Creating an Active and Effective Analog Circuit Education Classroom

Jian-Jun YIN
330 Science Building, Fudan University, Shanghai, 200433, China
yinjianjun@fudan.edu.cn

Keywords: Effective teaching; All-round Education; Analog circuit course.

Abstract. In the past, the analog circuit course only paid attention to the explanation of knowledge points in the course of teaching. Teachers explain profound theories in simple language, so that more students can better grasp the basic knowledge of analog and electrical points, and they can effectively analyze the circuits, design the circuits. However, after years of teaching practice, we find that it is not enough to teach students only to master the knowledge of the curriculum. Sometimes in the process of circuit design, there are many setbacks and difficulties in the process of debugging the circuit. Sometimes, in the process of team work with colleagues, there are also problems and so on. Facing with these problems, many students have not been able to deal with them well, thus failing to apply the knowledge and technology of analog circuit to the best, and failing to better serve the country and society. We hope to train more pillars of the country, not only to master technology, but also to have the excellent qualities, such as not afraid of difficulties, positive and upward, teamwork and other abilities, so as to make more and greater contributions to the country and society in the future.

Introduction

Analog circuit course, as a basic course of electronic circuit specialty such as electronics, electricity and microelectronics, is very important[1, 2]. It is a compulsory platform course for related specialties in freshmen and sophomores. It is also the basis of the following courses, such as digital circuit, high frequency electronic circuit, analog integrated circuit design, electronic system design and digital integrated circuit design. The course includes the following main contents and knowledge points: semiconductor devices (diodes, bipolar transistors, field effect transistors), transistor amplifiers (common emitter amplifier, common collector amplifier, common base amplifier, common source amplifier, common drain amplifier, common gate amplifier, multistage amplifiers, frequency response), integrated amplifiers (current source and active load, differential amplifiers, power output circuits, operational amplifiers), feedback (negative feedback, deep negative feedback, frequency characteristics, positive feedback), signal processing circuit (operation circuits, active filter, precision rectifier circuits, current source circuit), power supply, etc.

In the past teaching process, we are more concerned about the students' understanding and mastery of analog circuit knowledge points, more about whether the answer is correct, more about whether the circuit design meets the target, and more about whether the test paper score is high. However, it is not enough. We should try to cultivate the positive spirit and atmosphere, the ideological and political character of the students, positive values, craftsmanship, teamwork ability and hardworking spirit, etc [3, 4].

As university teachers, we should strive to cultivate the pillar of the country in the new era, we should not only teach students the knowledge points of the curriculum, but also cultivate their excellent ideological quality, positive attitude towards life and various abilities, so as to make greater contributions to the country and our people [4, 5]. Following are some of our research and explorations in the analog circuit all-round education classroom in recent years, mainly from the aspects of telling more good stories, more flipped classrooms, showing more smiles, doing more practice and whole staff education.
Telling More Good Stories

For some important theorems and inventions, we should tell more stories behind them, for example, under what conditions and by what means did scientists discover and prove it? What difficulties they encountered in the process of putting forward, and what twists and turns did they take to achieve the final success? We should tell more stories about the development of disciplines and the tales of outstanding professional seniors growing into talents. We should tell more stories about patriotic devotion and some stories about returning home to devote themselves to the development of national science and technology. The stories contain truth, contain positive spirits such as craftsmen spirit and sense of cooperation. Through the explanations of these positive stories, students' patriotism, sense of mission and responsibility can be stimulated, and the spirit of loving science, respecting science and rigorous learning can be cultivated. At the same time, students may have the spirit of doubt and critical thinking, and establish four self-confidence.

More Flipped Classrooms

We have carried out the mixed flipped classroom teaching, which offer opportunities for interaction that traditional curricula can't match, and also strengthens the relationship between teaching and learning, fully mobilizes students' subjective initiative, cultivates students' autonomous learning ability, and changes the disadvantages of passive teaching in the past. At the same time, diversified teaching methods and the use of the Internet make students learn more freely. For the students who have enough strength and are enterprising, they will have more chances and means to learn, which will better promote the mastery of knowledge. From the teacher's point of view, the process of preparing mixed teaching also deepens the understanding of teaching, it will strengthen the communication with students, and promote each other, which will achieve good results. Benefiting from the mixed flip classroom students not only improved their academic performance (the final score was significantly higher than that of the parallel classes), but also exercised the ability of expression and team work to solve problems.

In addition, we have carried out more extensive "flips":
Flip in time - for example, flip the time to a certain time before, when some theorems have not been put forward. How do you deal with this problem?
Flip in space - what do other excellent colleges and universities say when they talk about this problem? What's different from us?
Flip in different courses - encouraging the intersection and integration of disciplines, encouraging students' innovative ideas.
Flip in teaching and learning—it is not the teachers who ask questions and the students who answer them, but the students who ask questions and discuss them with the teachers.
Flip in the school and outside the school—we invite the outstanding elders who have been employed for many years to come back and interact with students, combine their own development to teach students the practical role of this course and how to learn this course well. Also we organize students to go to counterpart enterprises to see the practical application of knowledge, to see what kind of talents that high-tech enterprises need.

Smiling More

Sometimes the theoretical theorem study of the course is tedious, and the course is also difficult in general. Teachers should first maintain a positive mental state, keep smiling as much as possible, and give everyone a pleasant and comfortable learning atmosphere. In the course of lecturing, knowledge points, life experiences and happiness should be effectively integrated. We should summarize more stories like "landmines" (when it comes to temperature sensitivity for transistor amplification factor), and "street lamp stories" (when it comes to hysteresis comparator), which let the students firmly grasp
the knowledge in laughter, and also discover the fun of analog circuit, so that they are willing to learn it in depth, learn it well, and use it well.

**Practice More**

The purpose of learning analog circuits well is to apply them, to design better circuits and better chip systems, we should emphasize more hands-on in the teaching process. At the same time, students are encouraged and guided to strengthen the practice of scientific research by participating in scientific creation projects, subject competitions, production practices and other research projects. We should strengthen the practice of scientific research and highlight the cultivation of innovation and teamwork.

**Whole Staff Education**

In order to better realize the full-staff education, we cooperate with the college student team to carry out a series of online and offline student activities with the characteristics of professional courses. Through lectures, exchanges and interaction between students, and laboratory visits and learning, classroom teaching and learning activities are effectively integrated to achieve multi-faceted full-staff education and the whole process education.

**Summary**

In view of the limitations of the original analog circuit course, which attached too much importance to knowledge points and examination results, this paper discussed some experience of creating an active and effective analog circuit classroom. This article started from the aspects of telling more good stories, giving more flipped classes, showing more smiles, doing more practice and whole staff education, striving to improve the shortcomings of the previous analog circuit class, in order to train better college students. Our analog circuit course is not only a course of teaching knowledge, but also a course of cultivating the pillar of the country.

**Acknowledgement**

This analog circuit course was supported by the Dean's Office of Fudan University.

**References**


[3] Yao Lu, Integrating Craftsman Spirit into Course Ideology, China Education Daily, 2019.4.1
