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Analysis on the Teaching Reform of University Electronic Circuit Course

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Abstract. Some problems are found in the teaching of our Electronic Circuit Course in the university, such as strong theory, complicated course structure, few class hours, lack of hardware facilities, and insufficient practical experience etc. This paper conducts a comprehensive teaching reform research on the Electronic Circuit Course by the research of teaching content, teaching means and teaching methods. Based on the goal of teaching reform as a starting point, our new teaching reform revolves around the theory teaching and practice teaching. In order to enhance the teaching quality, a series of reform suggestions are put forward. These reform suggestions include rearranging theory teaching contents, reform the teaching methods, using experimental and practical teaching methods, developing the students' interest in learning and increasing students' study enthusiasm.

Keywords: Electronic Circuit Course; teaching reform; teaching methods; reform suggestions.

1. Current Situation of the Electronic Circuit Course

The Electronic Circuit Course is one of the most important basic courses for computer and electronic majors in the university. For theoretical teaching, this course has enormous contents [1] [2]. Furthermore, its structure is relatively complicated, involving the foundation of semiconductor devices and circuit analysis, etc, which is both theoretical and systematic. Some students do not have a solid grasp of basic theoretical knowledge and they are weak in understanding. So it is difficult for students to learn the theory of electronic technology involved in the course. In addition, for some students of the computer science majors in some liberal arts schools, the teaching time of the courses, which generally take about 48 hours, is limited, resulting in insufficient time for students to absorb, understand and apply relevant knowledge. The traditional teaching focuses on theory, which leads to a low proportion of experiments in the whole course [3]. Due to the limited experimental conditions and experimental facilities in some schools, students can only do some simple welding experiments, which is not the practical teaching in the real sense.

Furthermore, the electronic courses in colleges and universities also put forward new requirements for teachers [4], which not only requires teachers to have a solid theoretical foundation of the courses, but also to have experience in the development of electronic products in enterprises. At the same time, more extensive knowledge and practical experience related to practical work should be introduced into the teaching. However, the teachers who teach this course generally lack practical experience, especially the practical application of analog circuits, let alone the practical application.

Based on the teaching problems above, both the teaching problems in both theory teaching and practice teaching have to be solved. (1) In the aspect of theoretical teaching, teachers can only cut the content of the course due to the lack of teaching hours. However, in the absence of sufficient analysis of the course structure and the focus of the course, the temporary omission of the course will cause students to be at a loss, making the entire course knowledge structure chaotic. On the other hand, some students have weak ability of understanding and their ability to sort out knowledge is not strong enough. These reasons make them difficult to master the knowledge point system of the whole course. (2) In the aspect of practical teaching, the current problems mainly lie in the following aspects. First of all, the own conditions of the universities lead to a large difference in the laboratory conditions. Many experimental equipment of the university also has the phenomenon of aging and disrepair, which makes the experiments unable to proceed normally and greatly reduces the quality of experimental courses. Secondly, the teaching method of practical teaching is single. Both experiment and practical training are simple and independent experiments, which are not closely related to the

curriculum. As the development of information technology, various design and virtual simulation tools can make the teaching methods more diversified, which is expected to improve the teaching effect. It's necessary to broaden students' vision and improve their ability of self-creation and self-research and development by practical teaching. However, students' ability of creation and research and development is very limited in the original teaching mode. Finally, the final assessment of practical teaching in the universities is imperfect. The assessment method of practical teaching is only to do some small experiments, resulting in that students do not pay attention to the practical application of the subject. The transfer of theoretical knowledge and application ability are poor.

2. The Teaching Reform Proposal of the Electronic Circuit Course

Based on the above existing teaching problems, this paper puts forward some suggestions on teaching reform through theoretical teaching and practical teaching, as shown in Fig.1.

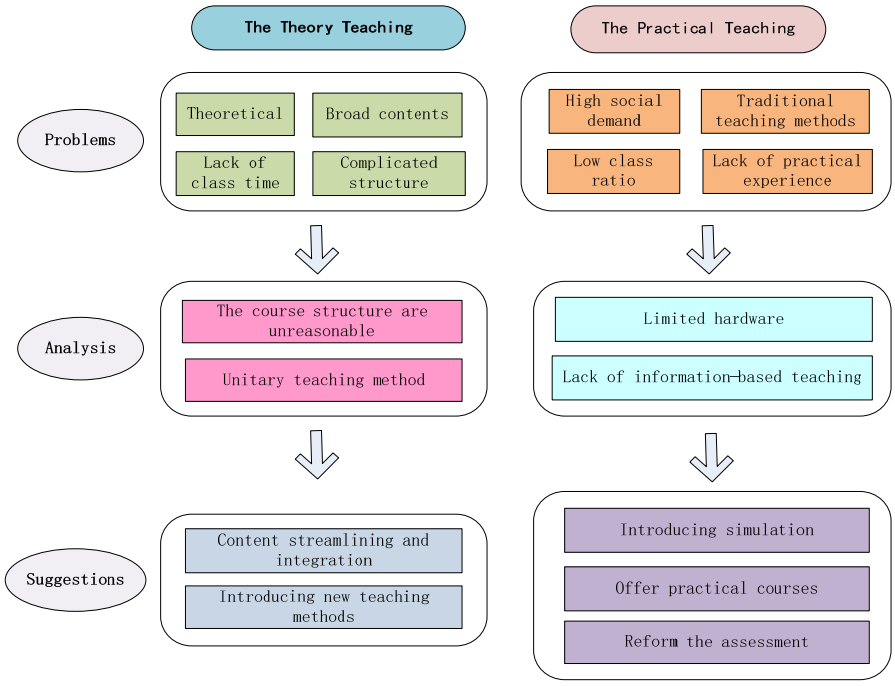

Fig.1 Problems in the curriculum and Suggestions on the Electronic Circuit Course

2.1 Simplify and Diversify Theoretical Teaching.

First of all, it is necessary to simplify and integrate the teaching content of the Electronic Circuit Courses for students. The purpose of teaching content simplifying is to delete knowledge points that are difficult to understand and worthless in practice, keep more important knowledge points, and add a few knowledge points related to practical application to highlight more practical application. For example, in the arrangement of the analog electronic circuit, the following can be simplified. The analog electronic circuit is divided into five parts: semiconductor device foundation, basic amplifier circuit, negative feedback circuit, integrated operational amplifier and power amplifier circuit. For the content of the basic part of semiconductor, the paper focuses on the macroscopic characteristics of various semiconductor devices, the selection of device parameters and their functions in the circuit and the physical content of semiconductor devices such as the microscopic motion and microscopic characteristics of the devices. In the part of semiconductor devices, practical contents such as CMOS field effect transistors can be added for more suitable to the practical application. In terms of amplifying circuit and negative feedback circuit, the single-level and second-level amplifying circuit and the feedback circuit composed of them should be narrated, so as to reduce the difficulty of the course. Integrated operational amplifiers involve a wide range of applications of integrated circuits, which should be explained as a key content, appropriately increase the proportion of class, and introduce more relevant and practical circuits as examples. For the chapter of power amplifier circuit,

the basic principle of power amplifier can be explained briefly if the class hour is sufficient. If class hour is insufficient, treat as alternative lecture content. In addition, the teaching of this part can also be conducted in the practical class in a way of circuit design.

Secondly, it is necessary to get rid of the existing teaching method. As the development of technology, the means of teaching are not limited to blackboard, chalk and textbook. The development of multimedia and Internet can make the teaching methods more diversified [5]. We can make videos and interesting animations for the course, and visualize some abstract and complicated knowledge points in the course by multimedia technology. On one hand, teachers use multimedia to explain the difficult knowledge; on the other hand, they make knowledge points by multimedia (such as animation, video, etc.), which can make their teaching ideas clearer. For example, when explaining the carrier motion inside the diodes and transistors, the process of carrier motion can be clearly seen by making relevant multimedia animations. And the teaching effect can be doubled with half the effort.

In addition to multimedia teaching, network teaching resources are also very worthy of reference. At present, China is making great efforts to develop online teaching resources, which includes national quality resources courses and China MOOC. These resources can expand students' extracurricular knowledge and deepen the classroom teaching. Students can reasonably arrange time according to their own needs to download teaching courseware, teaching video and other learning resources for self-study. These excellent courses are usually created by famous teachers in universities. For teachers, these courses can improve their teaching level and have reference effect. For students, the introduction of a small number of these courses in the class not only helps students' learning, but also expands their horizons. So that students who are interested in further study can learn by themselves after class and finally their self-learning ability are improved.

2.2 Discussion on the Reform of Practical Teaching.

In order to improve the teaching quality of experimental courses and make full use of teaching resources, the traditional teaching methods should be changed in practical teaching.

(1) Introduce circuit simulation. Teaching with circuit simulation can organically combine theoretical knowledge and the applied circuit. On the one hand, it can deepen students' understanding of knowledge in the practical class by simulation; on the other hand, it can also cultivate students' self-learning ability. These virtual simulation tools (such as Multisim, Proteus, etc.) are very important means to achieve high efficiency electronic design. The talent demand of corporations for flexible use of various simulation tools is also greatly increased. Corporations not only need a graduate from school, but also need to be able to flexibly use various virtual simulation and design tools to create wealth for themselves. So, these tools become a skill that students have to grasp. Due to the lack of class hours, it is properly introduced in practical teaching, students can only design relevant small experiments and small projects. However, the simulation tools can help students to quickly understand circuit design and improve their independent research and development ability. In the course of the electronic circuit, Multisim and Proteus can be used as the main simulation software, and Protel DXP design software can be properly introduced to explain the process of designing and making applied circuit. Thus, students can be teached by the method of circuit simulation in a more direct and more social and applied way. This will not only arouse students' interest in learning, but also greatly help the whole course.

(2) Set up more practical courses such as circuit design and circuit production. The practical course "simulated circuit practice training week" is offered. This course is mainly conducted in the way of circuit simulation and circuit board design as a supplement. Students are required to learn simple circuit design, thus greatly improving students' practical ability. In addition, such practical courses also require students to learn independently. In these courses we also can appropriately allocate part of the production tasks or multimedia network teaching resources to students, such as internal carrier animation production triode, using common electronic chips related website resources, making electronic experiment of related circuit laws and its corresponding with the experiment of simulation

resources, etc. These practical courses can let the students independently to complete tasks and have a more in-depth understanding at the same time.

(3) Reforming assessment methods. In the traditional assessment method, the experimental course only takes up a small part of the assessment. Even the total score do not count in the experimental course. This reform requires that the test only account for 60% of the total scores and the remaining 40% are composed of experimental scores. The experimental results mainly include the performance score, the experimental report and the circuit design score. The course practice week is an independent course, which requires students to complete a whole circuit design task independently or in groups. The design tasks all involve certain application background, which is very practical. In this way, the teacher guides the students and develops their ability to participate in the project development, laying solid foundation for their future work.

3. Summary

Aiming at the problems existing in the teaching of the Electronic Circuit Course, this paper conducts an in-depth study and discussion on the teaching content, teaching means and teaching methods. It is also pay attention to improving the learning efficiency of students and stimulating their interest. Through the reform measures, the course content is simplified and optimized. The practice is reformed for introducing a variety of teaching methods. Teachers combine theory with practice, making students more interested in learning the Electronic Circuit Course. The knowledge that the student learns is closer to practice and their self-learning ability and practical ability have certain enhancement.

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