Improving practice teaching by the project-type education mode

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ABSTRACT: The research presented in this article outlines the objectives and ability requirements for teaching English in engineering majors. The main objective is to develop high-quality, skill-oriented engineering graduates who pay attention to practical knowledge and cooperative communication in various circumstances. Several methods may be used for this purpose, such as English literature reading after school and a specialised course on the teaching process; carrying out project teaching of teamwork, advocating students' independent study; implementing project-type English teaching; and realising integration of engineering education mode with project-type teaching mode based on the principles of engineering education and efficient teaching. After a one-year practical teaching experiment on project-type mode projects based on the CDIO concept, for two classes of engineering majors, the results showed that the project-type education mode can improve students' practical ability, independent learning ability and teamwork capability.

INTRODUCTION

The engineering education mode uses the whole lifecycle of products, from a system production process and product research, to product operation, maintenance and, hence, there is the possibility to establish a project-type course system that is based on this life cycle, aligned with real life and supportive of the learning effort [1]. The engineering education mode ability outline and 12 standards are the two most important guide documents for the implementation of the engineering education mode. The engineering education mode is characterised by the following: a large engineering concept, attention to cultivation of comprehensive quality, close relations with industries and systematic reform of engineering education [2]. This mode enables students to learn about engineering in active and practical ways, and study how to apply professional knowledge in practice by systematic production and design flow of products. It also cultivates the students' personal ability, vocational ability, team coordination, and communication capability and comprehensive quality, e.g. the ability to conceive, design, implement and operate (CDIO) a product system in enterprise and social environments [2].

The engineering concept of the engineering education mode emphasises the cultivation of students' comprehensive ability and is closely related to industry, making it valuable to offer information on thoughts and methods, and acts as a conceptual mode [3]. Thus, it may be applied to specific conditions in practical teaching. In accordance with teaching modes, learning engineering major courses is difficult because much of the knowledge is abstract. Reading related professional knowledge and literature tends to bore students as they encounter difficulty in understanding and comprehending the content [4].

However, most major courses are taught by translating English textbooks word for word, which has many disadvantages. Engineering course teaching must ensure enough practical application. Nevertheless, realising this purpose through traditional education modes is difficult; thus, graduates have difficulty adapting to career demands. Most engineering graduates mastered basic knowledge and theories from their majors, but lack independent practical operability, teamwork and coordination ability, exploration and innovation ability, and comprehensive quality, which has impeded further development of science and technology industry [5].

In project-type teaching, students may choose groups and different research tasks freely to develop project research independently according to their interests, hobbies and skills, so as to cultivate their innovative spirit and ability [6]. Research on the engineering education mode not only complies with this trend of educational reform, but also cultivates engineering college students' practical ability and enables engineering major courses to be taught more efficiently.

Integrating engineering education mode and project-type teaching mode, motivates students to think, learn and explore by themselves [7]. Carrying out project-type teaching through four steps (conception, design, implementation and

operation) and enhancing students' ability to solve practical problems avoids various shortcomings of traditional teaching modes. Project-type teaching also arouse students' enthusiasm, initiative and responsibility sufficiently, and contribute to cultivating high-quality skill-oriented engineers who pay attention to comprehensive practical knowledge ability and cooperative communication. The present article recommends using specialised English in teaching oral language courses in engineering that integrate the engineering education mode and the project-type teaching mode to engineering major teaching.

RESEARCH OBJECTIVES

This research takes college engineering majors as samples, formulates the school's specifc CDIO education mode by combining it with the school's own demands and features after the engineering education mode CDIO has been introduced, and uses project-type course teaching and three-level projects as carriers. The course design focuses on the needs of engineering rather than the demands of the subjects. Hence, projects are used to connect courses in an integral process, so that students can have a strong learning purpose and pertinence. Implementation of three-level projects would further strengthen students' independent thinking ability and teamwork consciousness.

RESEARCH METHODS

The engineering education mode based on CDIO is applied to the course *Oral English Teaching of Architecture*, and the project-type English teaching mode is supplemented.

Conception: first, with respect to project selection, it relies on practical operability and *combining English teaching with productive labour*. One may combine these with projects in other major courses, and ask students to review (in English) their achievements in these courses. Entrepreneurial projects should be subjects all the time, wherein students may select projects according to their operating posts and work content, and combine English learning organically with the work.

Design: drafting a perfect project plan is necessary. teachers should search for relevant and related books and other literature, and students should try to read science and technology information using original texts, without translation. Students should search for literature and materials through case and project design, which requires them to find and summarise English materials independently. In addition, students should consider all the details in this step in advance to ensure that projects can be carried out successfully.

Implementation: in this process, the design is converted from a concept into a finished product. This step is an important transitional process in which all group members need to cooperate with one another in finishing the projects.

Operation: projects are evaluated through this process. Teachers may ask students to demonstrate their projects' practicality and applicability in an oral presentation in English, demonstrating the decision-making process. When showing their project cases, students should not only unscramble prepared materials, but also express their professional comprehension and opinions freely.

RESULTS

The objective of an experiment carried out during this research was to investigate the effectiveness of practical teaching, through randomly selected undergraduate students from an engineering pilot class in the 2011 cohort, and a regular class in the same grade, and administering questionnaires on comprehensive ability evaluation. Forty questionnaires were distributed to the regular class, and 36 valid responses were collected. Similarly, 40 questionnaires were disseminated to the pilot class, and 38 valid ones were collected. At the same time, 21 questionnaires were distributed to teachers who taught both the pilot class and the regular class, and all 21 received were valid. Student-edition questionnaires on comprehensive ability evaluation contained basic personal information (sex, age, class and student number).

This evaluation was based on 25 items, classified into four aspects: personal ability and attitude, vocational ability, professional ethics, and teamwork and communication. Scoring according to grades was carried out, with scores 1-4 representing *rather bad*, *ordinary*, *good* and *excellent*, respectively. Students evaluated situations by themselves and their classes in each item, respectively. The principal statistical indices were four evaluative dimensions of the scale. Except for personal information (sex and post), other evaluation dimensions and statistical indices of teacher-edition questionnaires on comprehensive ability evaluation were the same as those of the student-edition questionnaires, which evaluated situations of the pilot and regular classes that such teachers taught in each item. This research tested randomly selected students and teachers collectively and used SPSS15.0 software for statistical analysis.

This research adopted homogeneous reliability (α coefficient) and split-half reliability to investigate the reliability of the student- and teacher-editions of the questionnaires on a comprehensive ability evaluation. Statistical analysis using SPSS15.0 software indicated that the three types of questionnaires have a high homogeneous reliability and split-half reliability, and comply with basic theoretical requirements.

Table 1: Reliability indices of questionnaires on comprehensive ability evaluation.

Reliability	Students' evaluation of themselves	Students' evaluation of their classes	Teachers' evaluation
α coefficient	0.919	0.966	0.948
Split-half reliability	0.824	0.816	0.821

As shown in Table 2, the self-evaluation of students from the pilot and regular classes was not significantly different among the four above-mentioned dimensions. The reason for this result may be that the self-evaluation of the students was not objective enough. Moreover, the evaluation of the students reflects self-aggrandisement. Thus, this group of data can only be considered to be informational.

On the basis of the students' evaluation of their classes in the four dimensions, the evaluation of the pilot class is obviously higher than that of the regular class. This result indicates that the students from the pilot class have a strong collective consciousness about their own class. Collective and mutual relations were more harmonious in the pilot class than in the regular class, and the students approved of the ability of one another to a large extent. This result may be due to the effect of project-type teaching mode on students.

Independent-sample *t*-test was used to analyse the comprehensive ability evaluation of the teachers on the pilot and regular classes. The corresponding results are shown in Table 3. The teachers thought students in the pilot class were better than those in the regular class on the basis of the four dimensions (Table 3).

These results suggest the higher objectivity of the teachers' evaluation. The teachers involved in the evaluation taught the two classes simultaneously and observed differences in student performance between the two classes. This result confirms that the comprehensive abilities of the students in the pilot class have been generally approved by the teachers.

Table 2: Comparison between students' self-evaluation and evaluation on class in the pilot and regular classes.

Evaluation object	Evaluative dimension	Pilot class (33)	Regular class (45)	*df*	*t*
Self-evaluation	Personal ability and attitude	3.13 ± 0.07	3.07 ± 0.06	82	0.48
	Vocational ability	2.91 ± 0.10	2.77 ± 0.08	81	0.87
	Professional ethics	3.43 ± 0.06	3.21 ± 0.06	81	1.79
	Teamwork and communication	2.98 ± 0.11	3.01 ± 0.05	82	-0.42
Evaluation on class	Personal ability and attitude	3.43 ± 0.05	3.09 ± 0.05	81	3.10**
	Vocational ability	3.24 ± 0.06	3.03 ± 0.07	82	1.46**
	Professional ethics	3.52 ± 0.08	3.10 ± 0.09	81	2.34**
	Teamwork and communication	3.41 ± 0.07	3.02 ± 0.07	82	2.85**

Table 3: Comparison between teachers' evaluation on the pilot class and the regular class (M ± SD).

Evaluative dimension	Pilot class (21)	Regular class (21)	*t*
Personal ability and attitude	3.16 ± 0.28	2.06 ± 0.35	12.99***
Vocational ability	3.08 ± 0.37	2.11 ± 0.32	11.14***
Professional ethics	2.96 ± 0.22	2.17 ± 0.58	6.52***
Teamwork and communication	2.88 ± 0.29	2.02 ± 0.31	9.69***

Note: *p < 0.05, **p < 0.01 and ***p < 0.001

Students from the engineering pilot class had significantly different engineering education modes and current talent cultivation modes. Specifically, the educational concept of the mode is to promote the comprehensive development of the people, and its teaching objective is to cultivate the comprehensive quality of the students. Results of the investigation of the engineering ability of engineering students have shown that the ability of the students will be noticeably improved by taking up one more year of engineering education.

The evaluation results of the students and teachers were higher in the pilot class than in the regular class on the basis of the four aspects. Hence, this research sufficiently proves that the implementation of the engineering education mode has a considerably positive effect on students. Significant differences in knowledge may be determined at school, whereas differences in concept mastery and application can only be identified once students work in industry.

ANALYSIS

The innovative thinking of students is developed during the project conception stage. With regard to project selection, students can master rich professional research tasks and comprehend the latest information about their chosen topic in the international arena. During the project design, students can improve their preciseness, carefulness, as well as their

planning and logical abilities. In addition, a plan related to their own majors can enhance the writing ability and language comprehension of students.

Meanwhile, the communication of the project process and its effectiveness can enhance the design and professional sense of engineering work in students. During the project implementation stage, both students and teachers are challenged and trained. In fact, project implementation is a step of learning and harvesting, during which students may often repeatedly encounter failure and bottlenecks.

However, this process can arouse in students the spirit of brave exploration and practice. Undoubtedly, this process helps students accumulate practical experience and expand their classroom knowledge. In project operations, excellent students may exert themselves and increasingly draw the attention of teachers and industry representatives. This process may narrow the gap between students and their future employers.

Furthermore, project-driven methods allow each group member to have an equal chance to participate and communicate. Cooperation increases the confidence of students in learning and achievement, reduces tension, cultivates a sense of responsibility and of group pride, and drives them to accept teaching subjectively. Presentation of the projects enhances the communication ability and expression capability of students and allows them to express their own ideas clearly. Moreover, this teaching mode can arouse the enthusiasm of students for English learning.

An active classroom atmosphere increases the number of students who are willing to participate in classroom discussion and communication. The mode of classroom communication can create an atmosphere in the class where all students finish teaching projects, enabling them to discover their potential, increase their confidence, communicate using the knowledge they have gained, improve their English presentation and communication skills, and cultivate their sense of group honour and team spirit. Finishing a series of thinking and related activities focusing on related themes and problems in text reinforces the previous knowledge and experience, encourages the exploration of new knowledge actively, and inspires the probing of problems from many perspectives and in many aspects.

CONCLUSIONS

This concept of engineering education emphasises *learning by doing* and highlights the importance of practice in enhancing engineering abilities and knowledge acquisition. Professional English fluency and the ability to attain domestic and foreign professional knowledge rely on practical projects.

The direction of professional engineering teaching, including all teaching of engineering courses, is to avoid the complacency and reliance on traditional engineering teaching modes, and to substitute them with the cultivation of students' cooperation in teaching, deepening students' perceptual knowledge about professional English learning processes and keeping a foothold on reality. It permits the development of a relationship between students and employers who are familiar with work environments and business processes, as well as solving practical problems.

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