

FOUR-IN-ONE SCIENTIFIC AND INNOVATIVE SURVEYING AND MAPPING POSTGRADUATES TALENT TRAINING SYSTEM OF "IDEOLOGICAL AND POLITICAL - CURRICULUM - PLATFORM - TEAM"

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ABSTRACT:

Graduate education is an important cornerstone of building an innovative country. With the rapid development of a new round of scientific and technological revolution and industrial transformation, the demand for surveying and mapping postgraduates with firm ideals and beliefs, solid professional knowledge, exquisite practical skills and outstanding scientific and technological innovation ability is becoming more and more urgent. Shandong University of Science and Technology has carried out long-term exploration and practice in the postgraduate training of surveying and mapping. In view of the problems existing in the current postgraduate training, such as the insufficient combination of professional education and ideological and political education, the curriculum system not adapting to the needs of high-level space-time information services of natural resources, and the lack of scientific research and innovation ability of postgraduates. This paper puts forward a four-in-one talent training system of "ideological and political-curriculum-platform-team" for surveying and mapping postgraduates, which combines ideological and political education, curriculum education, platform education and team education. After 10 years of exploration and practice, the application of this system has achieved fruitful results: The quality of postgraduate training has been significantly improved, the ability of postgraduates to serve the society has been significantly improved, the teaching results have been fruitful and widely used, and the level of discipline construction has been improved. It provides a reference way of education reform for the cultivation of scientific and innovative surveying and mapping talents in the surveying and mapping industry in the new era.

1.INTRODUCTION

The high-quality development of natural resources puts forward unprecedented higher requirements for scientific and technological innovation. As the main force of the future surveying and mapping industry, the engineering practice ability and scientific research innovation ability of surveying and mapping graduate students are particularly important (Wang Zhigang, 2020) (Chen Jing, Huang haixia, 2018) (Song Chunpeng, 2019) (Ning Jingsheng, 2019) (Gao Jingxiang, Wang Jian, Li Zengke, 2019). With the field of surveying and mapping science and technology as the background, this paper focuses on the major needs of national economic construction, social development, information-based surveying and mapping, earth observation and navigation, natural resources monitoring, etc

(Chen Junyong, Dang Yamin, Zhang Peng, 2009), with an aim to cultivate scientific and creative surveying and mapping talents with a focus on surveying and mapping and multidisciplinary crossover. In view of the problems existing in the current postgraduate training, combined with the experience of ideological and political education, curriculum, platform and team building, we will effectively improve the quality of postgraduate training and provide reference and thinking for the training of postgraduates in other similar colleges and universities.

In the document " Opinions on Accelerating the Reform and Development of Postgraduate Education in the New Era, " the Ministry of Education and the National Development and Reform Commission pointed out that socialism with the socialism of Chinese characteristics has entered a new era, the

demand for high-level innovative talents in all walks of life is more urgent, and the status and role of postgraduate education is more prominent. The cultivation of postgraduates should adhere to demand-oriented, innovation-led and reform-driven, enhance the sense of mission and responsibility of postgraduates, and comprehensively enhance knowledge and practical innovation ability (Ministry of Education of the People's Republic of China, 2020). Postgraduate education shoulders the important mission of high-level personnel training. The new round of scientific and technological revolution and industrial transformation has put forward new topics for surveying and mapping geographic information technology in the new era, and also put forward new requirements for the training of engineering practice and scientific research innovation ability of practitioners (Li Deren, Zhang Guo, Jiang Yonghu, 2022) (Yan Li, Li Jiancheng, 2020). The training objectives of postgraduates also need to make corresponding changes to adapt to the new forms and changes faced by the new era.

Through investigation, it is found that there are still several key problems in the training process of surveying and mapping postgraduates.

(1) There is a "two skins" problem between professional education and ideological and political education.

Professional education for postgraduates is to impart scientific and technological knowledge, develop their intelligence, and cultivate their innovative and practical abilities. Ideological and political education for postgraduates can make them better adapt to the open cultural environment and enhance their sense of social responsibility, mission and urgency. However, at present, there is a "two skins" problem between professional education and ideological and political education, that is, professional education and ideological and political education independent of each other, and ideological and political education has not been effectively integrated into the professional education process (Yang Qiang, Chen Dong, 2021). The main body of postgraduate ideological and political education is single, the education process is not coherent, the understanding of the important task of the times and the spirit of surveying and mapping is not deep.

(2) The curriculum system is not suitable.

The curriculum system fails to meet the needs of high-level space-time information service of natural resources. The teaching methods are single, and the cooperation and openness are insufficient. The teaching of the course attaches importance to knowledge transfer, neglects the cultivation of scientific and technological innovation ability, and does not provide enough

practical platforms and opportunities for graduate students. This has caused the phenomenon that postgraduates have rich theoretical knowledge, lack of practical ability, and the combination of theory and practice is not close. In the future, they may not be able to adapt to the actual needs of the surveying and mapping industry for engineering practice ability and scientific research innovation ability.

(3) The ability of scientific and technological innovation needs to be improved

Postgraduates lack of innovation spirit, innovation ability, curiosity and skepticism, only the textbook theory as the truth. The research vision is narrow, the scientific cross-ability is weak, the scientific and technological achievements are less connected with the latest scientific and technological progress, and the ability to serve the country and region needs to be improved. Therefore, cultivating students with innovative thinking ability in the true sense has become an urgent problem to be solved.

All in all, the current training mode of surveying and mapping postgraduates has failed to adapt to the urgent demand of the world's scientific and technological powers for surveying and mapping talents.

2. FOUR-IN-ONE SCIENTIFIC AND INNOVATION SURVEYING AND MAPPING POSTGRADUATE TRAINING SYSTEM

Talents are the decisive factor in determining the future of national and social development. Postgraduate education is an important way for the country to select high-level specialized talents and top-notch innovative talents. Shandong University of Science and Technology was established in 1951. It is one of the 5 famous schools with special features for the cultivation of applied basic talents under the key construction of Shandong Province. Among them, the 'Surveying and Mapping' discipline relies on the first-level discipline doctoral point and post-doctoral mobile station. In the process of participating in the construction and development of the industry, it has developed into a distinctive, leading and well-known advantageous discipline in the province. In the fourth round of national discipline evaluation, it was rated as B grade, ranking 7-10 in the country, and has trained more than 4000 surveying and mapping professionals for the country.

In response to the problems existing in the cultivation of postgraduates majoring in surveying and mapping, following the training idea of 'demand-oriented, innovation-oriented,

reform-driven, science and education integration', connects with the orientation of the school, and relies on the national teaching and research platform, provincial and ministerial education reform projects, provincial youth innovation team and provincial construction courses, the four-in-one scientific and innovative surveying and mapping postgraduates talent training system of "ideological and political-curriculum-platform-team" has been built in this paper to meet the urgent needs of the world's scientific and technological powers for surveying and mapping talents. As shown in Figure 1.

The "four" refers to the parallel of "ideological and political guidance, building courses, strengthening platforms, and creating teams", which provides support for the operation of the talent training system of science and technology innovation surveying and mapping: 1) Taking science and technology innovation serving the country as the initial intention, we build a high-standard ideological and political position of "cultivating the spirit of surveying and mapping in the new era with the connotation of great country craftsmen," and build a solid foundation for ideological and political education. 2) Focusing on the cultivation and training of scientific and innovative methods, we build a high-quality curriculum system with four levels of "general knowledge dimension, professional dimension, expansion dimension and promotion dimension", and consolidate the foundation of curriculum education. 3) Relying on the improvement and optimization of the scientific and technological innovation environment, we strengthen the high-level scientific research and teaching platform of "coordinated development of science and education, innovation demonstration leading", and build a solid foundation for platform education. 4) With the goal of improving the cultivation of scientific and technological innovation ability, we create a high-level team cultivation mechanism with the deep integration of "politics, production, learning, research and application", and build a solid foundation for team education.

The 'One' refers to the urgent need for scientific and innovative surveying and mapping talents under the background of the strategy of strengthening the country with talents in the new era, adhering to the ideological and political concept of 'cultivating the spirit of surveying and mapping in the new era with the connotation of great power craftsmen', realizing the integration of government, industry, university and research with demand as the guidance, and constructing the training system of scientific and innovative surveying and mapping talents.

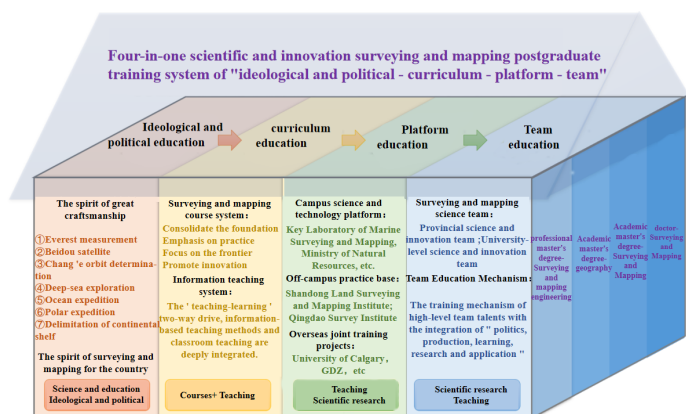


Figure 1. Four-in-one scientific and innovation surveying and mapping postgraduate training system of "ideological and political - curriculum - platform - team"

2.1 The first of four : Ideological and political education (Create an ideological and political position of "cultivating the spirit of surveying and mapping in the new era with the connotation of great country craftsmen.")

Relying on the " great power craftsman spirit " and " surveying and mapping spirit, " to create " longitude and latitude blueprint cultural project. Carry forward the "cultivating the spirit of surveying and mapping in the new era with the connotation of great country craftsmen, relying on the spirit of Everest, Beidou, and Chang'e, Enhance surveying and mapping postgraduates' sense of discipline identity and patriotism to shoulder the responsibility of the times, and strengthen their ideals and beliefs of rejuvenating the country through science and technology and serving the country through surveying and mapping. Carry out a series of outstanding alumni high-level academic reports such as famous lecture forum and " great power project. Condense the excellent research results obtained in the fields of Everest measurement (Wu Hao and Zhang Qingyu, 2020), Beidou navigation, Chang 'e orbit determination (Wu Hao, 2021), deep sea exploration(Wang Jiangaog and Hang Hongshuo, 2020), ocean scientific expedition, polar scientific expedition, continental shelf delimitation survey (Ma Liyu et al. 2020), and satellite remote sensing application, and feed back the ideological and political construction of the course. Through the integration of Xinhua Network, China Education News Network, China Youth Network, Dazhong Daily, Guangming Daily, Science and Technology Daily and other media reports, we use positive social public opinion to stimulate students' professional interest and innovation

motivation.



Figure 2. Create an ideological and political position of "cultivating the spirit of surveying and mapping in the new era with the connotation of great country craftsmen."

2.2 The second of four : curriculum education (Build a high-quality curriculum system with four levels of "general knowledge dimension, professional dimension, expansion dimension and promotion dimension")

Adhere to the concept of establishing morality and cultivating people. Establish a four-level advanced curriculum system of "general education dimension, professional dimension, expansion dimension, and promotion dimension" based on the concept of "consolidating the foundation, emphasizing practice, focusing on the forefront, and promoting innovation". Among them, consolidating the foundation includes strengthening the professional foundation and the general knowledge of surveying and mapping disciplines; Emphasizing practice includes attaching importance to professional technical practice courses and professional practice, and cultivating practical ability; Focusing on the forefront includes focusing on major scientific achievements in the professional field and grasping the frontier dynamics of the industry; Promoting innovation includes promoting the cultivation of innovative thinking ability, and guiding pioneering research and exploration. The general knowledge dimension takes consolidating the theoretical basis as the requirement, optimizes the core curriculum setting, and cultivates provincial high-quality courses, teaching case base, and curriculum ideological and political demonstration courses; The professional dimension focuses on curriculum practice as a means to strengthen the combination of theoretical teaching and scientific research practice of professional master, and promote the integration of experimental teaching and practical teaching of

professional master's Academic master; The expansion dimension attaches importance to focusing on the frontier of science and innovation, holding academic conferences, training lectures, and hiring industry experts to regularly participate in professional course teaching. The promotion dimension aims at promoting scientific innovation, using excellent innovation results to guide the cultivation of innovation ability, and realizing the seamless connection from ideological and political education and curriculum education to platform education and team education.

With the "engineering thinking, collaboration, integration and innovation, lifelong learning" as the training objectives, we will refine the major cutting-edge innovation achievements in surveying and mapping, carry out the construction of online courses and high-quality courses for graduate students, and create a new teaching relationship driven by "teaching-learning". Based on the network teaching platform, the teaching methods of pre-class guidance, in-class guidance and after-class supervision are designed to stimulate students' inquiry learning and promote 'learning' by 'teaching'. combining flipped classroom and discussion-based teaching strategies, students are given full initiative to choose topics independently; Strengthening communication will help teachers to master students' learning drawbacks, update teaching content, promote "teaching" by "learning" and realize the cultivation of innovative thinking of postgraduates.

Through the construction of the above curriculum system, the optimal allocation of basic courses, professional courses and practical courses is finally realized, which promotes the deep integration of information-based teaching methods and classroom teaching, and lays a solid foundation for cultivating the scientific research and innovative thinking of postgraduates in surveying and mapping.

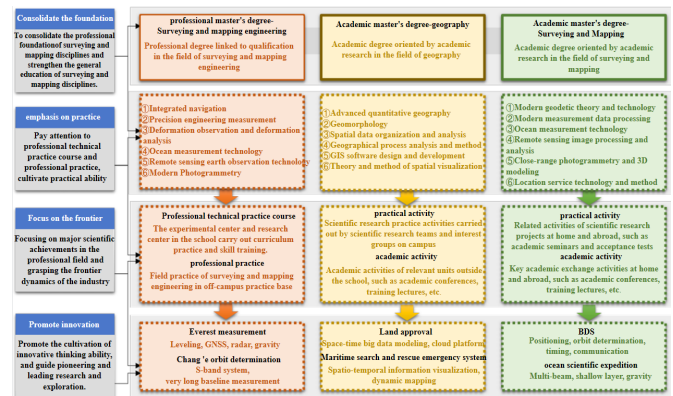


Figure 3. 'Consolidate the foundation, Emphasis on practice, Focus on the frontier, Promote innovation' surveying and mapping postgraduate curriculum system

2.3 The third of four : Platform education (strengthen the scientific research and teaching platform of ' coordinated development of science and education, innovation demonstration and guidance ')

Taking the national experimental teaching demonstration center of surveying and mapping engineering as the support platform, the cooperative construction mechanism of ' school and research institution, school and enterprise, school and regions, school and school, school and government ' is brought into play, and the integrated practical ability training and scientific research innovation platform of ' on-campus + off-campus + overseas ' of ' experimental center + comprehensive experimental field + practice base ' is built to promote the deep integration of science and education and optimize the environment of science and innovation.

Relying on the on-campus platforms such as the National Experimental Teaching Demonstration Center of Surveying and Mapping Engineering, the Key Laboratory of Marine Surveying and Mapping of the Ministry of Natural Resources and other on-campus platforms to encourage students to participate in the research and development of key technologies and equipment for submarine topographic survey, domestic series of high-resolution satellite processing system and other on-campus innovative practices; We strengthen scientific research cooperation with surveying and mapping, ocean, land and other scientific research and production units and related high-tech enterprises. The collaboration is driven by the needs of relevant units and enterprises, supported by scientific and technological projects, and guided by the principles of "complementary advantages, resource sharing, mutual benefit, and synergistic development". The joint scientific and technological research and development work conducted by graduate students and enterprises aims to strengthen talent development, mutual cooperation, and technical communication between them, effectively enhancing the practical and innovative abilities of graduate students. Through the joint training of postgraduates, taking the participation of off-campus supervisors in postgraduate training as the starting point, the school and off-campus supervisor, the school and the joint training base can establish substantive business exchanges. While training postgraduates, a good collaborative education mechanism can be formed to promote the effective integration of production, and research. In cooperation with domestic joint training bases, such as co-building scientific research joint

training bases with the Land Satellite Remote Sensing Application Center and the Marine Research Institute of the Ministry of Natural Resources, and co-building practical joint training bases with the Shandong Provincial Institute of Land Surveying and Mapping and the Qingdao Municipal Institute of Surveying and Mapping, the integration of external innovative resources to achieve complementary advantages. In cooperation with international joint training units, such as the University of Calgary in Canada and the German Geoscience Research Center, through extensive international exchanges and cooperation with foreign universities and research centers, students can ' go out ' and ' communicate more ', timely understand the cutting-edge technology, theory and development trend of the discipline, and enhance the international academic vision and intercultural communication ability of graduate students.



Figure 4. Scientific and innovative mapping research education platform and mechanism

2.4 The fourth of four: Team education (Create a high-level team cultivation mechanism with the deep integration of "politics, production, learning, research and application")

Innovation is a high-level production-education deep integration team talent training system with the integration of 'politics, production, learning, research and application' as the core. It builds a team education mode of 'demand-oriented, project-based, mentor as a military teacher, and doctoral students

as pioneers' and a 'three-early education' method of 'early team, early project and early laboratory'. It relies on the perfect ideological and political position, curriculum system and science and education platform, takes the service of social needs as the guidance of scientific research team, and encourages teachers and students to choose topics according to national and regional development and industry needs. Taking the project as the position of the scientific research team, innovation as the purpose of the scientific research team, and the 'on-campus + off-campus + overseas' education base as the platform to support graduate students to participate in national key scientific research projects and high-level discipline competitions in turn, so as to realize the cultivation of scientific research literacy of surveying and mapping graduate students and the effective improvement of scientific thinking ability and scientific innovation ability.

Relying on the top-level design of the college, we have successively established a number of teaching and scientific research teams, such as modern measurement data processing, satellite positioning and navigation, mine surveying, mobile surveying, marine intelligent navigation and perception, etc. At the same time, the college take 'integration of science and education, collaborative education' as the training goal, 'problem-oriented, integrated innovation' as the educational concept, with the system of 'one with one' for professors and young teachers, forming a group of high-level compound talents team with high grade, precision and advanced as the direction, reasonable collocation of Older, middle-aged and young adults, and combination of Industry-University-Research Cooperation.

3. ACHIEVEMENT

After 10 years of continuous exploration and practice, the practice of this approach has been effective and its application ontology has achieved fruitful results.

3.1 The teaching results are fruitful.

The implementation of this project has promoted the construction of high-level scientific research platforms such as the Surveying and Mapping Professional Committee of China Marine Lagoon Society and the Key Laboratory of Marine Surveying and Mapping of the Ministry of Natural Resources. The project has undertaken more than 20 provincial and school-level teaching and research reform projects, constructed 4 provincial and ministerial high-quality courses and teaching case

bases, constructed 1 provincial youth innovation team, obtained 1 excellent postgraduate guidance team, won more than 10 provincial and ministerial teaching achievement awards, and 1 first prize in school teaching achievement award. At the same time, through the project, 17 characteristic works and teaching materials were published, and 18 educational and teaching papers were published. Among them, 'Jindai Celiang Pingcha Lilun Yu Fangfa' won the first prize of the National Coal Industry Excellent Textbook of China Coal Education Association; 'ArcGIS 10 geographic information system textbook-from primary to proficient' was selected into the list of first-class textbooks for general higher education in Shandong Province in 2020.

3.2 The quality of postgraduate training has been significantly improved.

In recent years, the college has trained students to obtain 14 provincial excellent postgraduate and doctoral dissertations, 4 provincial postgraduate excellent achievement awards, 16 national invention patents, and more than 130 high-level SCI retrieval papers. Thirty-one graduate students participated in the ocean and polar expeditions, and seven students went to the University of Calgary in Canada, the German Geoscience Research Center and other universities to exchange and study. A large number of outstanding graduates have the Beidou Navigation Satellite System (BDS) research and development, Chang'e orbit determination and other major projects, as well as the difficult remote areas and grass-roots front-line contribution talent, meritorious service. For example, Zhang Decheng participated as a youth representative in the special program 'BangYang 3' jointly recorded by the Central Organization Department and the Central Radio and Television Station; Chen Jingtao, Wang Panlong and others participated in the Everest altimetry task in the first national survey team.

3.3 The ability to serve the society has been significantly improved

The results directly meet the needs of national and regional development and industry. In recent years, it has won more than 20 provincial and ministerial scientific research awards, including the second prize of national scientific and technological progress, the first prize of outstanding achievements in scientific research in colleges and universities,

and the special prize of marine engineering science and technology. The team's academic research and social service ability have been significantly improved, which has aroused widespread concern and reports in the society. Guangming Daily, Science and Technology Daily and other media have widely reported the typical deeds of the implementation of scientific research achievements and the deep integration of industry-university-research projects with the topic of "why small teams produce great achievements frequently" (Liu Yanjie and Han Hongshuo, 2021). More than 20 media, such as China Education News Network, China Youth Network and Science and Technology Daily, reprinted and reported the outstanding achievements of the team in the seamless connection of independent innovation and 'production, study and research'.

3.4 The results are widely used

The results have been applied and promoted in many universities such as China University of Mining and Technology (Xuzhou), China University of Petroleum (East China) and Liaoning Technical University, and the effect is good. The team members were invited to more than 20 universities such as Information Engineering University of Strategic Support Force, Jilin University and Shaanxi Normal University for experience introduction. In the national teaching conference or training class to do the conference report, the cumulative number of online and offline participants more than 5000 people, covering nearly 200 universities across the country.

3.5 The level of discipline construction has been improved

The cultivation of graduate students' scientific innovation ability in our school has effectively promoted the discipline construction. In 2017, the surveying and mapping discipline of our school was rated B in the fourth round of discipline evaluation by the Ministry of Education, ranking 7-10 among the similar disciplines in China. In the 2019-2020 postgraduate education sub-discipline ranking list, it is rated as "5★" discipline, ranking sixth among 58 universities in China, and has important academic influence at home and abroad.

4. CONCLUSION

Postgraduates are the new force of an innovative country and the main force of scientific and technological innovation research in schools. At present, four-in-one scientific and innovation surveying and mapping postgraduate training system of "ideological and political-curriculum-platform-team" has been explored and practiced for a long time. During the period, fruitful teaching results have been achieved, the quality of postgraduate training has also been significantly improved, and the ability to serve the society has been significantly improved. The cultivation of graduate students' scientific innovation ability has effectively promoted the discipline construction, and the effect of teaching reform has been fully affirmed. It provides reference and thinking for the cultivation of graduate students in other similar colleges and universities, and provides a reference way of education reform for the cultivation of scientific and innovative surveying and mapping talents in the surveying and mapping industry in the new era.

Postgraduate education is the highest level of higher education personnel training, is an important cornerstone of national development and social progress. The cultivation of scientific and innovative surveying and mapping talents should be oriented to the needs of national development strategy, aiming at the frontier and key fields of science and technology, comprehensively promote the training mode of scientific and innovative surveying and mapping talents, and continue to improve, explore, reform and innovate, and strive to cultivate surveying and mapping postgraduates with firm ideals and beliefs, solid professional knowledge, exquisite practical skills and outstanding scientific and innovative ability. How to promote the overall development of postgraduate students' moral, intellectual, physical and aesthetic development, effectively enhance the ability of postgraduate education to support and lead socio-economic development, while providing sufficient talent and technical support for the high-level spatiotemporal information services of natural resources and the intelligent transformation and upgrading of the geomatics engineering industry in the new era, is a topic that requires continuous exploration and attention.

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