Exploration and Practice of "Signals and Systems" Teaching Based on Project-Driven Teaching Method

Ying Meng

Beijing Institute of Technology, Zhuhai, Zhuhai, 519088, Guangdong, China

Keywords: Signals and systems, Project-driven teaching, Practice

Abstract: "Signal and System" is a compulsory course for communication engineering, electronic information and Internet of Things majors, and it is a main course. It plays an important role in teaching and is a technical basic course for cultivating students' analytical ability of "Signal and System". The theory of "Signal and System" is rigorous and practical, which is closely related to engineering practice. The outstanding feature of project-driven teaching method is the integration of practice and research activities in learning process. In project teaching, the learning process becomes a creative and practical activity in which everyone participates, focusing not on the final result but on the process of completing the project. The project-driven method is applied to the course design of "Signals and Systems". Students are divided into several groups, each of which is responsible for some tasks, and the content learned in the class is applied and the design is completed through independent learning. The results of students' questionnaire show that students generally actively participate in inquiry learning and carry out project activities, and have high interest in project-based learning and good self-evaluation, which further shows that project-driven teaching mode is conducive to the cultivation of students' core literacy.

1. Introduction

"Signal and System" is an important professional basic course for undergraduates majoring in electrical information, and it is the core course of communication and information technology. With the in-depth development and wide application of information technology, it is more and more urgent to understand and master its basic theories, concepts and methods. However, due to the huge circuit, complex mathematical calculation, rapid development of components, special analytical methods and strong theoretical and abstract nature, there are practical teaching problems in the teaching process[1].

Project-driven teaching is a new advanced educational concept, which focuses everything in the education system on the achievements that students should achieve when they graduate to organize, implement and evaluate[2]. Learning initiative and learning interest are mutually reinforcing and complementary. Therefore, in order to stimulate students' learning interest and initiative, traditional teaching methods should not be adopted, and a new teaching method, project-driven teaching method, should be tried.

2. Teaching Concept of Project-Driven Teaching Method

"Signal and System" plays an important role in teaching, and it is a basic technical course to cultivate the analytical ability of "Signal and System". Signal and System is strictly theoretical, practical and closely linked, which is of great significance to help students develop a rigorous and scientific way of logical thinking, strengthen the spirit of innovation and strengthen engineering practice.

The outstanding feature of project-driven teaching method is the organic integration of "scientific research" and "practice". In the process of learning, the teacher's "teaching" is closely linked with the students' "doing", which constitutes a teaching mode in which the students' "doing" is the main part and the teachers' "teaching" is the supplement[3-4]. Its core is the implementation of the "project", not the final result of the "project". Through the project practice, students can

deepen their understanding of the knowledge and skills required by the course, feel the hardship and joy of innovation, and cultivate the thinking and methods of analyzing and solving problems.

"Project-driven" means that in a certain situation, teachers provide a real engineering project, and then let students design and implement the project themselves. "Project-driven" means that "project" is composed of multiple disciplines. With the teacher's guidance. Give a relatively independent project to students. Data collection, plan design and implementation are all completed by the students themselves. On this basis, the course content, course content, teaching methods, teaching methods and teaching methods are deeply studied. Adopting project-based teaching method can give full play to students' learning enthusiasm, initiative and participation, and make students play the role of teamwork in enterprises, improve students' entrepreneurial consciousness and creativity, and promote students' strong practicality in vocational colleges and avoid their weak practicality.

3. The Implementation Process of Project-Driven Teaching Method

3.1 Project Import

In the teaching of Signal and System, the project directly affects the teaching effect, so the project design and arrangement are very important. The selection of projects should be based on the content of teaching, take the realistic objects as materials, not only include basic teaching knowledge points, but also pay attention to designing some interesting, practical and feasible tasks according to the characteristics of students, so that students are willing to learn, love learning and enjoy learning, and can arouse their enthusiasm for solving problems [5]. For example, the application of EDA tool software. Teachers and students can participate in the selection of projects together, and teachers should pay attention to inspiring students to actively discover the materials around them and choose projects with suitable difficulty.

Set the general situation that runs through the whole project unit learning, put forward a series of core questions and arrange project tasks based on the situation, which is the main teaching thread of core concepts. Based on the core questions, we set up sub-situations and put forward a series of driving sub-questions, which drive students to actively learn and establish the concept of secondary positions at all levels. The setting of sub-situations and sub-problems needs to aim at solving the core problems and constructing the concept of secondary position. In the selection of projects, the whole course is divided into several projects, which are carefully designed into three levels of project content-basic projects, systematic projects and comprehensive application projects.

3.2 Teaching Process

In the interest introduction stage, teachers use multimedia teaching equipment to show examples similar to digital tubes in life through pictures and videos, such as the digital countdown of traffic lights, the scoreboard of ball games in sports, the scoreboard of entertainment programs, etc., so as to induce students to put forward more examples in life. Then create a situation, which leads to this task: making a ten-second countdown device [6].

After creating a situation and arousing students' interest in learning, the teacher put forward this task: making a ten-second countdown timer. The schematic diagram of the hardware connection of the modules used in the experimental board is displayed, leaving a short time for students to explore their own solutions. The whole teaching process is Figure 1.

The division of students' groups is an important step in the implementation of the "project-led task-driven" teaching method. There are two principles of grouping: one is that students can freely combine according to objective conditions such as interest and personality, and the other is that teachers designate groups according to their understanding of students' ability level. In this project, teachers make systematic deployment according to students' free grouping, and carry forward the principle of complementary advantages. Each group selects the module leader, who is responsible for overall arrangement, and each subtask is "contracted" to different team leaders to be responsible for the implementation and arrangement of the task. One subtask completion team leader becomes

an ordinary team member, and participates in and listens to the arrangement plan of the next subtask team leader.
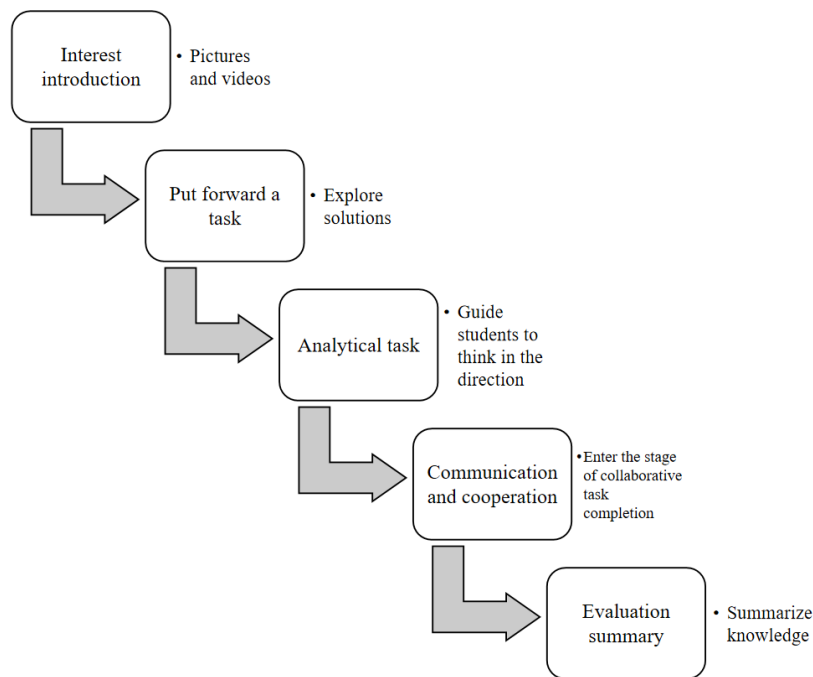

Fig.1 Teaching Process

Teaching related knowledge in combination with the project, and then teachers can successfully demonstrate the implementation process of sub-projects, and teachers can not demonstrate the outstanding students, so as to cultivate their self-learning ability and enhance their self-confidence [7-8]. After the students finish the sub-project, the teacher will summarize it from the perspective of project-driven. In the group practice, under the guidance of teachers, the students are led by the group leader to complete the project, which cultivates the leader's leadership ability and the cooperative spirit of the students in the group. Through the driving of the students in the group, the students with poor level improve their practical ability and stimulate their interest in learning.

3.3 Teaching Evaluation

In the process of project realization, the method of classroom teaching is no longer adopted, but the form of discussion is adopted. The learned communication theory knowledge is further verified by simulation. Students rethink and understand the problems of communication system in practice [9-10]. In order to evaluate students' learning effect, promote teachers to reflect on their own "teaching" and adjust in time, combined with learning objectives and academic quality standards, the author formulated a process evaluation scale for evaluating students' learning practice and a result evaluation scale for evaluating students' project results. Whether it is a process evaluation or a result evaluation, the sources of evaluation should be teachers, students themselves and other study groups. In this teaching design, teachers' evaluation weight for students accounts for 40%, students' self-evaluation weight accounts for 30%, and other groups' evaluation weight accounts for 30%.

4. Analysis of Teaching Effect

The author applies the above teaching design to the teaching practice of "Signals and Systems". In order to test the teaching effect of the project-driven teaching mode, the author makes an in-depth analysis of students' questionnaire survey and performance comparison, and interviews with teachers, so as to provide a basis for the implementation strategy construction of the project-driven teaching mode. Test the students' grades in two classes to find out their learning level.

Students use anonymous questionnaires to evaluate courses. Table 1 gives three aspects of the project for students to choose satisfaction. Satisfaction is divided into five grades for students to

choose from: very dissatisfied, dissatisfied, basically satisfied, satisfied and very satisfied.

Table 1 Students' Evaluation of the Course

serial number	question
Q1	Very interested in the project
Q2	Obtained communication knowledge and design ability
Q3	Overall satisfaction with the course

Figure 2 shows the statistical results of the satisfaction survey of the project, and 95% of the students filled out the questionnaire. The figure lists the statistics of three aspects of the project respectively. The survey results show that more than 80% students are satisfied with the project.
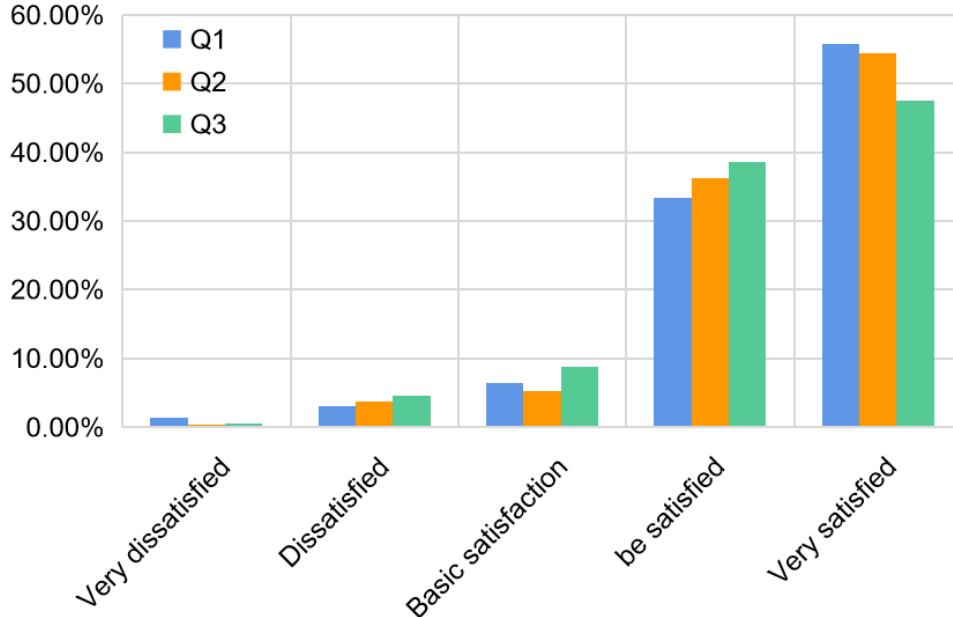

Fig.2 Statistical Results of Satisfaction Survey

The results of students' questionnaire show that students generally actively participate in inquiry learning and carry out project activities, and have high interest in project-based learning and good self-evaluation, which further shows that most students have recognized this teaching method. The interview results of teachers show that the project-driven teaching mode is beneficial to the cultivation of students' core literacy, but considering the professional ability of teachers and the heavy learning tasks of students, the implementation of this teaching mode is a bold challenge for teachers and students.

However, through these interviews and questionnaires, the author also found that students also encountered many problems in the learning process. First, students are greatly influenced by traditional teaching methods and still rely heavily on teachers' guidance. Second, students still lack experience and skills in project development, and some students lack confidence. Third, teachers need to further consider students' cognitive development level and simulation of the market and employment environment when choosing cases and projects.

The author believes that teachers should constantly update and improve teaching methods, select and design reasonable projects according to the objective situation such as students' feedback, and further optimize teaching while improving personal knowledge, teaching ability and level, so that students' ability can be improved imperceptibly.

5. Conclusions

Project-driven teaching involves a teacher proposing an actual engineering project in a specific scene and asking students to design and complete the project independently. Project-driven teaching includes many courses. Under the guidance of the teacher. Leave a relatively independent project to the students themselves. Students are responsible for information collection, scheme design and

implementation. Practice has proved that "project-driven" teaching mode is adopted in the teaching process of "Signals and Systems" course, and students' learning enthusiasm is high, their learning interest is strong and their learning objectives are clear. It not only improves students' learning effect and ensures teaching quality, but also exercises students' ability to solve practical problems and adapt to practical work quickly, laying a foundation for future employment. Therefore, the project-driven teaching mode is an effective teaching method. However, through these interviews and questionnaires, the author also found that students also encountered many problems in the learning process. Teachers should constantly update and improve teaching methods, select and design reasonable projects according to the objective situation such as student feedback, and further optimize teaching while improving personal knowledge, teaching ability and level, so that students' ability can be improved imperceptibly.

References

[1] Yang Xuerong, Cheng Siyuan,&Guo Zhongning. Teaching reform and practice of reverse engineering technology based on autonomous project. Experimental Technology and Management, vol. 33, no. 1, pp. 4, 2016.

[2] Sun Kexue, Guo Yufeng, Xiao Jian, Cheng Yong, & Cheng Xie Feng. Construction and Exploration of Engineering Practice Teaching System for New Engineering. Experimental Technology and Management, vol. 35, no. 5, pp. 3, 2018.

[3] Fan Yuxin, Zhang Ming, Xie Jingmei, Ma Shaohui, Guo Chenguang, & Yang Jing. Exploring the ideological and political construction and practice of medical imaging course based on online and offline mixed teaching. Journal of Practical Radiology, vol. 2022, no. 003, pp. 038, 2022.

[4] Xiao Xiaoqiang, & Ning Weixun. Exploration of cooperative practical teaching of "embedded system curriculum design". Computer Engineering and Science, vol. 40, no. 01, pp. 5, 2018.

[5] Zhang Guoqiang, Wang Bin, & Zhao Jing. Application of MATLAB and labvew in Signal and System Teaching. Experimental Technology and Management, vol. 2017, no. 34, pp. 148, 2017.

[6] Liu Mingqiu, Quan Zhexue, Ding Xiaoming, Yingming Wang, & Zhong Jiang. Exploration and Practice of Microbiology Curriculum Design Based on "Learning as the Center". Microbiology Bulletin, vol. 47, no. 4, pp. 10, 2020.

[7] Kai Qu. Teaching methods and research of numerical analysis based on curriculum ideology. Educational Research, vol. 3, no. 5, pp. 16, 2020.

[8] Wang Ling, Fu Han, Hou Qihang, Wang Shumao. Development of multifunctional rotor experimental teaching system based on virtual instrument technology. Experimental Technology and Management, vol. 37, no. 12, pp. 4, 2020.

[9] Zhou Mengfei, Cai Yijun, Liu Huayan, Xue Jilong,&Pan Haitian. Exploration and Practice of Project-based Teaching Mode Based on Competition. Control Engineering, vol. 27, no. 4, pp. 4, 2020.

[10] Liu Jiantao, Wang Xuan, Zhou Yumin, Lu Qingyan, Fu Lijun. Exploration and Practice of Project-based Experimental Teaching Based on Flip Classroom -- Taking the Course of Biological Comprehensive Experiment as an Example. Journal of Livestock Ecology, vol. 040, no. 004, pp. 89-92, 2019.