

The training method of group-innovation ability for graduate students in China

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Abstract. Graduate education under the background of double first-class is one of the important contents of Chinese higher education research. The cultivation of innovative ability of postgraduates is an important aspect in postgraduate education. Different from the previous methods of cultivating individual innovation ability, a group innovation ability training method based on the Synectics Method was proposed, and a studio for undergraduates, masters and doctorates was established. Through specific case analysis, it was shown that the proposed group innovation training method is feasible and efficient.

1 Background

It has been nearly 15 years since the State Council of China approved and forwarded 'implement the Postgraduate Education Innovation Plan' in 2005, which is listed in the Ministry of Education's '2003-2007 Education Revitalization Action Plan'[1]. The Plan pointed out 'The purpose of implementing the postgraduate education innovation plan is to deeply explore the laws of postgraduate education under the new situation, update concepts, deepen reform, promote innovation, and establish a postgraduate education system and operating mechanism that is compatible with the socialist market economic system. It is also want to strengthen the construction of postgraduate training bases, improve training conditions, and promote the sharing of high-quality resources. The plan is trying to establish an incentive mechanism for postgraduate scientific research and innovation, create an innovative atmosphere, and strengthen the cultivation of innovative awareness, innovative spirit, and innovative ability. The implementation of the plan will promote the training quality of china's postgraduate close to the overall level of postgraduate education of developed countries, so as to lay a solid talent foundation for the implementation of the strategy of rejuvenating the country through science and education and the strategy of strengthening the country with qualified personnel.' To this end, in recent years, there have been many postgraduate education research fund projects, which have put forward different innovative reform ideas, hoping to provide reference and assistance for the cultivation of graduate students' innovation ability.

At present, the main factors affecting the cultivation of graduate students' innovation ability in higher education include three aspects [2], a) supervisor factor, b) personal factor

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of graduate students, and c) innovation environment factors, and related aspects of research in the field of university degrees and graduate studies are hot research topics. The Central Committee of the Communist Party of China and the State Council put forward a major strategic decision to build a world-class university and a first-class discipline, that is, a "double-first-class" university, in 2017, which not only has clear expectations for the innovation and entrepreneurship ability of undergraduate students cultivated by colleges and universities, but also puts forward higher requirements for the innovation ability of graduate students cultivated by universities. In the same year, the Ministry of Education and the Academic Degrees Committee of the State Council jointly issued the '13th Five-Year Plan for the Development of Degree and Graduate Education,' which pointed out 'In order to meet the demand for high-level talents in economic and social development in the new era, it is necessary to comprehensively improve the quality of postgraduate education.' This shows the importance of exploring the cultivation methods of graduate students' innovative ability and the reform of educational methods.

Recently, most domestic research has proposed a clear training strategy or educational method for the individual innovation ability of graduate students. Dong et al. conducted a more comprehensive investigation and analysis of the innovation ability of China's graduate students in the journal of Degree and Graduate Education, and the analysis believes that the innovation ability of graduate students includes four aspects: the ability to construct knowledge, the ability to find problems, the ability to solve problems and the ability to improve transformation, and there are significant differences in graduate students of different ages, genders, disciplines, grades, and economic conditions, and they should provide personalized training programs and formulate educational methods[3]. Liu et al. formulated a plan to improve the innovation ability of graduate students according to the characteristics of computer science and believed that the scientific and technological competition should be used as a carrier to cultivate and promote the innovation ability of graduate students [4]. Through the analysis of the practical effects of pilot grade graduate students, graduate innovation education based on science and technology competitions has a positive impact on cultivating high-quality innovative talents that meet the needs of the IT industry. Sun et al. believe that the professional attributes of graduate students in science and engineering universities are too strong, and the knowledge structure is too single, which causes "congestion" of research objects, which in turn hinders graduate students of science and engineering universities from engaging in innovative scientific research activities, which is worth pondering [5]. Chen et al. proposed to enhance the cultivation of graduate students' scientific research and innovation ability through scientific research practice and training links, believing that relying on open laboratories, breaking the single tutor guidance system, and improving the practical training environment provide conditional support for graduate students' innovation [6]. Li et al and others have similar views, believing that the scale of graduate students is expanding day by day, the shortcomings of the single tutor training model are becoming increasingly prominent, and the team mentor training model has become a new trend in the future training. Cao et al and others also started from the training environment. By building international cooperation and exchange platform for postgraduates, they strengthened the construction of international teachers and built a training system for postgraduate international innovative talents [7].

In summary, the current research on the reform of the cultivation of graduate students' innovation ability and the method of education emphasizes more on the improvement and improvement of tutor factors and environmental factors, emphasizes more objective factors than subjective factors, and focuses on the external training environment and ignores the internal innovation-driven research of graduate students. Therefore, how stimulating the internal innovation motivation of graduate students, exploring the feasibility of relevant means, and proposing corresponding reform measures are of great importance.

2 Target and method

2.1 Research target and content

In order to solve the problem of stimulating the internal innovation power of postgraduates, we propose a new concept of “group” innovation for postgraduates, emphasizing the collaborative and complementary innovation ability of “groups” to replace the inherent model of “individual” innovation ability emphasized in traditional postgraduate education. Explore the feasibility of relevant research methods and reform measures through the following three aspects of research.

(a) Research on analysis of the main factors affecting the internal innovation drive of graduate students and evaluation of the degree of influence.

The source of an individual’s internal innovation drive varies from person to person. It is necessary to comprehensively and carefully analyze the impact of different factors in the cultivation of graduate students’ innovative ability on the source of the driving force, clarify the degree of influence, complete the evaluation, and provide support for the subsequent formulation of plans. Analysis and discussion of the essential difference between the cultivation of individual innovation ability of postgraduates and the cultivation of group innovation ability.

(b) Research on exploration and construction of graduate student's group innovation model.

The design of the Group innovation model needs to consider the design of the curriculum system, the design of the practice link, the design of the tutor's education method, the construction of the training environment, etc., and finally determine the independent thinking ability, logical analysis ability, problem-solving, etc. of the graduate students in the "group" environment capacity building model.

(c) Research on the evaluation system and result analysis of the improvement of graduate students' group innovation ability.

The effect of ability training needs to be evaluated qualitatively and quantitatively through a scientific evaluation system, and the evaluation results must be analyzed and fed back, so as to further improve the innovative model constructed and enhance the scientificity

2.2 Synectics method and application

2.2.1 Definitions and features

In 1944, Professor Gordon of the Massachusetts Institute of Technology proposed a method of using external things to inspire thinking and develop creative potential, that is, the ‘Synectics Method’, also known as the analogy thinking innovation method. The idea is to use external things or existing achievements as the medium, divide them into several elements, discuss and study the elements, and comprehensively use the inspired inspiration to invent new things or solve problems.

The field of management has two interesting characteristics:

(a) Heterogeneous assimilation

Heterogeneity assimilation simply means to treat unaccustomed things as familiar things that have long been accustomed to. Before the invention is successful or the problem is not solved, they are all unfamiliar to us. Heterogeneous assimilation requires us to analyze a completely unfamiliar thing or problem with all the experience and knowledge

we have. , compare, and based on these results, make a situation that is easy to handle or very sophisticated, and then use what method to achieve this goal.

(b) Homogeneity

The so-called homogeneity and dissimilation refer to the observation and research of some long-familiar things, according to people's needs, from a new angle or using new knowledge, so as to get rid of the shackles of old and fixed views and produce new creative ideas, i.e. to turn the familiar things into unfamiliar things.

we intend to try to apply the 'Synectics Method' theory to the education method reform and system construction in the cultivation of graduate students' innovative ability in this paper.

2.2.2 Form of application

The application of the Synectics Method to the cultivation of graduate students' innovative ability will be constructed in the form of a "Bachelor-Master-PhD" studio. In the form of student mentoring and team leadership role training, uncombined attempts are made. Students can be grouped by task and goal orientation. The specific plan should be further explored continuously, and the grouping should follow the principles of the same background, different grades, and different backgrounds in the same grade, so as to ensure that the team members can be graduate students with different project backgrounds, and even have different disciplinary backgrounds, that is, interdisciplinary training.

Through the construction of a sound, rich-level undergraduate-master-doctoral studio system, it can highlight the leading role of doctors, the backbone of masters, and the reserve role of undergraduates in scientific research. The team's innovation ability reflects the characteristics of continuous, stable, traceable, and predictable. Taking the scientific research project "a flexible general sensor" as an example, the doctoral group can play a major role in the theoretical extension and model establishment by using the accumulated knowledge in the professional field, and proposing the architectural idea according to the development direction of the project, and then pass the master group through the master group. For undergraduates who are still in the primary stage of scientific research, they can conduct research on scientific research literature, collect and record experimental data, organize and summarize scientific research report materials, etc. To gradually accumulate basic scientific research capabilities and improve their understanding of the project. As time progresses, the overall recommendation and innovation of the project will not be interrupted. In the process of innovation iteration, the integrity and continuity of the team's innovation ability will be maintained, and a stable research direction will be formed.

In the process, the Synectics Method was able to show different results in different levels of students. The professional background of the group has an important influence on the effect of the Synectics Method. Through the distinction of professional background, the different understandings of researchers with different professional backgrounds on the same issue are introduced, and the open group discussion is used to inspire the group's sense of innovation and collide with innovative ideas. Still taking the above project of flexible sensor design as an example, the potential solutions and implementation technologies in this project can be determined through the Synectics Method, and effective conclusions are given for innovative applications

3 Conclusions and thoughts

The Synectics Method has positive significance for group-innovation ability for graduate students. Through the specific implementation process of the project case, it is verified that it is feasible to use the form of undergraduate, master and doctoral studios with different

professional backgrounds and scientific research training to develop group innovation ability, and the training results are effective.

In the future, the objective evaluation and analysis of the innovation effect of the comprehensive method will be carried out through more and wider cases, and the age and gender parameters of the subjects to be tested will be introduced to further improve the integrity and comprehensiveness of the data analysis.

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