

Cultivation and Exploration of Innovative Practical Ability of Postgraduates in Mathematics

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Abstract—How to train innovative postgraduates has become a new task and challenge in contemporary postgraduate education. In view of the training of mathematical postgraduates, this paper discusses the practical experience of teaching reform in recent years, including the core curriculum reform and the formulation of postgraduate training programs. In addition, it emphasizes that it is indispensable to improve the innovative ability of mathematics graduates through scientific research projects and participation in scientific and technological practice.

Keywords—*Innovative ability; Core curriculum reform; Scientific research projects; Scientific and technological practice*

I. INTRODUCTION

Postgraduate education is the highest level of education and an important part of higher education [1]. Research-oriented postgraduate teaching method has been widely used. The factors affecting the innovative ability of graduate students are: strong academic motivation, degree and mode of curriculum participation, academic exchange experience, scientific research topic participation, academic guidance of tutors, etc. These factors will affect the innovative ability of students, especially the degree of participation in graduate course teaching. Certainly, academic guidance of tutors is the most influential factor.

In China, many universities have tried the teaching mode driven by scientific research and innovation, and achieved good results. In the course of graduate project teaching, we should pay attention to the guidance of students, and let students learn the scientific research skills they need under the environment of stimulating interest. Functional analysis and algebra have gradually become two basic courses of modern mathematics offered by postgraduates of mathematics in Chinese universities. It is essential to cultivate the innovative spirit and ability of postgraduates of mathematics. From graduate syllabus in our university, the teaching lessons of functional analysis and algebra are 48. How to effectively improve the innovative spirit and ability of graduate students will be an urgent issue.

At present, China's graduate students have made rapid progress in the ability to use existing scientific research methods and the ability to express results, but there are still obvious gaps in innovation ability and original results. Therefore, cultivating innovative talents is the fundamental task of postgraduate education. Mathematics is a basic subject, which is very important for development of one country. The

strength of one country is often influenced by the strength of mathematics. Maintaining the leading position in mathematics has become one of the strategic needs of developed countries. Liu et al. [4] think that the main problems existing in the cultivation of innovative ability of graduate students in mathematics are: (1) lack of self-cultivation and awareness of mathematics; (2) lack of individual gradual graduate students, and attach importance to the authority of tutors; (3) tutors attach importance to "specialized" rather than "comprehensive"; (4) some existing management systems of graduate students are not conducive to the cultivation of innovative ability of graduate students. In the teaching of postgraduate courses, students may have a good grasp of the understanding and extension of theory by exerting the collective strength of their tutors and integrating classroom discussion, classroom demonstration and theory teaching. Project-driven teaching can be based on students' research topics. Some core courses must be taught in the course teaching, because they will combine students' research topics, and put forward feasible research methods in teaching. Moreover, we should intentionally infiltrate scientific research consciousness, quality and ability, and provide scientific reference for promoting innovative education of mathematics postgraduates and improving the quality of cultivation of mathematics postgraduates.

The rapid development of scientific theory and people's in-depth exploration of the world also provide a new thinking for teaching reform. Under the guidance of today's graduate students, we fully mobilize the interest of graduate students in mathematics, and change the traditional single teaching for truly cultivating the innovative ability.

II. REFORM OF POSTGRADUATE MATHEMATICS CORE COURSE

Postgraduate course teaching, as a key link in the process of postgraduate training, plays a vital role in the cultivation of innovative ability. Graduate students can enhance their ability to find, analyze and solve problems. In China, due to the obvious differences in mathematics discipline, some core curriculums of discipline do not coincide with the all research

topics in many universities. Therefore, it is necessary to select the class and important curriculum, according to the characteristics of the research topics of mathematics. The purpose of reform of mathematical core course teaching is to enable graduate students to master certain knowledge structure and professional skills, and lay a solid foundation for their

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follow-up research topics. Postgraduate curriculum learning can play a role in building a reasonable knowledge structure [5].

As we know, in the teaching of core courses for postgraduates in mathematics disciplines in Chinese university, there are many drawbacks, such as teacher-centered and full-time education [6]. While imparting classical theoretical knowledge, the combination of scientific research and the cultivation of innovative ability of postgraduates are neglected. At present, through the undergraduate "flip" teaching and curriculum system reform, has produced a large number of excellent results. Therefore, we need to combine the characteristics of postgraduate teaching, pay attention to the cultivation of students' practical and innovative abilities, compile and publish a series of highlighting and explore the postgraduate teaching mode under the construction of "double-first-class" disciplines.

In order to deepen understanding of most research methods and break through the bottleneck of mathematical knowledge, postgraduates are encouraged to strengthen their self-reinforcing study of advanced mathematics, probability theory, mathematical statistics, linear algebra, etc. In addition, taking "task" as the core will explore the breakthrough point of scientific research and innovation, and enhance their innovative ability. The graduate students make their own project implementation plan for the task. On the basis of full investigation and research, they put forward solutions to the research problems, process data and information with appropriate tools and means. Finally, they can write research reports, make physical models and other solutions to solve and answer the problem. In the teaching of postgraduate courses, students may have a good grasp of the understanding and extension of theory by exerting the collective strength of their tutors and integrating classroom discussion, demonstration and theory teaching. In the process of teaching, we intentionally infiltrate scientific research consciousness, quality and ability.

III. FORMULATION OF POSTGRADUATE TRAINING PROGRAM

Teachers play a very important role in cultivating graduate students' innovative ability. When a tutor enrolls a graduate student, he or she should have a full assessment of all aspects of the student, including his or her motivation for admission and his or her mathematical foundation.

According to the students' foundation and interest, we should establish and improve the corresponding training program and the management and supervision system of graduate students to better cultivate their scientific research ability. Through specific training programs for different types of students, let students understand the frontier trends of their research directions, and let graduate students get in touch with scientific research as soon as possible for entering the topic research as soon as possible. Therefore, tutors or senior graduate students can lead them to carry out relevant theoretical analysis or numerical simulation, so as to cultivate their interest in scientific research.

Regular academic seminars are held, and new innovative achievements are collided through the combination of lectures and special lectures. We will increase the number of postgraduates participating in academic exchanges, strive to

establish long-term cooperative relations with domestic teams in the field of disciplines, and organize students to participate actively in academic discussions. At the same time, graduate students are encouraged to participate actively in the classroom teaching and to perform actively, and to guide graduate students to participate actively in the whole process of teaching and research. Course types can be designed more diversified, such as flipping classroom, interactive teaching, open teaching, case teaching, simulation teaching, discussion teaching, intuitive teaching, etc. Through teacher-student interaction, group cooperation and other forms to complete, each person according to their own strengths, select tasks, fully mobilize the enthusiasm and creativity of graduate students in exploration and practice, thus training and research. In foreign countries, many colleges and universities have tried to adopt different postgraduate training programs according to different students, and have achieved good results.

IV. CULTIVATION OF INNOVATIVE ABILITY BASED ON SCIENTIFIC RESEARCH PROJECTS

In the reference [7], it shows that 78% of postgraduates have a certain understanding of scientific research projects, 68.64% of postgraduates majoring in mathematics have not participated in scientific research projects, 29.67% of postgraduates majoring in mathematics have participated in 1-3 research projects, of which only 11.86% participated in national projects. This means that mathematics postgraduates have fewer opportunities to participate in scientific research projects and lower project level, which affects the enthusiasm of postgraduates to participate in scientific research projects and directly reduces the cultivation of innovative thinking ability of postgraduates. Moreover, the postgraduates of mathematics have the mentality of "quick success and instant benefit", which is not conducive to opening up their thinking, bold innovation and improving their ability of scientific research and innovation.

Mobilize the enthusiasm of graduate students to participate in scientific research. Because of the different learning purposes of graduate students, some graduate students are unwilling to invest in scientific research and only want to complete the minimum conditions required for graduation. Or some graduate students because of their low learning ability, unable to participate in the team's research projects, more than enough and less than enough. In order to enable more graduate students to really participate in scientific research, we should give them attention and help from the ideological and learning ability. Promote graduate students to participate in team research projects, improve the training level of graduate students, so that graduate students in scientific research ability, work ability, scientific literacy, cooperation ability and other aspects have a greater mention, so that graduate students can focus more on scientific research, create a relaxed academic atmosphere, so as to better stimulate the formation of graduate research enthusiasm and innovation ability. At the same time, some regions and governments can set up special funds for postgraduates, such as the special funds for innovative research of postgraduates, in order to strengthen the training of postgraduates' scientific research, and strengthen the cultivation of their innovative consciousness and ability [8]. We should have a clear understanding of the work foundation,

construction objectives, construction plans, expected results and schedule of graduate innovation.

Through the diversified curriculum evaluation system, we can optimize the educational system and structure of school research, develop the research potential of graduate students, and make the education, teaching and management of school operate efficiently, so as to improve the comprehensive quality of research, realize the development of students' subjectivity, and further meet the needs of educatees' own development and social development.

V. ORGANIZE AND GUIDE POSTGRADUATES TO PARTICIPATE IN SCIENTIFIC AND TECHNOLOGICAL PRACTICE ACTIVITIES

The cultivation of higher talents in our country has entered the period of upgrading, opportunity and fortification to improve quality. Facing the new situation of the reform and development of higher education in the world, curriculum content and teaching methods lag behind the requirements of the development of the new era. The National Post-Graduate Mathematical Contest in Modeling is one of the thematic competitions of the "National Graduate Innovative Practice Series" sponsored by the Degree and Graduate Education Development Center of the Ministry of Education. Therefore, the participation of graduate students in mathematical modeling can not only exercise the ability of the participants to solve practical problems by using the theory they have learned, but also improve the goal attainment and social adaptability of graduate training. In addition, in the process of participating in the mathematical modeling competition, we need to carry out collective discussion on practical problems, which can mobilize the enthusiasm of team members to participate in cooperative scientific research and attract the attention of all team members to this scientific problem. At the same time, in the process of postgraduate modeling training, tutors can transform the latest achievements of scientific research into teaching content, academic resources into teaching resources, and guide postgraduates to carry out innovative practice activities.

In recent years, Chinese universities have actively explored the reform of postgraduate education and teaching in mathematics, constructed a new curriculum system under the background of "double first-class", adjusted the teaching content according to the cultivation of innovative top-notch talents, introduced modern mathematical achievements into postgraduate mathematics curriculum, and focused on cultivating the innovative ability of postgraduates. The first-level master's degree in Mathematics in our school began to enroll students in 2011. After more than ten years of construction, although some achievements have been made, we still need to continue to work hard on the cultivation of innovative consciousness and ability of postgraduates. In recent

years, our school has carried out some reforms in the process of postgraduate training in mathematics, focusing on the cultivation of Postgraduate Innovative Ability from the core curriculum reform, the formulation of postgraduate training program, the improvement of innovative ability based on scientific research projects and participation in scientific and technological practice activities, including: the construction of postgraduate courses, the formulation of postgraduate training program, and the coordination of team members.

The assessment and evaluation of postgraduate studies is the key core of China's education. At present, there are many functions and disadvantages of academic evaluation of graduate students in Colleges and universities. It is imperative to set up a special evaluation management organization and teacher training department to form a diversified evaluation system. To clarify the content of academic evaluation of graduate students in Colleges and universities. Change the content and form of unified assessment of different abilities and different requirements of graduate students, to truly meet the needs of modern society for the diversification of talent. Although the mathematic research team has rich academic experience, due to the influence of various factors, there are abuses of teacher-centered and full-time education. While imparting classical theoretical knowledge, we neglect the combination with scientific research. There are still some problems in the way of cooperation, foreign exchanges, and graduate system training mode, which need further research.

VI. CONCLUSION

The State Council regards "training top-notch innovative talents" as an important construction task in the "double-first-class" construction plan. Faced with the challenge and opportunity of "double first-class" construction, how to improve the curriculum construction to meet the needs of "cultivating top innovative talents" is a tough problem that must be resolutely solved. As the cornerstone of talent cultivation, curriculum construction can be the focus of "double first-class" construction.

Premier Li Keqiang has repeatedly stressed the importance of mathematical foundations, pointing out the importance of basic disciplines such as mathematics to enhance original innovation ability, implement innovation-driven development strategy, and build an innovative country. In addition, he also stressed the importance of promoting the integration of basic science and applied research. Innovation and research are the foundation of postgraduate training in mathematics specialty, and the cultivation of innovation ability is achieved step by step through continuous in-depth study of problems. Therefore, taking scientific research projects as a platform and participating in postgraduate mathematical modeling contest is a necessary and effective way to improve the innovative and practical ability of postgraduates in mathematics.

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