The Investigation of research-teaching model for undergraduate students

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Abstract

Nowadays, the research-teaching models of high education are highly developed in Chinese universities. However, many common problems are presented in these teaching processes, which are mainly three types of problems as bellows: 1. teaching evaluation mechanism; 2. creative teaching training for teachers; 3. teaching management model. The reasons of these problems are analyzed in this paper. According to several research-teaching methods，three types of research-teaching models are applied in the course Measurement Technology, which are the combination of theory and practice, the design of opening experiments, and undergraduate students integration into researching topics. These research-teaching models are proved practically to be effective methods for improving creative and practical ability of undergraduate students.

Key words： Research-teaching model; Creative teaching; Teaching model; High education

1. Introduction

Near the year of 2000, the research-teaching model is presented in Chinese high education. At the year of 2005, Chinese Ministry of Education published an Announcement about: “Several suggestions about improving the teaching work of undergraduate students”. In this bulletin, the research-teaching is presented in high education and the creative ability should been trained. Furthermore, a government document, named “Several suggestions about comprehensive improvement of high education quality”, gives the definition of research-teaching as follows: the creative teaching method should been implemented. Additional, the heuristic, inquiry, discussing, and participatory teaching should been advocated.

In the recent years, many Chinese universities, especially these universities in Project 985 and Project 211 are reforming teaching model and promoting research-teaching method. However, what’s about the effects? Are these research models fit for undergraduate students? How many research contents are integrated into class teaching and weather the students like these research contents? A large number of questions should be considered by the teachers advocating the research-teaching model.

2. Problems of research-teaching

The combination of teaching and research method is not been promoted widely, and the research-teaching model is difficult to be realized. Three factors of such situation are discussed in this paper as follows: teaching evaluation mechanism, novel teaching training for teachers, and teaching management model.

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2.1 Teaching evaluation mechanism

Nowadays, most of the teaching evaluation mechanism aims to the traditional teaching method, but not to the research-teaching model. Thus, the unreasonable teaching evaluation mechanism delays the popularization of research-teaching model. The evaluation objects mainly focus on the teaching plan, curriculum testing method, class preparation, students' evaluation, and supervisor classroom observation in the teaching evaluation mechanism now. Even most of the universities require of evaluating students' knowledge, ability, and professional skills. Actually, the evaluation focuses on the knowledge and credit, but not on the ability. This will result in the phenomenon of high scores with low abilities. It is no use for students' creative ability and resolving actual question ability. It is the primary difference between Chinese university and famous American university.

The teachers in the university works hard to pass the professional title evaluation and to sign the next job contract. Thus, keeping the teaching process in normal status is sufficient, but not caring weather use creative teaching model or integrating research into the teaching process. Most of the universities still not require the teachers about the ratio of creative teaching, which will reduce the initiative of research-teaching reformation. Some teachers are not willing to improve teaching contents, perfect teaching methods, and enhance classroom teaching quality. It will influence the development of research-teaching model.

2.2 Creative teaching training for teachers

Most of the teachers are not trained very well in creative teaching method. They just were trained in teacher induction year, and the training contents were limited in several courses as Education, Teaching psychology, and Education law. As to the creative teaching or research-teaching model, it is almost equal to zero for most of these teachers.

Nowadays, some Chinese teachers are supported by China Scholarship Council and visit in some famous American universities or in some European universities. They learned some new teaching model and methods which are very useful to improve students' ability. For example, the traditional exercises are not assigned to the students, but substituted by comprehensive practices for resolving actual problems. The comprehensive practices need use many courses and relative knowledge, and the resolving process includes model setup, calculation, programming, experiment, and deduction. However, many teachers don't wish to use creative teaching method in their teaching process because most of the students are not good at resolving these problems and the final examination looks like the best method for checking students' study.

For the university managers and educational administrators, they maybe not support such creative model because it will change the traditional working style and product new workload. Thus, those teachers visiting abroad universities have many creative methods but are not able to execute into their teaching processes.

2.3 Teaching management model

The teaching management model of universities is not desirable for the research-teaching requirements. Many universities still have not systemic, specified management method of research-teaching; still have not management institution of supporting teachers to develop research-teaching; and still have not protective regulation of encouraging students to engage in research. For example, many universities don't require how much proportion of the courses should be the research-teaching type; don't obviously require the teachers should advance the research-teaching for their workloads and professional titles; and don't require the students to choose some ratio research-teaching courses.

Above cases will result in the teachers to be lack of research-teaching positivity. Furthermore, students also have not enough interesting in the research-teaching courses. Actually, all these things should be formed the regulation or the rules. Universities should set up a managing mechanism include: target management

system, work running mechanism, service protecting method, achievement estimating rule, and guidance stimulating mechanism.

3. Method exploration of research-teaching

According to above problems, we will discuss the research-teaching method which has been applied in the course Measurement Technology in this paper.

3.1 Combination of theory and practice

In the teaching process of course Measurement Technology, the practical contents and creative thinking model are introduced into the teaching process. Measurement Technology is a professional basic course which includes measurement system composition, working principle, sensors application and so on. The knowledge is highly associated with engineering. In the teaching process, we design several experiments as signal synthesis and decomposition, sensor static characteristics and dynamic characteristics, strain gauge sensor, capacitance sensor, and inductance sensor. Students can well understand the working process of measurement system, signal and sensors after finishing these experiments.

In the teaching process, we utilize the software Matlab to simulate the signal processing and use the 3D software Solidworks to plot the sensor structures. These teaching materials integrated with PPT help students to learn the course well. For example, when discussing the capacitance sensor, the gap-change type and the area-change type are made into animation to show its work principle.

In addition, when teaching the measurement system, we require students to observe the daily life example of measurement system and to explain the example according to the structure of measurement system. When teaching sensors, students are required to find sensor materials in websites and design a novel sensor that is not presented in the textbook. Furthermore, the working principle, technical parameters, and application of the designed sensors should be introduced on the platform. The teaching and the practice are integrated very well which will stimulate initiative and creative thinking of the students. Comparing with the traditional teaching model, the research-teaching model will highly improve the study interesting.

3.2 The design of opening experiments

The opening experiments, distinguishing with traditional experiments, have no designed steps, process, and results which just provide students test components, wires, resistance and capacitance, amplifier, bread board, electric power, sensors, data acquiring card, industrial computer and so on. Students are required to test someone parameter such as temperature, pressure, or distance.

This type experiment is a challenge to students because students should find the specification materials about the sensors, set up the test circuit, learn the principle of data acquisition, and study the signal transmitting method. Then, they should construct the manipulating circuit of sensor by using bread board, wires, and components.

Generally, students will spend one week to finish such an opening experiment. They will show big interesting and achievement after they finish it. In all, doing the opening experiments is good research-teaching method which will improve their practical ability and creative thinking.

3.3 Undergraduate student integrating into research topics

In the teaching process of the course Measurement Technology, we provide several topics which are connect with the research topics in our research group. These topics are as follows: 1. the point control using

3D motion platform; 2. signal acquisition and manipulation of a gyroscope; 3. signal acquisition and manipulation of a temperature sensor; 4. signal acquisition and manipulation of a PSD sensor. These topics will assist the undergraduate students to use the knowledge of Measurement Technology into practical research process.

These topics require the students to learn the working principle and to know the specification such as the test range, resolution, test environment, output signal type, and interface type. Furthermore, the students should know the parameters, interface, install type, and driving mode of the acquisition card. They should connect the sensor and the acquisition card and program the code in order to obtain the correct sensor data.

The research period is two months. During the period, the students always take part in the research works with high interesting. They find research materials, study data acquisition card and motion control card, program application code, measure and manipulate the sensor data. Our research groups discuss the topic process with the undergraduate students and arrange the work contents in the coming week. They utilize the knowledge of the course Measurement Technology into the practical research works very well. In the end, we extract two segments of the report that the students submitted as follows: 1. “This research experiment gives us many enlightenment and stimulates our interesting. We hope learn more other type sensors, research the sensor principle, and develop some novel type sensor during our graduated study time.” 2. “Thanks our teacher to give us a good chance to study sensor with graduated students. We have a great achievement in the research topic and learn the course Measurement Technology more clearly.”

4. Conclusion

In all, several conclusions are shown as follows according to teaching practice in many years.

1) University should provide reasonable estimating mechanism, and encourage young teacher to develop research-teaching model. Some ratio research courses should be designed in the course arrangement. The students should choose the research courses more than 30% proportion.
2) The teachers should take part in the creative teaching training and communicate each other periodically. Those teachers who are not willing attend the creative training should be encouraged to join into it.
3) The teachers should develop different types of the research-teaching models. The students actually like the creative teaching model because it will improve their practical abilities, stimulate their study interesting, and increase teaching effects and quality.

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