

Research Course Teaching Model in Nuclear Magnetic Resonance

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Abstract—The different understanding of the research course is analyzed in this paper. Based on the essence of its concept, we delve further into the idea of the research course teaching model and the development of target for emotion, knowledge, and ability. Meanwhile, the theory of research course teaching model is applied to nuclear magnetic resonance course to show the establishment of the teaching mode is beneficial to the reform of NMR teaching strategy. In addition, it is also an effective way to realize the improvement of the overall quality. This teaching model can be help to set modern educational concept and to realize university educational objective.

Keywords—research course; teaching model; nuclear magnetic resonance

I. INTRODUCTION

There is no doubt that cultivating high quality talents with innovative spirit and practical ability is the focus of university education in the era of knowledge economy. Quality education has been put on the agenda. Responding to quality education, the priority is to change the stiff rigid educational pattern, which is that teachers give emphasis on knowledge and skills training, while students accept the knowledge passively. The educational pattern we pursued is to make students form active exploration of knowledge and pay attention to solving practical problem. Inquiry learning, which is put forward by J.J. Schwa, a professor in University of Chicago, emphasizes that students participate in rigorous academic creation activities under the teacher's guidance. Discovery Learning, proposed by Bruner J, a Harvard University professor, asks students to think and to explore like a scientist, to find the structure and conclusions of teaching materials and do regular learning. In the late 1990s, there were many different disputes on the distinction between research course and research study in China. Someone consider that research course is limited to the course, which means learning activity, or the course; while the research study permeates in the activity as a kind of study way. Besides, there are some compromises, such as research learning course, research learning activities, etc. Actually, it is meaningless to make a distinction strictly between these concepts. On the contrary, too much definition will be a hindrance to create a rich and colorful curriculum model for various schools. The problem needed to be solved urgently is the understanding of course and the construction of the new teaching model.

From the perspective of course function, the structure of the university education can be divided into basic courses, extended courses and research courses. Being different from the others, the research course should be understood from a broad sense. It refers to a learning method which aiming at developing the spirit of innovation and practical ability with the guidance of the teacher. The students select and determine the research topic from the study life, take the initiative to acquire and apply knowledge, then solve problems. There are four points needed to be underlined about this concept. The first one is the tutor. The students should complete their work with the guidance of their teacher. The concept of tutor can be extended to the social field, so as to prevent the research course from limiting the students to the school, not just refers to the teacher. It is helpful to develop students' vision. In addition, the role of the tutor is guiding, not teaching, and can't be replaced. The second one is the target. Aiming to developing students' innovative spirit and practical ability, the process of research subject should be practical, enlightening, and widening. That is, the tutor should let the students to think, to find and to do, for training students' ability and improving students' quality. The third one is autonomy, reflected especially when students select and determine their research subject. The content of the course can be opened to every field of our study and social life. Facing with such a large scale when choosing a subject, the students' interests and strengths should be taken into account. And tutor's opinion can only be a reference. The fourth one is diversity, including both the form and content of the students' study. Rich research topics are good for paying attention to the students' personalized development.

Above all, the subject of the research course is the students, and the students' autonomous participation throughout the whole research process. The research course asks students to select and determine the subject by their own, and encourages students to select and study forwardly. Furthermore, the research course creates space for the students' personality development, and expects students to experience life and society. The tutor just helps students improve their ideas, and they can't do the research instead of students. By showing respects to students' personality development and concerning about the students' creative performance, the research course is more suitable for achieving the goal of developing students' creation.

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II. THE IDEA OF THE RESEARCH COURSE TEACHING MODEL

A. *Insisting on developing student's personality, and cultivating students' independent choice and active investigation*

The purpose of the research course is to change the students as the passive recipients of knowledge into an active participant in the development of the course, so that each student can be integrated into the course to play their individual's potential. Moreover, the research course aims to develop students' 'free personality', and guide students to conduct rich and colorful inquiry learning activities by creating a broad space for their personality development. It can not only help students to understand the basic knowledge and have a command of learning methods, but also cultivate students with a strong interest in the research. The requirement, motivation and interest of the students must be put in the first place.

B. *Insisting on regarding students as the main body in practice activities, as well as developing students' practice ability and guiding students to experience life*

Piaget, a psychologist, holds that the individual cognition results from practice activity which is the bridge between subject and object interaction. Therefore, students' really meaningful learning should occur in the meaningful situations. The research course teaching model requires that the students as a dominant position in practice, and take the initiative in participating in practice activities. With this model, it establishes students' practice awareness in real life, applies what they have learnt to good use, diversifies the procedure of teaching, and makes the teaching with exploration. The traditional teaching model has been giving priority to putting academic theory into students' mind. Students have always been faced a conceptual understanding of different theories or deduction of different formula every day, which backs away from the actual life. This could make students bored even fear. Then how to study well? To make students close with the real life by research course is an effect way. What we expect is not a complicated topic the students chose, but a skill they had. By developing students' academic research method and their practical ability, their life experiences enriched.

C. *Insisting on the guiding role of the tutor in the research course*

The tutor of the research course can be a teacher, or a graduate student, and someone engaged in related work. Whoever, they must play their role fully in the process of course, rather than replaced simply. Tutors should change their teaching idea and realize that they are no longer a simple teacher, which means they do not need just to tell the students what it is, but to guide them how to discover problems; how to solve these problems after found them; how to obtain the information in the process of solving the problem; and how to get information, statistics data, and so on. On the one hand, the tutors can't replace the student to complete the task, even if the subject is so simple, or not. On the other hand, the tutors can't let their students alone, because the subject of research course is only college students. They just start to contact with

study, and they need certain guidance and help, otherwise they may lose confidence and interest. It requests the tutors play their guiding role in the right time.

D. *Insisting on school management and adjustment*

Every subjects of the research course should be managed and adjusted by assigning related departments. For most research need the investigation, study time and funds, they may not only complete in the classroom. Whereas, the students spend most of their time in school, and lack a certain amount of social experience. Therefore, the factors such as the safety should also be taken into account when opening activities, the management and regulation are needed to strengthen.

III. REFLECTION IN NUCLEAR MAGNETIC RESONANCE

A. *Setting up the course reasonable*

For one thing, teachers need to know the students' professional knowledge base and knowledge structure, so as to strengthen the students' weak knowledge link in the teaching process, and avoid repeating the knowledge content the students already know well.

For another, on the basis of theoretical teaching, the proportion of practical teaching is needed to increase in the course. Before each experiment, teachers should do certain brief review of the theory of MRI and imaging principle and equipment structure with students to help them sort out the theory of nuclear magnetic resonance.

B. *Using the guiding teaching method*

At the beginning of each class, the teacher explains the main contents, the theoretical emphases and difficulty of this course to students, and uses the method of mutual knowledge to guide students to think about concrete practice method combining with the theory knowledge. At the same time, the teacher can also raise questions to analyze the relevant experimental phenomena.

C. *Conducting independent design experiments*

After the completion of the teaching content and the basic experiment, the teacher can set small topic whose difficulty adapt to the level of students, so that students in the team can choose the subject by their own interests. Through checking the relevant literature at home and abroad, students can complete the nuclear magnetic resonance experimental program design independently, carry out experiments, and analyze and solve the problems in the experiment.

In the teaching process, teachers should encourage students to participate in scientific research projects actively, and organize students to apply university student innovation fund and innovative projects funded by schools and colleges.

D. *Achieving the opening practical teaching*

Nuclear magnetic resonance laboratories should be open to students every day and equipped with special experimental

teachers. So the students can go to the laboratory to practice and discuss the problems in the experiment with the teacher.

At the same time, we can further improve the use of the MRI experimental apparatus on the basis of laboratory opening to students. We can use network technology, data acquisition technology, remote control technology and other computing technology to construct a remote experimental platform for nuclear MRI technology, to let the students make full use of their spare time to explore the nature of the study.

IV. THE EDUCATING TARGET

Every course started with a necessary planning and design. Due to different characteristics of different school, there are different methods. But in generally speaking, overall design can be followed. The implementation of the research course teaching model must be started with setting educating target. And compared with the teaching objectives of basic course, students' practical application of knowledge and skills are emphasized more on research course. In addition, their understanding of the learning value is deepened through personal experience and their emotion is sublimated.

A. Target of emotion

Target of emotion can be summarized as attention, participation, collaboration, and progressive. For the first, attention is to let students pay attention to others by research course teaching model; pay attention to the people and things around and the development of human beings. It is helpful to establish professional consciousness and the entrepreneurial spirit, and cultivate sense of social responsibility and sense of mission through the choice of research and practice. And to understand the scientific achievements and technological innovation is for the sake of social production and living, especially to human beings' survival and development. Participation, which means to encourage students devoting into science actively, knows that science is not mystery. Through the process of basic scientific research experience, the students shall experience the interesting scientific activities, to develop their learning desire and enthusiasm of creation. Collaboration means to train team spirit which is the willing of cooperation by the research course teaching model. The students should learn to cooperate and acquire knowledge by communicating with others, then feel happy in the process of sharing research information and the results, and improve their personality. Progressive is to establish their scientific research self-confidence and perseverance in the research, daring to challenge and to be realistic. The students can explain or resolve the practical problems using scientific method, and stimulate their curiosity and desire to explore. Show respect for science and knowledge, it develops a scientific attitude of continuous improvement, and forms a habit of thinking and helping.

B. Target of ability

Firstly, the most important ability in the research course teaching model is research ability. The process of learning always need students to collect information widely, analyze the data, put forward to some ideas, confirm their idea and express

their views, which can enhance students' learning ability. Doing the research is a process, so it should be pay more attention to the elaborate design before activities and the stage of the activities. According to the characteristics of college students, and their different ages and stages of study, we can complete the system of research courses as follows.

First grade: To find the problem and learn the studying method of the research under the tutor's guidance.

Second grade: To master research methods and complete a small research.

Third grade: To deepen the research content, clear the direction, and go deep into thinking and mining of the research.

Secondly, the needed ability is communication skills. In the diversification of course activities, we should promote the communication between teachers and students. To enhance our emotions among students and make teachers and students step into society, which means to develop communication skills through the actual intercourse.

Thirdly, language expression ability can't be ignored. Pay more attention to develop students to express their opinions and ideas in study, and elaborate their viewpoint logically by appropriate form, which is to exchange the information effectively and give clear and definite answers to different questions.

Fourthly, it is organizational skills. In the whole research process, it still needs mutual coordination ability between the members. This requires students to make a good plan so as to complete the research project.

C. Target of knowledge

The requirements of learning are no longer single. The students required to use all kinds of knowledge, or to learn a variety of skills to put their knowledge to accomplish our topics. In the process of applying learned knowledge, we need to absorb the knowledge and comprehensive application. The innovation ability is showed from comprehensive application of a variety of knowledge, and then to understand their favorite science and technology, life, etc. Do further study on the knowledge of a certain field and the related subjects, new knowledge of value is obtained. In the same time, we still do creative learning to digest our knowledge under the driving of strong desire.

V. CONCLUSION

All in all, the development of research course teaching model in college will change the original teaching methods, make students become more active, which is helpful to improve the students' learning interest and to deepen the knowledge learned in class. In the course of the study, it also helps to improve the students' initiative, communication ability, teamwork ability, and so on. So that students' quality is fully developed. At present time, the needed talented person not only masters the systematical and the complete theory knowledge, but also has the innovation spirit and the practical ability. And the research course teaching model is adapting to the social development and the needs of the times.

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