

Teaching Reform of Theory and Practice Course of Analog Electronic Technology under the New Engineering Background

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Abstract: In order to cultivate electronic information professionals with lifelong learning ability and independent innovation ability, and to meet the needs of fresh engineering construction, the paper reformed the teaching of Analog Electronic Technology from all aspects, such as teaching content, teaching methods, experimental teaching and assessment mechanism. The teaching content is project-oriented, the teaching methods are mixed, the innovative EDA and pocket laboratory are introduced, the comprehensive design experiment projects are added, and the outstanding ability cultivation and process-oriented evaluation mechanism are established.

Keywords: New engineering; Project teaching; Output orientation; All-round education.

1. Research background

Under the background of the rise of fresh technologies such as Internet of Things, artificial intelligence and big data, higher requirements are putting forward for the knowledge ability, professional quality and industry vision of contemporary engineering and technical talents. New engineering is put forward by China to actively respond to a fresh round of scientific and technological revolution and industrial transformation, support service innovation-driven development and "Made in China 2025" and a series of national strategies, so as to continue to deepen the reform of engineering education and promote the construction and development of new engineering. Since 2017, the Ministry of Education has successively issued important notices such as the Notification on Developing New Engineering Research and Practice, the Notification on Recommending New Engineering Research and Practice Projects, and the Action Plans of Artificial Intelligence Innovation in Colleges and Universities. Fudan University Consensus, Tianjin University Action and Beijing Guide have been successively launched, forming a "trilogy" of new engineering construction, discussing the connotation characteristics of new engineering construction, the path selection of new engineering construction and development, and reaching a consensus.

As a very important required course for the majors of electronic information and communication engineering, analog technology course includes basic knowledge of electronic components, basic analysis methods of unit circuits and calculation methods of their parameters, integrated circuits and their applications, signal processing and waveform generation circuits, DC power supply, etc. It is a professional basic course with strong application, and both theory and practice should be emphasized in teaching. New engineering requires graduates not only to have solid professional knowledge, but also to have independent learning ability and cross-border integration ability. Therefore, the construction of new engineering course requires the theoretical and practical teaching of analog electronic technology to be promoted to a new height.

2. The problems existing in traditional teaching

2.1. The teaching content is outdated

The traditional teaching content is to teach students from the front to the back according to the textbook content. The teacher is the leader, and the students attend the class in the classroom with the teacher's teaching. The whole process is passive. In order to teach all the knowledge points of the textbook to the students, teachers usually fill the room, and the students accept it without questioning or discussing.

2.2. The teaching form is single

The traditional classroom teaching in which teachers teach students to learn has completely failed to arouse students' interest. Especially in the information age, smart phones and various entertainment platforms have earned enough students' interest. How to make students use their mobile phones to serve their learning in class and improve their learning enthusiasm is also an urgent problem to be solved.

2.3. Experimental teaching is mainly based on verification experiments

Traditional practice teaching means that students go to the experiment to conduct a simple verification experiment operation. Although it can help students deepen their understanding of textbook knowledge, the experimental content is solidified, with poor flexibility and poor applicability, and students have no room to play.

2.4. The evaluation mechanism is single

In the final evaluation, the final exam accounts for 80% ~ 70% of the total, and the usual homework accounts for 20% ~ 30%. Lack of process assessment and evaluation of students' learning, with a final decision, students only pay attention to the final exam. But when it comes to the exam, students are basically grinding their guns, mechanically reciting formulas and examples, and changing circuit parameters in the title, students may not do it.

3. The teaching reform of the theory and practice course of Analog Electronic Technology under the new engineering background

Under the ideological and political background of professional courses proposed by the Ministry of Education, taking the national first-class undergraduate professional construction and engineering professional certification as an opportunity, the teaching reform of "three-round education" with students as the center, moral education as the goal and output as the guide is put forward, which can well meet the requirements of the training of electronic and information professionals in the new engineering background on the ability to apply multi-disciplinary knowledge, the ability to solve practical complex engineering problems, professional ethics and humanistic quality. The reform framework of the theory and practice course teaching of Analog Electronic Technology is shown in Figure 1.

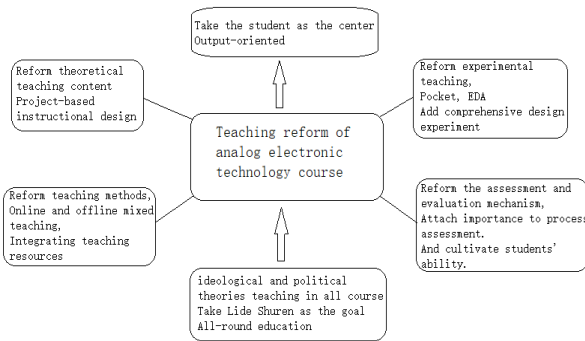


Figure 1. "Analog Electronic Technology" Theory and Practice Course Teaching Reform Framework

3.1. Reform the content of theoretical teaching and carry out project-based teaching

Based on the OBE concept, taking the output as the guidance, the training scheme of electronic information major and the syllabus of Analog Electronic Technology course are revised, the course content is reconstructed, the ability training is highlighted, and the "three-round education" is realized. To carry out the project-based instructional design which originates from and is higher than the textbook, the traditional curriculum arrangement of analog electronic technology is generally to finish the theory first, and then go to the laboratory for experimental verification. Students are not interested in learning boring theoretical knowledge, so we reverse design the teaching content in the form of experimental projects, turn theoretical teaching into practical teaching, and turn the teaching of knowledge points into students' knowledge exploration. Move the classroom to the "round table" laboratory. With the help of Lichuang EDA online experimental platform and "pocket" experimental equipment, you can demonstrate the experimental phenomena in class first, so that students can be curious and learn the theoretical knowledge corresponding to the experimental principles with questions. For example, the unilateral conductivity of diode, the experimental phenomenon can make students feel its switching function and waveform shaping function intuitively. Expand the knowledge of diodes, for example, photosensitivity can be made into photosensitive diodes, which is also the power generation principle of solar cells; LED can realize 256*256*256 true colors, and is used

in TV sets, display screens, etc. Students' interest in learning professional knowledge has been greatly enhanced.

3.2. Reform the practical teaching content and add comprehensive design experiments

Traditional verification experiments are not conducive to cultivating students' autonomous learning ability. In order to meet the training requirements of new engineering talents, some verification experiments are used as students' autonomous exercises before class and demonstrations in class, and comprehensive design experiments and innovative experiments are added, such as simple electronic organ design, digital frequency meter design, waveform generation circuit design, etc. Establish EDA online innovative practice teaching platform to build a practice teaching management system, and students can independently complete the experiment preview and circuit simulation after class. The practice adopts "pocket" experimental equipment, which is an expandable and freely built circuit bread board. It is small and easy to carry, and can be connected to a computer. The purpose of mobile laboratory can be realized by using software. Students can complete it in the laboratory or borrow it back to the dormitory for use, which is convenient for students to independently carry out comprehensive design experiments. To realize the online and offline mixed teaching and management mode of experimental teaching, students can submit the experimental process, experimental data and results online, and at the same time, it is convenient for teachers to conduct online review and experimental evaluation. Fully arouse students' enthusiasm for autonomous learning, cultivate students' innovative ability and team cooperation ability, and comprehensively use analog electronic technology and other professional knowledge, and complete the division of labor and cooperation in small groups.

3.3. Reform the teaching methods and carry out the online and offline mixed teaching mode

Using excellent online teaching resources such as MOOC of China University and teaching platforms such as Rain Classroom, Wisdom Tree and Learning Pass, we will carry out blended teaching, make course PPT, record course videos, integrate online and offline teaching content and course resources, and enrich online teaching resource database. Build a course exercise resource base and realize online test paper generation, so that students can independently conduct chapter self-test and final self-test. Under the background of new engineering, teachers take the lead and students take the lead. Students are divided into groups in advance, and typical project contents are selected, such as radio assembly and welding, circuit simulation of audio amplifier, amplifier of three operational amplifiers, design of signal generator, DC regulated power supply, etc. Let each group of students choose their own project contents, fully carry out discussion and exchange, and then gradually carry out flipping class. Students who have won prizes in national and provincial electronic design competitions, Internet of Things competitions and photoelectric design competitions are invited to show and report their entries, and record them as video materials and upload them to WeChat official account, "Light of Things and Electricity", so as to motivate students' enthusiasm for learning Analog Electronic Technology and their confidence in innovation and exploration.

3.4. Reform the assessment mechanism and attach importance to the process assessment and the cultivation of students' ability

The training of electronic specialty includes the ability to solve problems by applying engineering knowledge, professional accomplishment and career development. Cancel the final exam, and increase the process evaluation and students' comprehensive ability evaluation. The usual grades include classroom discussion and contribution barrage, pre-class test and usual homework recorded on online platforms such as Rain Classroom as usual grades. Comprehensive ability evaluation includes students' independent research and writing of small scientific papers, the completion of group projects, flipping classroom performance, participating in competitions and projects, etc. In order to improve students' professional quality, encourage electronic information college students to actively participate in teachers' scientific research projects, participate in professional and technical competitions at all levels, apply for national and provincial college students' innovation and entrepreneurship training programs, and actively transform their achievements and apply for national patents, which can directly realize the total score bonus. At the same time, it has improved students' comprehensive innovative practice ability, and formed a virtuous circle of "promoting learning by competition and teaching by competition", which just embodies the OBE concept of "output-oriented", "student-centered" and "continuous improvement" and the requirements of new engineering.

4. Conclusion

The reason why teachers are teachers is that they need to keep learning and adapt to the pace of the development of the times. In recent years, in addition to the reform of teaching content and means, the more important teaching reform should be that teachers should be educated first, break the traditional educational ideas and teaching means, and keep learning and growing. The college actively contacted enterprises to provide full-time teachers with enterprise course training, encouraged young teachers to take part in enterprise attachment training and invited enterprises to proofread teachers for professional teacher training, greatly increasing the proportion of "double-qualified" teachers. Professional teachers are encouraged to guide students to

participate in various college students' science and technology competitions, and strongly support professional teachers and college students to apply for national invention patents, set up technology industry incubation bases, and use professional technology to serve local economic development, thus building a bridge for graduates and employers. At the same time, typical teaching cases and practical teaching cases are provided for teaching, forming a typical project teaching case resource base.

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