Application of new quality training modes to engineering colleges

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ABSTRACT: Quality-oriented education is a core teaching strategy with which to develop skilled staff in the new century. It is highly significant as a means of cultivating talent. New quality training modes have been applied widely in all institutions of higher learning, since they were proposed. The training at engineering colleges focuses on the excellence of knowledge about engineering majors. The study carried out for this article was based on teaching using implicit and explicit team-teaching methods and by treating engineering students' courses as being about more than engineering. According to the results, it is shown that the new quality training method based on implicit and explicit team-teaching can improve both the teaching effect and students' enthusiasm and, in the process, enhance the overall quality of students. This research is of value to similar colleges that are developing quality teaching.

INTRODUCTION

Social demands, the subject itself and students are three factors that have a significant impact on engineering education. Since thoughts and attitudes toward engineering education can vary from college to college, their education systems may differ and, as a result, the students they cultivate also will be different [1]. Thus, the educational system in its training will reflect this variation by locality.

In order to develop college students' personality, treating students as subjects in themselves should be an important feature of engineering education [2]. The proposition is that college students should not be treated simply as a rational tool, but as *real* engineering students possessing a temperament and various accomplishments (e.g. literary) shaped by professional ability [3]. The educational goals of engineering colleges are to train college students to be knowledgeable and to have all-round skills, so as to adapt to the changing demands of society. Quality-oriented education elevates engineering education from simply a tool for training into a system that trains students to become professionally talented, with personalised values and accomplishments [4]. Therefore, engineering education must include aspects of social sciences and related interdisciplinary knowledge.

The development of education is the main force that has promoted China internationally. The driving aim of education in the new century lies in competing on quality. As early as the 1980s, the educational reform movement in China resulted in a pilot quality-oriented education project in colleges [4]. Especially, since China's third national conference on education in 1999 led to the guide: *Decisions of the Central Committee of the Communist Party of China and the State Council on Deepening Educational Reform and Advancing Quality-oriented Education Comprehensively*, quality-oriented education has been considered important [5].

After more than 20 years, quality-oriented education has been included in the *Education Law*. Hence, it is a standard that the Chinese educational system must comply with. There is a large body of successful experience and achievements [6]. However, there is now an imbalance in quality-oriented education, between regions and even between subjects. At the same time a heavy burden is upon students in the form of classwork and homework, which is driven by the need to achieve. Therefore, it is difficult to put quality-oriented education into practice. This is, especially, so given the engineering colleges focus on excellence in subject teaching. This benefits students, but at the expense of other aspects of quality, such as preparedness for the demands of industry, which means students are not fully developed [7].

In an effort to find solutions to the problems raised by quality-oriented education, a number of colleges have embarked on further reforms. These include the introduction of *people-oriented* teaching and exploring new teaching methods. Also, implicit and explicit team-teaching is drawing much attention from both Chinese and foreign scholars. The concept of implicit and explicit team-teaching was put forward by the psychologist Reber and his colleagues [8].

Implicit learning refers to the process by which students subconsciously acquire knowledge without, for example, absorbing it by consciously sitting down with textbooks or formally being presented with the facts by the teacher. Explicit learning is the opposite process, where students acquire knowledge through conscious means, for example, by way of formal learning with textbooks and lectures. Subconscious, spontaneous and passive implicit learning combined with conscious and purposeful explicit learning, can dramatically improve teaching [9].

Research shows that implicit and explicit team-teaching is a method that improves teaching and, while such research has focused on the teaching of professional courses, few scholars have carried out research on students in quality-oriented education. Noting this, research reported in this article was carried out using a selection of freshmen from an engineering college in China. The research project lasted one semester during which a new quality training mode was implemented, with the aim of measuring the effect of this new mode.

NEW QUALITY TRAINING MODE FOR ENGINEERING STUDENTS

Students from engineering colleges are often weakly developed in the humanities, non-popular music and aesthetics. In the example discussed in this article, the students appeared rarely to have contact with non-popular music and showed little interest in it. To develop quality-oriented education for this type of student, schools should compel them to take quality-oriented subjects as electives for which they earn credits. But, students also should be treated within these schools as *subjects* (or *people*) to be encouraged to actively take part in the quality training course through their own interests and personal hobbies. The college, where the research reported here was carried out, ran such a training experiment and explored new ways in which students could take part in quality training. The focus of the experiment was musical education and research into musical education guided the work [9].

Student Musical Associations

Musical extra-curricular activities have much content and take various forms. They are an important way in which colleges can implement music education. Nowadays, students in China generally show much enthusiasm for musical groups, with relatively free organisational forms, such as found in musical associations and bands. Associations are an important vehicle for students who wish to take part in group activities. In musical associations, students may freely find things they are interested in and can communicate directly with like-minded friends. By the method of mutual mobilisation and mutual promotion, students' enthusiasm and initiative for learning can be aroused. Teachers or senior students can be asked to hold posts in the associations. These associations have entertainment, a low level of stress, and are a specialty, all at the same time. The advantage for students is that their enthusiasm for learning is boosted when they admire the leaders in post. It is essential to organise activities, such as parties and contests. As well, activities can be organised with other associations, thus, enriching students' musical life.

Internal and External Activities; Connecting Teaching with Life

A requirement of the new quality training lies in its teaching using lively activities both in the classroom and outside. This requires teachers to be aware of students' lives as lived outside the classroom; thus, ensuring the classroom teaching can be connected to their private lives. In the current situation, students' musical experience is mainly popular music and musical tracks from films and television. They have little opportunity to attend concerts. In classroom teaching of music, the content should not only focus on the subject material, but also contain popular elements, so as to increase both the vitality of the teaching and to connect with the times. For instance, when teaching classical music, a current popular work could be included for comparison, e.g. Jay Chou's *Blue and White Porcelain.* Students' will find this entertaining even while helping to achieve the desired teaching effect.

Teaching Methods

New training methods on quality for science and engineering students that include music, should make use of several tools and develop the relationship between music education and other subjects. Of course, this relationship may not be obvious. However, it is possible to develop an awareness of the relationship using multimedia, for example, which provides useful audio and visual tools. Multimedia teaching can use music, film and animation to replace traditional blackboard-type teaching. Based on traditional teaching, but adding classroom interaction, there are forms of teaching that include students' teaching sessions and team discussion, which stimulate involvement.

Multidisciplinary Teaching

Subject knowledge is often connected to other subjects through multiple relationships, e.g. music and culture, music and psychology, music and therapy, computers and music, tourism and musical culture, acoustics and music. Through multidisciplinary teaching, students can make use of their musical knowledge in learning other subjects. This can not only broaden their viewpoints, but also help students to better learn the connotations of the music subject. As an example, writing music for classical poems, which when sung can enhance students' memory of the poems, assisting students in understanding language and enhancing students' understanding that music can spread emotion.

EXPERIMENTAL CONTRAST TEACHING METHOD

Analysis by Means of Experimental Contrast

Group A was the experiment group. For this group, implicit and explicit team-teaching was used according to the methods for engineering students' quality education. Group B was the control group, where traditional teaching methods were used, viz. a simple classroom explicit-teaching method. The structure of Group A's teaching is shown in Figure 1.

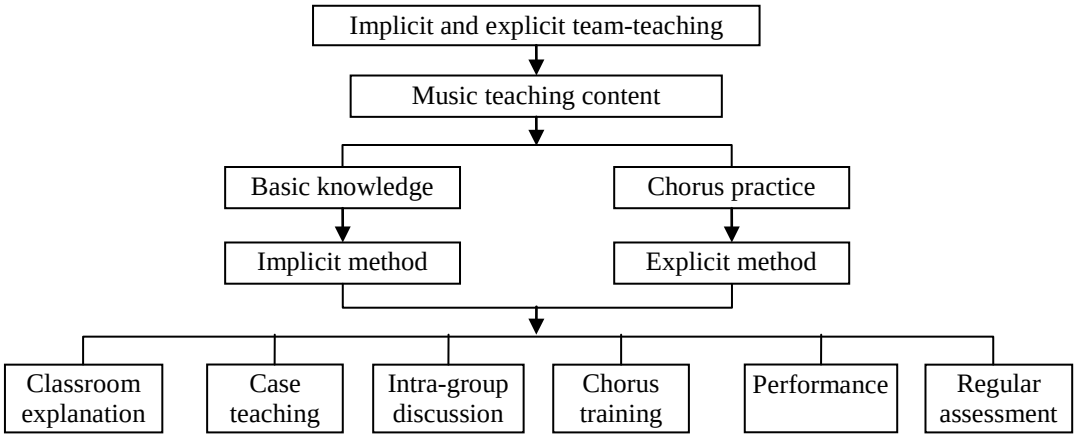

Figure 1: Content of the implicit and explicit team-teaching for Group A.

The following actions for this Group are:

- *Classroom explanation of basic knowledge.* Classroom explanation of the basic knowledge about choruses. It is used to explain methods and skills related to choruses. By means of the teachers' techniques, the learning acquired from tasks can be converted into students' implicit knowledge and, thus, they pick up the basic content of the course.

- *Case teaching of choruses.* Contrast an unsuccessful chorus with a successful chorus. Teachers explain the reasons for failure and success by analysing the artistic effect of choruses. At the same time, through group discussion, students enhance their comprehension of choruses.

- *Master basic knowledge, organise students into groups that take part in a practical choral exercise.* Enabling students to carry out a choral exercise will enhance their knowledge. The choral activity will allow students to apply knowledge to better understand how a chorus works. Teachers should be able to determine the skills of their students during the choral performance and provide feedback. This subconsciously develops students' awareness of choral culture by engaging them in realistic practical training. The resultant effect will be for students to internalise the experience, thus, boosting their skills.

- *Organise students into attending choral performances.* By attending performances, students have an opportunity to strengthen their practical skills and to feel the beauty and pleasure brought about by the performance of a chorus.

- *Carry out regular assessments using an open evaluation system.* Assess students on basic knowledge and practical choral ability. Point out their shortcomings and encourage them to correct their mistakes.

- *Research objects.* The engineering college selected for this study is a member of a second tier group of universities in China, whose student population is sourced countrywide. They have demonstrable abilities in logical thinking and engineering. Engineering and science majors include mathematics, physics, chemistry, professional engineering and the like. These students are exposed early on to courses with a high level of difficulty. Meanwhile, the number of students conducting study through a *green channel* (i.e. a means of applying for study) is large since most students are from families located in an area that is economically undeveloped. These students before attending colleges rarely come into contact with disciplined knowledge, apart from science, so their ability is poor in subjects such as aesthetics, music and humanities. Two classes in 2012 were selected from the same major, Class A and Class B, with 50 students in each. The male to female ratio for the two classes was about 4:1 and students were aged 16 to 22, with an average age of 17.5. Statistical analysis at the significance level $p = 0.05$ determined that the students in the two classes were not significantly different in age, sex ratio or performance in the entrance examination. Class A and class B formed the experimental group and control group respectively for comparative analysis.

- *Selection of teaching courses:* The engineering college established quality-oriented education for students in 2008 and introduced *public elective* courses that included college Chinese, physical education and music. Such public elective courses are popular in the school for students from Grade 1. For the research, the author established a music quality-oriented education course named *Chorus Course for College Students* at the school and used it as the teaching course for this experiment.

- *Evaluation of the experiment:* Performance assessment was by written examination for theoretical knowledge and a chorus activity. A questionnaire was used to investigate the effect of the classroom teaching. The results from the questionnaire were used to assess the students' interest in learning, attention, classroom interaction, the degree of comprehension and singing skill, through a five-point Likert scale. The five levels are very good, good, ordinary, bad and very bad, which were recorded as 5, 4, 3, 2 and 1 point, respectively.

RESULTS

After one semester's teaching, students in both Group A and Group B were assessed. SPSS 19.0 software was used for the statistical analysis. Performance of the two groups in the written examination and chorus is shown in Table 1.

Table 1: Assessment of the control group and the experimental group.

Group	Performance in written examination	Performance in chorus
Experimental	80.25	86.23
Control	74.42	69.16
p	< 0.05	< 0.05

According to Table 1, the average score of the experimental group in the written examination and chorus was 80.25 points and 86.23 points after one semester's assessment, respectively, while the average score of the control group in the written examination and chorus was 74.42 points and 69.16 points, respectively.

These results show that the performance of the experimental group in the written examination, after the implicit and explicit team-teaching was higher than that of the control group by 5.83 points (7.2%), and its performance in chorus was higher than that of the control group by 17.07 points (19.8%). Thus, it can be seen that implicit and explicit team-teaching can improve course performance in learning of both the written examination and chorus. However, compared with the performance in the written examination, that of the experimental group in the chorus was higher than that of the control group by about 14%, which indicates that implicit and explicit team-teaching can improve the quality of students' overall learning and to a large extent convert their implicit theoretical knowledge into subconscious practical ability. As a result, students' practical performance in chorus can be greatly improved.

Table 2: Teaching effect of the control group and the experimental group (by questionnaire).

Group	Learning interest	Attention	Classroom interaction	Understanding of knowledge	Singing skill
Experimental	4.56	4.21	3.98	4.23	3.86
Control	3.01	3.53	3.14	2.98	2.64
p	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Table 2 shows that there is a large gap between the score on the teaching effect of the control group and that of the experimental group. By analysing the difference in scores between the experimental and control groups for each teaching item in the questionnaire, a comparative figure was obtained, as shown in Figure 2.

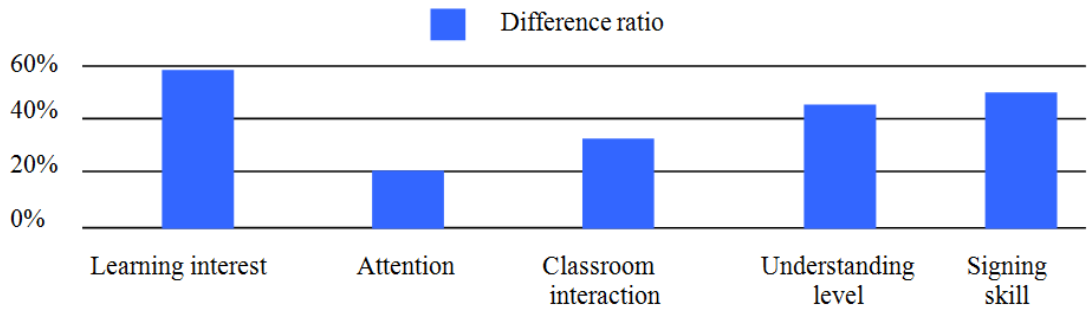

Figure 2: Difference ratio for each item for the experimental group compared to the control group.

For all items, the higher score was for the experimental group. Hence, Figure 2 shows the superiority of the experimental group over the control group. The difference ratio of *interest in learning* was the highest among all the

difference ratios, i.e. the experimental group's interest in learning improved by 50% compared with that of the control group. The reason was that the music itself aroused students' interest. By comparison, the *cramming* method of teaching, which has been used for a long time, weakened enthusiasm for the subject. Also, engineering students lacked confidence to learn music and showed little interest. However, after applying implicit and explicit team-teaching, the teaching content improved and the introduction of various types of activity increased the students' interest. Promoting communication among students through intra-group activities can inspire interest in learning.

There is least difference in *attention* between the two groups. The score of both groups was above 3.5, which is satisfactory. This implies that engineering students are careful in their approach to learning music and are well able to take part in classroom interaction. However, teachers' active understanding of the learning of the students and their attention to, and correction of, students' problems and mistakes also is effective in improving students' level of understanding. Thus, it was found that the experimental group's grasp of the subject knowledge was much improved, compared with the control group.

With respect to skills in singing: *ab initio* engineering students' skills are weak and traditional teaching does not much improve this. By comparison, the experimental group improved in *skills in singing* and had a higher score than the control group's score. This is a result of the team-teaching method, choral practice and students taking part in various activities.

The guidance of the teachers also contributed to the overall result. The results of the study show it is essential to ask students to take part by written and oral work; introduce various methods to encourage students to apply the knowledge they have learned; make them master skills required by quality-oriented education and improve their comprehension of basic knowledge.

CONCLUSIONS

Modern technology develops rapidly and influences engineering majors. Subject differentiation, as well as integration, requires co-operation about collaborative technologies. Teaching that changes engineering students' views about knowledge can arouse students' interest in learning.

In summary, it is suggested that researchers in education should change the engineering education mode *that is limited to technology* and ask students to combine humanities with engineering knowledge, so as to cultivate high quality engineering talent.

ACKNOWLEDGEMENTS

This work was supported by the Project of Higher Education Reform Research Project of Hunan Province (284) and the Project of Hunan Provincial Social Science Fund (13YBA11).

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