Discussion on the Teaching Mode of "Communication Electronic Circuit" Course Based on Task Oriented and Flip Classroom

Lin SONG¹ and Da-ren LIU²

¹Information Engineering College, Dalian University, China
²Toshiba Medical Systems Research and Development (Dalian) Co., Ltd., China

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Abstract. With the rapid development of communication and related industries, new communication schemes, new circuit structures, and new integrated circuits are being developed and used. Radio frequency integrated circuit design has become the bottleneck of mobile communication design. There is an urgent need for a large number of scientific and technological personnel with both theoretical and practical experience. Therefore, the main purpose of the course reform of communication electronic circuits is to improve students' ability of circuit design. On the one hand, use a wealth of online quality resources, adopt the teaching method of "hierarchical teaching" and "task driven", apply of heuristic, discuss style of teaching to make students "flip classroom", improve teaching quality while broadening their horizons. On the other hand, adopt the subject teaching mode to improve students' ability of system design, while strengthening the students' understanding and mastery of the circuit knowledge, training students' ability to analyze and solve practical problems, improve students comprehensive application ability. At the same time, the theoretical teaching and practical teaching promote and push each other, thus improve the course construction and quality of teaching.

Introduction

The course of communication electronic circuits is an important specialized basic course of communication engineering and electronic information engineering etc. It is also engaged in communication, electronics and other related fields researchers must understand the basic knowledge, there is a strong theoretical, engineering and practical. The course is based on nonlinear circuit and adopt the nonlinear analysis method. It analysis the high frequency unit circuit of transmitting and receiving device, relationship between input and output signals in the corresponding circuit and the rule of signal frequency spectrum & amplitude change. But the mathematical derivation is tedious, the concept is abstract. Therefore, It is imminent that how to make students master the theoretical knowledge of high frequency electronic circuits in a limited time and improve students' learning interest. At the same time, with the rapid development of communication and related industries, the new communication scheme, new circuit structure and new integrated circuit have been developed and applied, radio frequency integrated circuit design has become the bottleneck of mobile communication design[1]. There is an urgent need for a large number of scientific and technical personnel with both theoretical and practical experience. Therefore, it is very necessary to do some research and reform on the teaching and experiment of this course.

Analysis of the Present Situation of Teaching

Academician professor Wang Yue once said: "whether human beings can have a unified education model? The answer is no, because the effect of education is in the "future", and "the future" is unable to predict in detail and take action in advance. Education, especially higher education, it must be constantly discuss and constantly reform and develop." In order to improve electronic information engineering students quality education, reach the target of cultivating and reserving professional personnel. Students can meet the requirements of the job market which is the most
practical problems for universities. Classroom teaching is to ensure the implementation of an important part of that goal, and now, there are several problems in domestic college classroom teaching\(^2\)-\(^4\):

1. Optimize the integration of teaching content is not enough (speaking textbook);
2. The teaching mode and method of single (large classes taught);
3. The lack of teaching resources development and construction (quality less resources);
4. A single assessment method (final exam to test knowledge-based).

To solve these problems, our school communication electronics course through classroom teaching reform years, has completed the textbook reference book to return. At the same time, we carry out combining of multi-media teaching and writing on the blackboard model, and some high-quality resources of the Internet into the classroom. Although multimedia teaching can make students understand some of the principles and concepts of image, but it can’t stimulate students' deep thinking and creative thinking. They are just passive acceptance. Meanwhile, there have been great changes in the communication system, modulation coding mode, communication frequency band, bearer service type and other areas of wireless communication in recent years. The communication circuit has been developed from the discrete component circuit to the integrated circuit, the hardware communication system to the software communication system. New content and technologies are emerging which made new demands on its part of the RF circuit design. Teaching materials or reference books has been unable to adapt to the needs of society, the classroom teaching reform is imperative. Therefore, how to improve the effectiveness of teaching has become the focus of research in the course of communication and electronic circuits.

In order to meet the developments trend of the future social needs of multi-level and higher education reform, many educators put forward some new experimental teaching ideas. Views focused on a large number of experiments carried out diverse types of projects, including verification, simulation design, innovation, research and synthesis of other experiments. These experiments teaching new ideas reflect the direction of teaching system reform to give the education sector colleagues unanimously approved, but also spawned new problems, that is, the experimental teaching project needs to be sufficient to support the experimental hours. Through extensive literature research shows that the universities of communication electronic circuit experiment classes in 8-16 class hours. Obviously, the lack of experimental class become the key problem of the development of various types of experimental project.

**Exploration of Teaching Methods**

US National Training Laboratory confirmed that different learning methods, the average efficiency of the learner is completely different, which is known as the "Learning Pyramid", as shown in figure 1\(^5\). It can be seen from the figure, the learning absorption rate of active learning is far greater than the passive learning. Active learning includes group discussions, implementation of drill and immediate applications of these three aspects. Therefore, in order to improve the students' learning efficiency, the active learning should be introduced into the classroom teaching.

![Figure 1. Learning pyramid.](image-url)
Theory Teaching

**Adopt Hierarchical Teaching Method.** The difficulty of High frequency electronic circuit course is engineering analysis and engineering approximate calculation, students lack the ability to analyze practical circuits. Therefore, students feel that it’s difficult to learn the course.

In teaching, firstly, based on the transmission and signal processing system in the communication system, analysis of the composition and function of each module circuit, and then analyze the signal generation and transmission, grab the system -- module -- circuit -- signal of those four levels; Secondly, starting from the function of the module or circuit and the position in the system, analysis the impact of the performance to the system, complete approximate calculation of the project. Through the system to the circuit, and then back to the system from the circuit of this hierarchical teaching methods, Students' ability to analyze the circuit can be improved significantly.

**Use of Modern Means to Achieve Time, Space Expansion.** The course of high frequency electronic circuit has many characteristics, such as it has many of the schematics, formulas and teaching content, strong practicality and the speed of technology update. Compared with traditional blackboard, although multimedia teaching can improve the teaching efficiency, but only on textbooks or reference books knowledge teaching have been unable to adapt to the needs of society. In September 1993, the Clinton administration of the United States formally proposed construction of "National Information Infrastructure" (abbreviated NII), commonly known as the "information superhighway" program, its core is to develop Internet as the core of the integrated information service system and promotion of information technology (referred to as IT) is widely used in various fields society. Under its lead, many developed and developing countries have issued a series of national information infrastructure construction plan, which led to a global wave of information technology. In the United States the "information superhighway" program, in particular the application of IT in education as an important way for the implementation of education reform in the 21st century. From the view of educational, the basic characteristics of education information are openness, sharing, interaction and cooperation.

In teaching, first of all, use of the high quality "micro-lectures" and "MOOCs" resources on the Internet to develop students' horizons; Secondly, adopt the " task driven approach " that is, teacher to assign a task and then in the form of heuristic and seminar-style teaching organization which make students "flip classroom" to achieve time and space double expansion. This approach not only make students to contact the teaching content of communication system unit circuit with existing equipment, completed the study from the "single module circuit" to "System circuit" but also both the teachers and students will collaborate to complete the task of teaching. We give students visible, audible, tangible learning goals, to achieve the desired effect of teaching.

Practice Teaching

Creative Talent is, from teaching to research teaching traditional paradigm shift from the culture of the students' knowledge acquisition ability to convert from a knowledge center to the problem centered on the conversion. The cultivation of innovative talents is to transform from the traditional teaching mode to the teaching and research mode, from the knowledge acquisition to the ability cultivation, from knowledge centered to problem centered transformation. It needs a new teaching idea and thinking, namely the combination of scientific research and teaching.

The National Undergraduate Electronic Design Contest calendar year study of high frequency electronic circuit knowledge and some typical circuit of engineering arrangement into a plurality of subjects in each group of students after teaching is completed, select a topic and completed the design, Project design enhance students' understanding of levels in system - module - circuit - signal, improve analyzing and solving problems skills, increase team spirit, done by teaching converter to teaching and research.
Assessment Methods

Examination is the main way to test the teaching quality of the course. Due to the diversity of theory and practice teaching methods, we used the approach of "Final exam + Task + Experiment + Topic" to replace the original "Final exam + Experiment" assessment methods. On the basis of the existing evaluation methods, combined with student performance and research study reports on tasks and projects, we take a weighted assessment approach to determine the final grade for the course.

Summary

We take the compound talents training as a guide, the "knowledge, ability and quality" three-in-one cultivation as the goal to explore the teaching methods of the course of "high frequency electronic circuit". We take advantage of high quality "micro-lectures" and "MOOCs" resources on the Internet, use the teaching method of "hierarchical teaching" , "task driven" and "Subject teaching", application of heuristic, research style of teaching to make students "flip classroom" in broadening their horizons while improving reaching quality. In this process, students' autonomous learning ability is greatly improved and increased interest in learning.

References


