

One New Training Electronic Talents Method Based on Hierarchical Design

Min Zhang^a, Xiujuan Ma^{b,*}, Yan Jing^c, Fusheng Dai^d, Xinsheng Wang^e

¹School of Information science and Engineering, Harbin Institute of Technology, Weihai, 264209, Shandong, China

^amzhang_hit@hitwh.edu.cn, ^bmaxiujuan@hitwh.edu.cn, ^cjingyan@hitwh.edu.cn, ^ddfs1963@163.com, ^ewangxswh@126.com

*Corresponding author

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Abstract: Guided by the trilogy of emerging engineering construction and 40 items of higher education in the new era, hierarchical teaching design has been proposed in this paper to better teach students by their aptitude. Hierarchical teaching design includes hierarchical teaching objects and hierarchical teaching contents. The teaching objects are divided into three levels of junior, senior undergraduate and postgraduate. Teaching cases and teaching modes with different difficulty are adopted for different teaching objects. It has been proved by practice that the hierarchical teaching design can better solve the problems of various weak abilities commonly existing among students, improve the requirements of different levels students for learning content and targetability of different levels, and achieve the goal of cultivating electronic talents under the background of emerging engineering.

1. Introduction

Since February 2017, China's ministry of education has actively promoted the trilogy of emerging engineering construction, namely "Fudan University Consensus", "Tianjin University Action" and "Beijing Guidance". Fully exploring and forming the Chinese model and Chinese experience, which would lead the global engineering education and help to build a powerful country for higher education. In June 2018, the ministry of education held a national conference on undergraduate education for higher colleges and universities, and proposed the initiative of "people-oriented" and "four regressive" [1], emphasized the need to accelerate the construction of high-level undergraduate education and improved comprehensively the ability to cultivate talents. In the "40 rules for higher education in the new era" released by the ministry of education in September 2018. It pointed out that the reform of innovation and entrepreneurship education should be deepened, which is oriented to all, classified teaching, combined with major, and strengthened practice, to promote the comprehensive development of students. In April 2019, Wu Yan, director-general of the ministry of education, issued new requirements at the launch conference of the "six excellence-one top plan 2.0", proposed to train students with first-class quality and high social recognition, to effectively enhance the higher-order, innovation, and challenge of the curriculum. The new educational situation puts forward new requirements for the training of electronic professional talents. Therefore, it is of great social value and significance to explore and research the cultivation of excellent electronic graduates with innovative consciousness and engineering practice ability.

2. The problems existing in the course practice of electronic students

Talent cultivation is the eternal theme of colleges and universities. A major change in modern education is from emphasizing knowledge and skills to cultivate students' active learning. The focus of education is no longer to provide students with all the knowledge in their whole life, but to cultivate students' ability of independent learning. Taking student development as the center,

improving the teaching system of electronic courses, which should not only enhance the study of professional theoretical courses but also enhance the training of practical courses.

However, some electronic students in colleges have problems such as weak professional knowledge and skills, vague professional thinking mode, poor awareness of independent learning, weak engineering practice ability and insufficient creativity, which cannot meet the demand for innovative talents in the new era. Therefore, a new hierarchical design is established for training electronic talents in this paper under the background of emerging engineering.

3. Hierarchical teaching Design

Students of different ages have different knowledge bases and practical needs, and even people of the same age have different abilities. Therefore, it is very necessary to explore hierarchical teaching. “Hierarchical teaching” is not a new concept. In China, it can be traced back to the “teaching students by their aptitude” method proposed by Confucius. In foreign countries, the American educator Harris put forward the idea of multi-level teaching in 1968 [2]. Although many hierarchical teaching modes have been proposed and practiced by Confucius and Harris. But, the hierarchical forms are not single and fixed. In recent years, many colleges and universities keep pace with the times, adopt many different hierarchical modes in teaching, guidance, assessment and so on. The literature [3] puts forward a hierarchical, systematic and chain curriculum practical teaching mode, which implements practical teaching for students in their 4 years college life. Given electromechanical innovation practice activities, East China University of Science and Technology divides the practice teaching platform into three levels, each level contains different modules and orients to students of different ability levels, which can better cultivate students' multi-dimensional engineering ability [4]. Guided by broadening basic, quality education and ability cultivation, literature [5] proposes to establish a hierarchical experimental teaching system, which not only guarantees the training of students' basic professional skills but also improves their innovative consciousness and creative ability.

To deepen the university education reform of innovation and entrepreneurship and cultivate electronic talents, this paper proposes the ideas of hierarchical teaching respectively from hierarchical teaching object and hierarchical teaching content in the electronic practical course.

3.1 Hierarchical teaching objects

The teaching objects of the course are divided into three levels of junior, senior undergraduates and postgraduate students. Different groups correspond to different experimental contents and teaching methods with different difficulty. Due to their weak foundation, junior undergraduate students are mainly engaged in design-based experiments to cultivate their practical application ability of basic knowledge, and at the same time to equip them with basic engineering design concepts, engineering software, and engineering methods. Senior undergraduates have certain professional knowledge accumulation and engineering practice ability, which needs to be strengthened education and training. So the experimental content is mainly a comprehensive application. As high-end engineering design talents, postgraduate students need to cultivate the consciousness of independent innovation and the application ability of cutting-edge technology, so the experimental content is mainly innovative. Take the experimental teaching design of digital frequency meter as an example, although the case name is the same, the teaching objects for three levels have different contents and requirements.

For junior undergraduates, students are required to design a digital frequency meter that meets certain requirements by using EDA laboratory box, EDA development software and relevant digital circuit course principles. The completed content is shown in figure 1.

For senior undergraduates, students are required to fuse practical contents such as analog electronic technology, digital electronic technology, EDA and so on, to exercise students' comprehensive application ability. The completed contents are shown in figure 2.

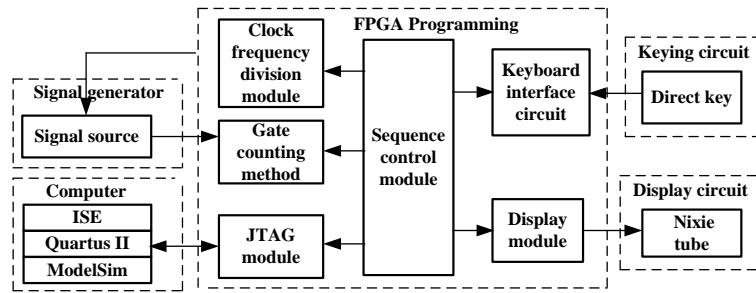


Fig1 Hierarchical teaching case for junior undergraduates

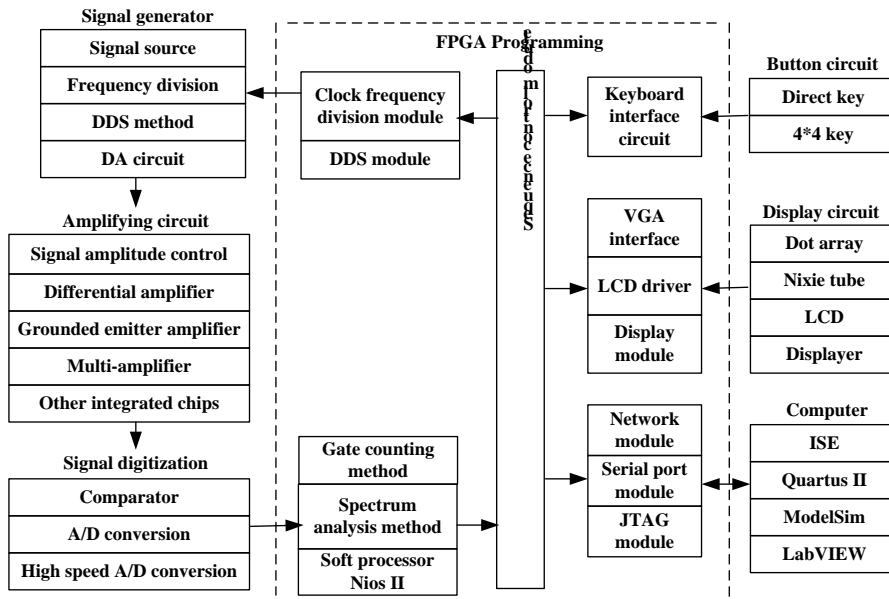


Fig2 Hierarchical teaching case for senior undergraduates

For postgraduate students, they are required to independently design, manufacture, weld and debug circuits to form circuit modules with specific functions. So, students can experience the process of approaching the actual product research and development, which cultivate students' awareness of independent learning and engineering innovation ability. The main contents are shown in figure 3.

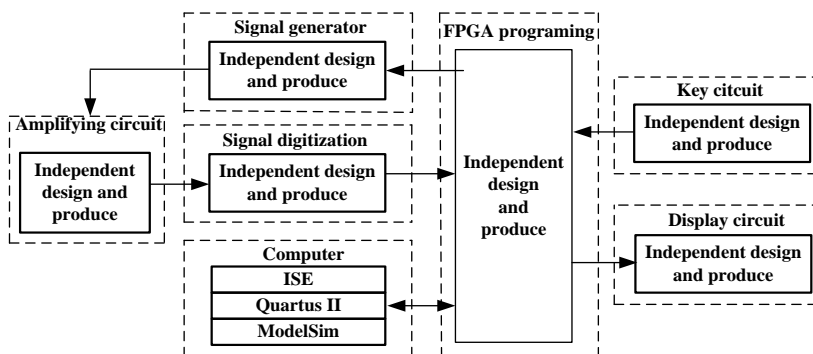


Fig3 Hierarchical teaching case for postgraduate

3.2 Hierarchical teaching contents

According to the different students needs of the three types of teaching groups, the corresponding teaching cases and teaching modes are adopted. The teaching cases are divided into three levels, namely design type, comprehensive applied type, and innovative type. This teaching mode can not only meet the basic teaching requirements of ordinary students but also meet the higher-level development needs of top students. Some hierarchical teaching cases of electronic and

information majors are shown in Table 1.

Table 1 Partial hierarchical teaching cases

Practical types	The practical cases	Teaching objects		
		junior	senior	postgraduate
Design type	Waterfall light	★		
	Signal generator	★	★	
	Serial communication experiment	★	★	
Comprehensive applied type	Digital thermometer design		★	
	Coded lock		★	
	Electronic clock	★	★	★
Innovative type	Digital frequency meter	★	★	★
	Range detection of radar echoes		★	★
	Tracing the car			★
	Laser lattice design			★

4. Conclusion

To meet the social demand for electronic graduates' innovative consciousness and engineering practice ability under the background of emerging engineering, a new hierarchical practical teaching mode of electronic course is established in this paper. Several years of teaching practice shows that the hierarchical practical teaching reform helps electronic students of different knowledge levels to improve the course knowledge system, strengthen professional knowledge and skills, enhance students' innovative consciousness, and improves their engineering practice ability and innovation ability.

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