Research on the System of Electronic Design Training for Undergraduates Majoring in Electrical Information

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Abstract

In the light of rapid development of higher education and enrollment in China and various competitions our undergraduates partook over last few years, the author explores the mode of electronic design training for undergraduates majoring "application-oriented" electronic and electrical information. The author also analyzed factors that influence students' training practice and innovative ability and proposed the system of electronic design training combining basic technology and engineering training based on the current training plan and improvement in the evaluation of practical training.

Keywords

Electronic Design; innovative ability; engineering training; training system.

1. Introduction

With the rapid development of China's higher education, the whole society pays more and more attention to higher education, and the quality of undergraduate teaching is advanced throughout the world. However, due to the expansion of enrollment in recent years, there are some serious deficiencies in higher education, poor practical ability being most prominent. The rapid expansion of enrollment has turned "elite" education into "mass" education. Either from the perspective of international comparison or the specific analysis of the training process, various quality measurement indicators show the problem of poor hands-on ability of college graduates in China is quite thorny. According to the pedagogy, practical ability refers to the individual absorption, integration of supportive educational resources and individual basic resources, adaptation to social life, solving basic practical problems, participating in social life practice, self-improvement and the ability to enhance hands-on practice on students' part. In 2005, the Ministry of Education issued Document No. 1, "*Several Opinions on Further Strengthening Undergraduate Teaching in Universities*", and put forward several requirements for undergraduate teaching, i.e. "insistence on imparting knowledge, cultivating ability, improving quality and coordinated development, paying more attention to capacity training, and improving College students' learning, practical and innovative abilities in particular, and comprehensively promote quality education" .

Presently, ZTE incident and Sino-US trade war have made China reflect on education. Given the fast development of higher education in China, why number of top scientific researchers and major scientific research achievements are far from meeting the needs of economic development? If you lag behind, you'll have to pay price. Technology is of utmost importance. It is necessary to continuously realize independent innovation and master core technologies, which requires that China's manufacturing must always adhere to the innovation-driven development strategy, and base itself on independent innovation for upgrading. At the same time, sound innovation environment and system should be in pace, and intellectual property protection should be applied. On in this way can innovation be more lasting and vital, and chance of a similar ZTE event taking place be lowered.

2. Factors Exerting Influence on Cultivation of Students' Practical and Innovative Ability

2.1 Traditional Teaching Approaches

At present, the traditional teaching mode involves many students, and its shortcomings lie as follows. First, poor targeting, choice of teaching content, teaching methods and difficulty of teaching materials cannot cater for all students. Second, the interaction between the lecturer and students is limited, which will not only gives rise to problems that cannot be resolved in a timely manner, but also lead to the limitations of the student's personality. Third, the preview-study -practice-review-examination learning mode enables students to gradually develop passive learning habits that rely too much on teachers after long-term reinforcement, which is not conducive to students' active learning, logic thinking, imagination and innovative thinking, thus making it hard to exercise and improve innovation.

2.2 Relatively Fast Update on New curriculum

Electrical-information-related majors, electronic technology, automation technology and computer information technology promote and permeate into each other. The development of modern electronic technology provides a material basis for that of computer technology, while the development of computer technology serves as driving force for that of electronic technology. With them come various new technologies and new knowledge.

2.3 Lack of hands-on training

At present, a large part of college students are quite laid back and in want of initiative and active thinking habits. Activities students take part in are limited to the experiment and the practice of the course, which is only a relatively passive practice and not enough for the cultivation and training of innovative ability.

3. System of Practical and innovative ability training

In our college's electrical engineering and automation undergraduate program, electronic design capabilities are highlighted as the core competence and distinctive ability. System of training is set up as follows.

3.1 Improve learning interest and enhance innovative consciousness

Interest is the best teacher, the driving force for doing anything and the key to transforming passive learning to active learning among students, and the prerequisite for cultivating students' innovative consciousness. The cultivation of students' innovative consciousness is mainly carried out in the following ways: knowledge of learning interest of freshmen when entering college (class supervisor), professional introduction (dean), employment introduction (students' affair office), publicity work (students' union) and the enrollment of various associations, etc.

3.2 Undergraduate Curriculum

Undergraduate Curriculum takes the SCM course as the core course, Circuit Principle, Digital Power, Mode Power, Power Electronic Technology and Sensor Technology as the basic course and Intelligent Instrumentation and Embedded System as advanced courses, all of which form theoretical training system of electronic design. In accordance with the requirements of electronic design training, courses are integrated in a basic, applied, practical and integrated manner. Each learning situation also refers to specific product projects and each project starts from the technical requirements of the products, step by step following the sequence of technical data review, familiarity with device performance, choice of hardware circuit design, compilation of device list, making hardware circuit, program design, software and hardware debugging, device and module circuit performance test and performance index test etc. The selection of teaching content fully reflects the requirements of students' comprehensive training and lays a good foundation for students' sustainable development.

As for teaching approaches, some important basic courses (analog electronic technology and single-chip principle etc) adopt break-through approach. Such method integrates the curriculum assessment into the course learning process, and requires that a block at certain level (theory + practice + design) be set at each stage of the course learning. Only those who "break- through" the block can get to the next stage of learning. Such teaching method not only stimulates students' interest in learning and enhances students' practical ability, but also fosters students' innovative design ability.

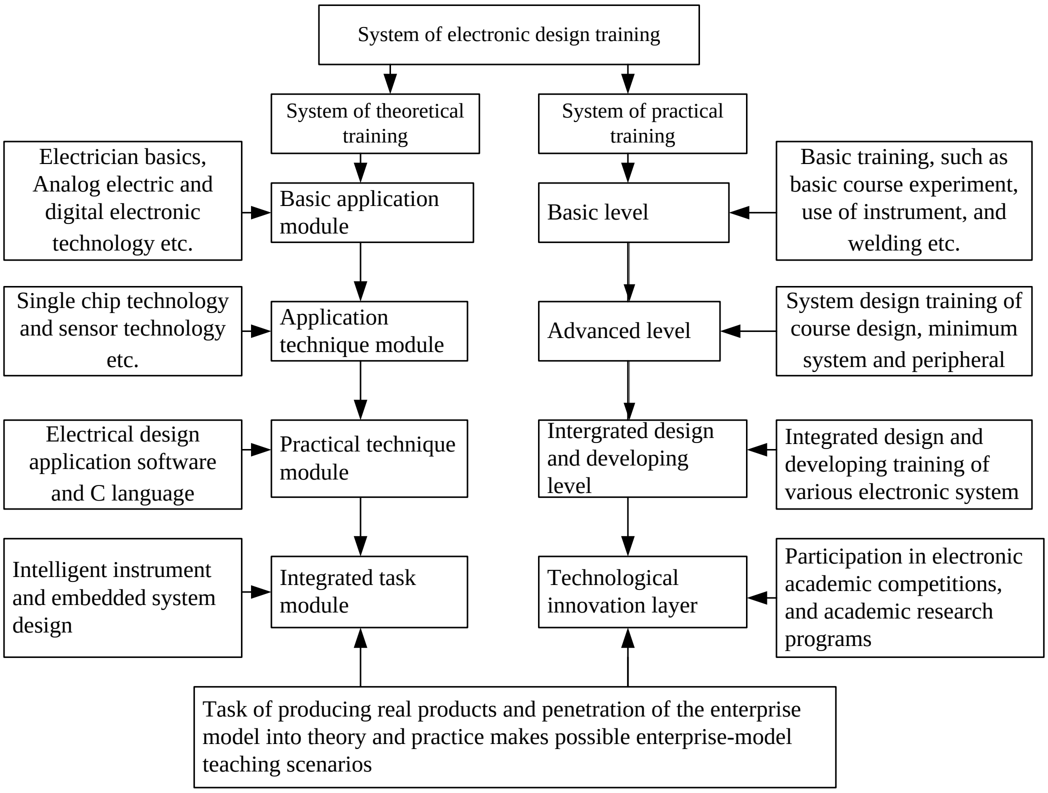

Fig 1 innovative ability training System

3.3 Practical Teaching System

As for the practical teaching system, practical training programs are designed highering up the scale of basic level, application improvement level, integrated design and development level and technological innovation level, of the most basic circuit board design, the minimum system design, and the control system design, and of difficulty spanning from the 4^{th} semester to the 6^{th} semester. The system focuses on "a solid foundation, self-learning, improvement, and continuous innovation". According to the characteristics of the hands-on activities, making real products is taken as task in the training process of each level. As regards training method, the universal six-step method is adopted, that is, following the steps of information gathering, decision-making, planning, implementation, inspection and evaluation, actively guiding students to learn independently, and apply the knowledge and skills they have learned to practice, making possible "Enterprise-model" training scenarios.

Our "Electronic Product Design and Manufacturing Engineering Training Center" is on-campus engineering training center, open to students majoring electrical, communication, computer, and electromechanical majors and targeted on training of students' electronic design special skills, embedded system application development, and electronic product design and manufacturing. Its functional positioning is closely related to the training of talents who are urgently needed in electronic information equipment manufacturing industry in Zhejiang Province, and has distinct application and engineering characteristics. The center's practical teaching system consists of three modules: course experiment, special skill training, and comprehensive engineering training. The teaching, research and service functions are organically integrated, and taking electronic products design, manufacturing, and testing field which is centered on electronic basic technology and embedded system application as core target. Since the completion of the engineering training center, it will better the practical teaching system for the electrical, communication, computer and electromechanical majors of our school, improve practical teaching, strengthen the core competence of students' electronic design, and play an important role in cultivating professional features with local characteristics. Besides, it is conducive to fostering relevant professional development.

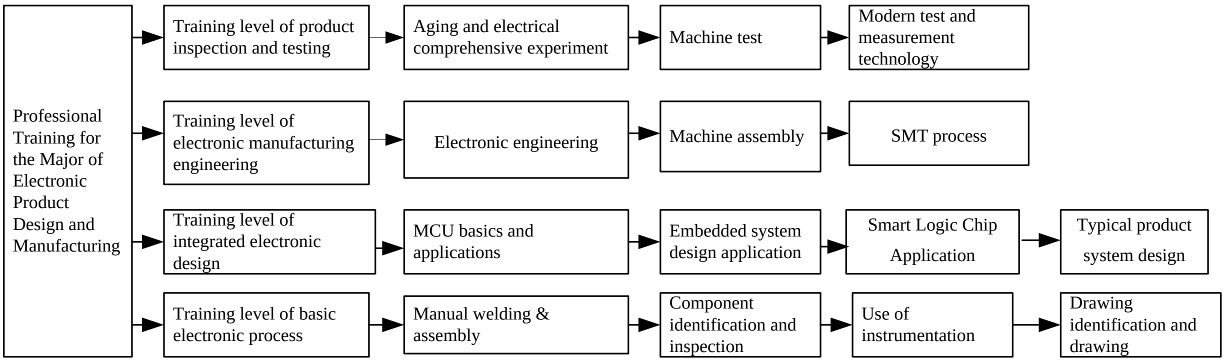

Fig 2 Electronic Product Design and Manufacturing Engineering Training Center

3.4 Leaning in additional course

At present, our college boasts the construction of additional courses, that is, the Electronic Amateur Association and the Computer Amateur Association. Members are recruited among freshmen who will be trained from initial interest level to capacity development level. The corresponding colleges have laboratories and related instruments open to students in their spare time. Meanwhile, instructors will be there answering students' questions and helping solve difficulties. At present, our college has the following four-level scientific research training system where Students can enter for various competitions and get involved in scientific research training programs. So far, good results have also been achieved.

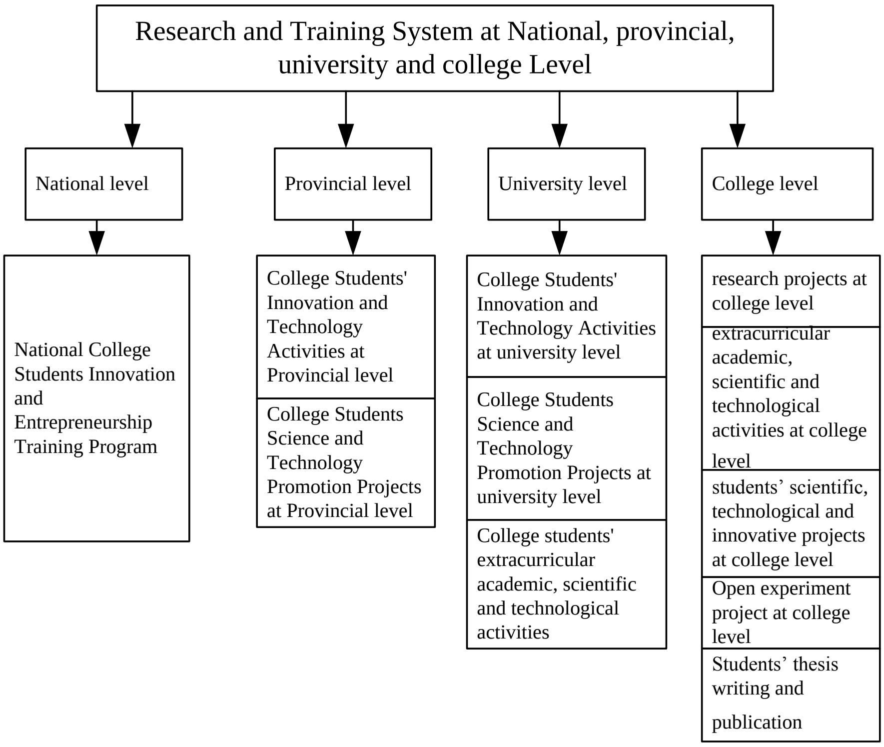

Fig 3 Research and Traning System ant National, provincial university and college Level

3.5 Practical assessment system

Our institute has intensified the reformation of assessing methods and subjects. The traditional assessing methods give way to diversified assessing methods and plenty of attention is paid to the assessment of vocational skills and professional competence. It adopts various assessing methods, such as written test, oral test, operation, essay, and production work. Besides, it seeks a combination of on-campus teachers, on-site experts, students' assessment and evaluation, or a combination of school, enterprise and social assessment and evaluation, of which a clear and reasonable proportion distribution is in place. Such assessing and evaluating model of which there's a combination of main-course assessment and the additional-course competition, of the teachers' evaluation on campus and the enterprise's and social evaluation, and of self-evaluation and mutual evaluation among students not only cultivates the students' ability to use modern information technology, but also improves students' expressiveness and teamwork spirit.

4. Conclusion

Application-oriented undergraduate colleges are the main base for cultivating practical and innovative talents. With the increasing demand of applied talents, universities pay more attention to students who have innovative consciousness, and are able to analyze and solve practical problems and engineering practice. For the undergraduates majoring in electrical and electronic information, the cultivation of electronic design capabilities is particularly important.

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References

[1] Shang Xuan, Gu Hongxin, Yuan Xi et al. Research on the Countermeasure of College Students' Innovation Ability Cultivation[J]. Vocational Education Research, 2009.126-127.

[2] Chen Xiaohu, Liu Huajun, Zhu Xiaochun, Zhang Huigang, Qu Huachang. Innovation and Practice of Personnel Training System for Electrical and Electronic Information[J]. Chinese University Teaching, 2006-4.

[3] Liu Mei. Factors Affecting University Students' Innovation and Ways to Cultivate Innovation[J]. Journal of Changsha University, 2011-3.

[4] Song Xueyan;Li Ximeng. Construction of Scientific Research Training System for Undergraduates of Archives Major[J]. Lantai World, 2018. 125-132.

[5] GUO Zhong-hua, LIU Hao, TAO Lei, WANG Zhi-quan. Enhancing Undergraduates' Scientific Research Training in the Construction of Open Experimental Platform[J]. Physical Experiment of College, 2015(2).243-248.

[6] Li Xinyi;Liu Jingjing;Yan Zhijun;Yan Zhili. On the Construction Objective of Scientific Research System of Local Undergraduate Universities in the Background of Transformation——Based on the Experience of Applied Sciences Universities in Germany[J]. Journal of Hebei Normal University of Science & Technology(Social Sciences). 2017(3):1653-1659.

[7] HE Kui;Xinjiang. Research on the Construction of Training System for Top Financial Undergraduates in the Era of Big Data[J]. Research and Practice on Higher Education. 2015(3):245-251.

[8] XinxinWang, FubaoZhou, TongqiangXia, MingjingXu. A multi-objective optimization model to enhance the comprehensive performance of underground gas drainage system. Journal of Natural Gas Science and Engineering.2016,Vol 36.852-864.

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