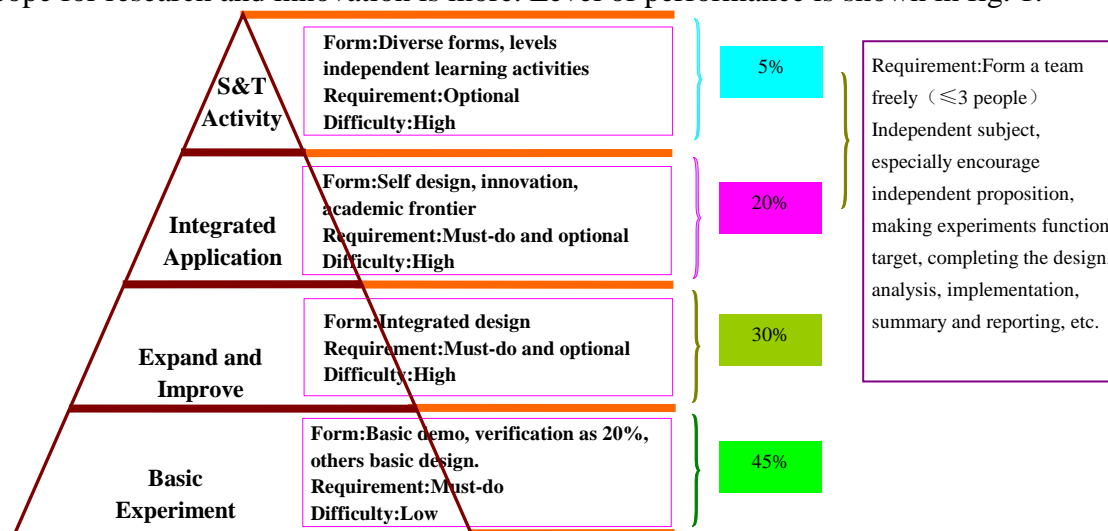


Fig. 1 Experiment level performance figure

3.4.2 The introduction of the EDA technology

Harmonious and unified of teaching practice and theory not only reflects in that the classroom can be moved to the laboratory, but also in that the theory class using EDA technology can be more intuitive to let the students observe the actual application of knowledge. The introduction of the EDA technology to expand the depth and breadth of the experiment and it has provided a broad space to the students to improve the students' innovation ability. This kind of teaching method has played a good

role in promoting effect of the students' interest in learning and teaching, cultivates the students' comprehensive design ability and engineering practice skills.

3.4.3 Exploring new Teaching Form

After years of construction, the electrical and electronic experimental center has completed the update of experimental equipment. Now each student is equipped a computer aided teaching as a group. Experimental conditions is advanced, electrotechnics experiment device and so on have been the domestic advanced level. Based on the experiment center, course group support the students to carry on the topic and scheme choice experiments through the open teaching and developing the second classroom, so as to improve students' practical ability.

In addition, some students can communicate with teachers, who are interested in electrical and electronic and want to learn more. They also can carry out the practice of science and technology depending on the teachers' scientific research project. At the same time, we encouraged students to take an active part in all kinds of science and technology innovation and electronic design contests. These activities will cultivate the innovative practice ability.

3.4.4 Reform of Assessment Way

After years of exploration and practice by trial and error, our curriculum group improved and gradually formed a relatively complete system of operational on the basis of summarizing the experience other colleges (see table 1).

Table 1 Method of experimental results determining

Given proportion of actual results	Test results at ordinary times 60%	Basic experiment examination (Cultivate the students' basic experiment, data processing, the results analysis and discussion skills)	Preview 10%
			Classroom questioning 10%
			The experimental operation process 40%
			The experimental results 20%
			The experimental report 10%
			The experimental hygiene, discipline, attitude, etc 10%
		Comprehensive experiment examination (To cultivate students' comprehensive thinking ability, the unity cooperation ability)	Preview 15%
			Classroom questioning 25%
			The experimental operation process 30%
			The experimental results 10%
			The experimental report 10%
			The experimental hygiene, discipline, attitude, etc 10%
		Innovative experiment examination (To cultivate students innovative thinking and ability, practice ability and problem solving ability)	Advanced and innovative experimental project 30%
			The experimental operation process 30%
			The experimental results 10%
			The experimental report 20%
			The experimental hygiene, discipline, attitude, etc 10%
	The final assessment result 40%	Written examination 50%	Examines basic experimental principle, experimental phenomena discussed, etc
		Operation 50%	Assessment of students' experimental skills: the use of instruments and equipment, circuit design and debugging, troubleshooting, the experimental results analysis, etc

3.5 Reform of Teaching Ideas, Modes, Methods and Means

First of all, teachers themselves must be more familiar with the engineering case, more involved in the engineering practice to improve their professional level and engineering capability [7]. Then combine the ideas of the engineering practice to teaching, and the teachers can keep constantly the introduction of new technologies, new methods and new theory in class. Then students can realize the practical application of theoretical knowledge value in the process of practice, which greatly improving their engineering consciousness and engineering application ability.

Secondly, teachers should actively guide and encourage students to innovation. When students creatively put forward some problems, on the one hand, teachers should timely give them affirmation and encouragement, on the other hand, should actively help them to solve.

Again, we can make full use of modern education technology, networked multimedia auxiliary teaching for extending the space of communication between teachers and students. Students can get

various forms of learning through the platform and communicate with teachers. That is to say, it fully meets the needs of students' learning and communication.

4. Implementation Effect

At present, harmonious and unified in practice and theory teaching as the core content of the adjustment of teaching reform has been put into practice in our university. Students generally reflect that this way closed the distance between teachers and students, encouraged students' learning to be a positive, active exploration process, to better develop their engineering practice ability and innovation ability. The students also had great achievements in various competitions. Awards that students got include one first prize, two second prize, one Tianjin first prize, three third prize in the 10th national undergraduate electronic design contest, one second prize in the 13th "Challenge Cup" national university student extracurricular academic science and technology works competition, and so on.

In addition, the course director was rated as excellent field on teacher, two members of curriculum group become good teachers of demonstration teaching experience exchange lesson. Young teachers actively took part in all levels of teaching competition; one of them got a grand prize and a second prize in the national young university teachers teaching competition, two won the first prize, two second prize, three third prizes and one honorable prize in Tianjin municipal level.

5. Conclusion

This paper puts forward the reform of engineering course in colleges and universities based on the harmonious and unified of practice and theoretical teaching as the core, which aims to cultivate students' innovation ability and practice ability, thus improves the quality of teaching. In the future, we will continue to emphasize students' study subject consciousness in the teaching process, and combine the course with engineering practice, complete the course system, improve the teaching effect of personnel training for more and better talent with high quality to the country and society.

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7. References

- [1]. Tang Jie. Electrotechnics (less) [M]. Beijing: Higher Education Press, 2009 (In Chinese).
- [2]. Qin Zenghuang. Electrical engineering [M]. Beijing: Higher Education Press, 2006 (In Chinese).
- [3]. Hua Hongyan, Zhang Hongliang. Applied undergraduate teaching reform and practice of electrical and electronic technology course [J]. Journal of Anyang Institute of Technology, 2011(3): 100-100 (In Chinese).
- [4]. Ren Lihong, Li Xiaoli, Liu Hao. Excellence engineers plan "electrical and electronic technology" course innovation teaching study[J]. Electric Power Education in China, 2012(4): 66-66 (In Chinese).
- [5]. Tu Qiaoling, Xu Xia. "Electrical and electronic technology" course content optimization based on the professional requirements[J]. Journal of Electrical and Electronics Teaching, 2011(3): 31-33 (In Chinese).

- [6]. Li Zhensheng, Li Xiaofei, Li Xiaojing, et al. Electrician electronic experiment tutorial[M]. Beijing: Science Press, 2012 (In Chinese).
- [7]. Li Xiaojing. Explore and practice in improving teaching ability of young teachers in engineering schools[J]. Journal of Heilongjiang Province Higher Education Research, 2015(12): 109-111 (In Chinese).