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TEACHING REFORM OF DATABASE COURSE FOR "OUTSTANDING ENGINEERS" EDUCATION IN CHINA

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Abstract

The database is an important software course of the Electronics and Information specialty. In order to solve the problem of traditional teaching, a teaching reform was carried out in the Electronics and Information specialty of Yangtze University, based on the "Plan for educating and training outstanding engineers" (P4ETOE) and "Strategic Emerging Pillar Industry Project" (SEPIP) projects. The teaching reform focused on three aspects:the theory teaching, the practice teaching, and assessment method. The teaching practicesof the P4ETOE and SEPIP experimental classes of Yangtze University, China show that our teaching reform is effective and successful. It comprehensively enhanced the students' practical engineering abilities and innovation abilities, cultivating them to be outstanding electronic engineers for the future.

Keywords:Excellent engineers;Teaching reform;Database course;Electronics Information engine -ering.

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1. Introduction

The "Plan for educating and training outstanding engineers" (P4ETOE) of China is a major reform program to implement the National Medium and LongTerm Education Reform and Development Program (2010-2020). It aims to train a large number of high-quality engineers,who have the capacities of innovation and meet the needs of economic and social development, for the industry, for the world, and for the future [1] [2].

The electronics and Information specialty of Yangtze University was approved for the "Strategic Emerging Pillar Industry Project" (SEPIP) led by Hubei Province government and P4ETOE led by Department of Education of China in 2012 and 2013 respectively. The database course is one of most important courses of the Electronics and Information specialty, which plays an important role in cultivating innovative and applied compound talent. However, there are many problems in the teaching of database course. Many students reflect it is hard to learn, and the teaching effect is not ideal[3] [4]. In order to solve the problems and improve the quality of teaching, we carried out a teaching reform in the aspects of theory teaching, practice teaching and assessment method, based on P4ETOE and SEPIP. The teaching practice of the P4ETOE and SEPIP experimental classes of Yangtze University showed that our teaching reform is effective and successful.

2. Reform of Theory Teaching Method

Database is a course with difficult theory and emphasis on practise. It is easy for student who facing a large number of concepts and difficult theoretical knowledge to lose their interest in study, if the traditional teaching method is used. So, we introduced a international advanced engineering education mode "Conceive, Design, Implement, and Operate" (CDIO) [5], which is a engineering design task-oriented, project-driven teaching method to develop the students' engineering abilities.

2.1 Using a project case as the main line

We use a medium-size database development case as the main line to integrate the isolated concepts and theoretical knowledge learned before. Students complete the tasks of submodule development, step by step, through the classroom learning, self-study, and interactive

cooperation. They can understand the role of the knowledge points in the whole project case under the guidance of the main line of the project case.

The submodules' name and its corresponding knowledge points, using the library management system as an example, are listed in Table 1.

Table 1. *Submodule of a project case and its corresponding knowledge*

Project Name	**Submodule Number**	**Submodule Name**	**The Corresponding Knowledge Points**
Library Management System	1	Requirement analysis and DB design	DB design theory
	2	DB information input module	Usage of SQL
	3	Simple and combine query module	Advanced usage of SQL
	4	Integrity check module	View and trigger
	5	DB Interface module	DB interface programming
	6	C/S mode DB system	C/S mode
	7	B/S mode DB system	B/S mode

2.2 Heuristic teaching

(1) Problem-oriented

Using the project case as the main line, we design appropriate questions to guide students learn the knowledge through explorative study and solving the practical problem. The reasonable designed questions can lead students to active thinking, active learning and building their knowledge structure gradually. Some of the questions are listed in the Table 2.

Table 2. *Examples of designed questions*

Submodule	**Designed Questions**	**The Corresponding Knowledge Points**

Number		
1	What informations need to be collected for requirement analysis? How to convert the result of requirement analysis into E-R graph? How to design the database structure according to the E-R graph?	Requirement analysis method, database paradigm theory, E-R graph
2	What is the syntax for data input? How to query the inputed data?	Basic usage of SQL
3	How to query the information of books, students, and student borrowing information?	Advanced usage of SQL
4	What is data inconsistency? How to ensure data integrity?	View and trigger
5	What are the database API? What are the advantages and disadvantages of them? How to write an database API program? How to improve the efficiency of database access using the stored procedure?	ODBC、OLE/DE database API, Stored Procedure
6	What is C / S mode? How to implement it?	C/S mode and its program
7	What is B / S mode? How to implement it?	B/S mode and its program

(2) **Group teaching**

Students were divided into several project groups, which consisted of 3 to 4 students, including a leader. The leader led the other members to complete the whole database system development process, such as requirement analysis, database design, view trigger and stored procedure design, coding, and testing. The Teacher acted as technical consultant and chief engineer guiding students to discover and solve problems. Through group teaching methods, the teamwork ability, engineering practice ability and innovation ability of students were cultivated.

(3) Interactive teaching

Sufficient time was reserved for the representation of a team to explain implementation process, analysis method of the problem, and resolving measures. Other students can actively ask questions, or put forward their own views. The teacher acts as a commentator. Every student could participate in the whole process of teaching and be motivated to learn through interactive teaching.

2.3Improving the CDIO abilities of teachers

The quality of teachers is the key to the success of CDIO teaching. Teachers should improve their CDIO capabilities by participating in software development projects, and training projects. Only in this way, teachers could guide students to analyze and solve the problems from the perspective of engineers, and share their engineering experiments to their students effectively and easily.

3. Reform of Practice Teaching

Practice teaching is critical helpful for training the basic skill, engineering ability, and innovation spirit of the students. It is important for the engineering education of colleges and universities [6][7]. There are some problems in the practice teaching of the database course, such as lacking of students' autonomy, insufficient interaction between teachers and students, irrational designed experimental projects, neglect of training the innovation ability and application ability of students. In order to cultivate students' ability of engineering practice, we optimize and adjust the experimental content and change the experimental teaching method, using a engineering task as the main line. The experimentswere divided four levels: basic experiment, design experiment, comprehensive experiment and course design, listed in the Table 3.

Table 3. *Multilevel Experiment System of Database Course*

Experiment Category	**Experiment Content**	**Main Teaching Methods**	**Develop Skills**
Fundamental	Demand analysis and database design; database	Teacher demonstrates at classroom, student self-	Deepen the understanding of

experiment	information input; database information simple query	study after class, Q&A during experimental class	the basic concepts, master the basic SQL syntax
Design Experiment	Integrity query; Integrity check; Database interface	Grouping, fully prepared for the experimental class, implementation and Q&A during the experimental class	Training students to analyze and solve problems, ability of the basic engineering
Comprehensive Experiment	C/S and B/S model database system design	Grouping, experimental class implementation, teacher on-site guidance	Training system design and analysis ability and engineering ability
Project Training	Course choosing system, online bookstore system, sports management system, student evaluation system	Grouping, Complete in two weeks, teachers on-site Q&A and guidance	Cultivate engineering practice ability and innovation ability

The basic experiment is mainly completed by extracurricular time self-study, which can not only solve the contradiction between experimental task and experimental time, but also can fully mobilize the enthusiasm and autonomy of students, exercise and cultivate students' basic programming ability, and lay a solid foundation for the follow-up experiments. The design experiment and the comprehensive experiment are carried out by grouping, which can train the students' teamwork ability and engineering practice ability, and also overcome the shortage of teachers in a certain extent. On the basis of the above three stages of practice, a two weeks dedicated time are spent to carry out curriculum design, which develops students' engineering practice and innovation.

4. Reform of Assessment Method

The traditional assessment method, which mainly depends on the final exam, is harmful to assess students' engineering ability. To ensure the effectiveness of teaching, we designed a diversified

assessment method, referring to CDIO standards, to assessthe students'basic personal ability, interpersonal skills, software development capabilities, and their theoretical knowledge.

The assessment method is described as following: (1) Dialy work, accounting for 10%, including attendance, homework;(2) Assessment for the learning process, accounting for 60%, which consists of the project self-assessment and teacher evaluation. The project self-assessment for each team member is conducted by the team leader according to the teamwork ability, practical engineering ability, innovation ability,assessment from other members. The teacher's assessment is based on the team's completion of the project, the effect of the project statement, and project report. (3) Final examination result, accounting for 30%, using the traditional examination methods, assessment of students' theoretical knowledge, ability of algorithm design and programming.

Through strengthening the teaching process assessment, we could control each teaching links, guide students to improve the autonomy of learning, and train theirabilities of teamwork, engineering practice, and innovation. The new assessment method could improve the teaching effectiveness by avoiding the students not study usually but drive a night car just before the final exam.

5. Conclusion

A systematic teaching reform was carried out from the aspects of theory teaching, practice teaching and assessment methods, based the P4ETOE of Chinese department of Education. The teaching reform was proven effective and successful by the teaching practice of P4ETOE and SEPIP experimental classes of Yangtze University in recent years. It comprehensively enhanced the students' practical engineering ability and innovation ability, cultivating them to be excellent electronic engineering engineers in the future.

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