

Reform of Postgraduate Developing Mode within Collaborative Innovation Chain under the Cross-disciplinary Background

Hong Xiaobin^a, Xiao Guoquan^{b,*}, Zheng Guihong^c

South China University of Technology, Guangzhou, Guangdong, China

^amexbhong@scut.edu.cn, ^bmegqxiao@scut.edu.cn, ^cGreveny@outlook.com

*Corresponding author

Keywords: Postgraduate developing Mode, Collaborative Innovation Chain, Cross-disciplinary

Abstract: In view of the problems of single mentor system, poor cohesion and coherence of transition between undergraduate and postgraduate, and lack of in-depth integration of industry-university-research in postgraduate developing, this paper explores the collaborative innovation chain mechanism of multi-disciplinary teachers' collaborative guidance, postgraduate student-led, self-research collaboration, and industry-university-research collaborative education. And a postgraduate developing mode within collaborative innovation chain under the cross-disciplinary background has been proposed, so as to comprehensively improve the innovation ability of postgraduate students.

1. Current challenges in postgraduate developing

At present, the training of postgraduates in China generally has the following problems: (1) Single tutorial system: Using the traditional "single tutorial system" mode, students always study with a tutor from the interview, enrolment, training plan making, topic selection and thesis research. The knowledge structure, way of thinking, research methods and subject areas of the tutor are easy to limit students' vision and ideas, and often make innovation at the intersection of disciplines impossible. (2) The coherence of undergraduate and postgraduate studies is poor: Except for a few students from innovative classes, it is difficult for most postgraduate students to obtain systematic scientific research literacy and ability training during their undergraduate stage, and it takes several months or even half a year to complete the transition from undergraduate to graduate and enter the state of scientific research when they are newly enrolled. This is a structural pain that is difficult for graduate students to overcome. How to tap and attract good students and explore the coherence of undergraduate and postgraduate connections. (3) Lack of in-depth integration of industry-university-research: there may be some problems in personnel training that are divorced from reality in the process of industry-university-research cooperation. It is necessary to explore the organizational structure and institutional mechanism among industry, universities and government, especially to study the mechanism of industry-university-research cooperation from the perspective of interest evolution mechanism. The effectiveness of industry-university-research collaboration in educating people needs to be improved, and there is a lack of effective mechanisms for in-depth cooperation between industry, academia and research institutes, so as to give full play to the integrated advantages of enterprises, universities and research institutes.

Xu Linyu ^[1] et al. proposed to shape the intelligent education environment from three technical characteristics; Zhao Gai ^[2] explored the model of joint training of graduate students by interdisciplinary tutors; Liang Baoying ^[3] et al. proposed to improve the integration system and organizational guarantee of production and education, so as to achieve the difference between professional degrees and academic degrees. Ke Qinfei ^[4] et al. proposed the "double synergy" model of production-education integration; Li Feng ^[5] et al proposed that elastic increment and vertical and horizontal diffusion of technology should be introduced to describe industrial generic technologies according to the innovation chain characteristics of specific technologies. Liang Wenliang ^[6] proposed that collaborative cooperation should be promoted based on the differences

and advantages of various subjects in the industrial innovation chain. Li Jingwen^[7] built a "talent-professional-industry chain" integrated collaborative talent training mechanism. This paper proposes a comprehensive reform in the key links of graduate training, such as cross-disciplinarity (platform, tutor team, etc.), undergraduate-graduate collaboration and industry-university-research (project and joint guidance) combination.

2. Reform and effect of postgraduate developing mode within collaborative innovation chain under multidisciplinary background

In recent years, interdisciplinary teams have focused on the collaborative mode of innovation chain to train graduate students, mainly from the interdisciplinary platform and cross-integration of mentors, graduate students to grow into their own project master and joint training of industry, university and research to improve graduate innovation ability.

2.1. Project cooperation promotes the interdisciplinary platform and cross-integration of mentors

The interdisciplinary team uses interdisciplinary development courses, employs cross-faculty tutors, and strives to break down knowledge barriers between faculties. The Unmanned Intelligent Technology and Equipment Laboratory has set up a team of graduate instructors covering multiple disciplines such as machinery, materials, Marine, power, software, computer and physics. Through multiple rounds of discipline consolidation, an independent research and development basic support platform for Marine engineering intelligent equipment has been initially built, mainly carrying out research on Marine engineering equipment, intelligent measurement and control equipment, independent performance testing, structural safety and operation and maintenance. In recent years, it has undertaken more than 40 national, provincial and ministerial science and technology innovation projects, and has achieved a series of academic achievements. The representative projects mainly include the national key research plan, the key special project of the Guangdong Provincial Science and Technology Department (artificial intelligence special project), and the major project of the Guangdong Provincial Natural Resources Department (marine engineering equipment special topic). In recent years, the main team members have jointly participated in the following representative scientific research projects: the 2019 National Natural Science Foundation project, including 3 team members; Central universities 2022 annual basic research expenses of Natural science - interdisciplinary research project, project members include 6 team members; The completed key special projects of Guangdong Science and Technology Department (unmanned technology topic), Guangzhou Major industrial technology research project, Guangzhou Major science and Technology special project (future major industry topic) and other projects include more than 3 team members.

The multi-disciplinary integration tutor team has published more than 200 academic papers in related fields, and has more than 100 patents covering advanced intelligent measurement and control of unmanned boats/ships, autonomous performance testing, structural safety and operation and maintenance platforms and applications. Among them, there are 36 authorized invention patents, 2 items of PCT, 10 software copyrights and 5 unmanned boat/boat manufacturing and performance test standards. The representative scientific research achievements include the second prize of Science and Technology Progress of Guangdong Province, the second prize of Science and Technology Progress of China Instrumentation Society, and the Excellence Award of China Patent.

2.2. Undergraduate-graduate collaboration to promote postgraduate students to become their own project masters

While building a multidisciplinary laboratory, on the basis of guiding graduation design, student projects and leading the team to participate in innovation competitions, the team teachers were approved as the school's "unmanned intelligent boat team" innovation base in June 2022. Under the leadership of the "double innovation" base, they jointly created a student practice innovation platform, focusing on the cultivation of collaborative innovation ability of undergraduates and

postgraduates and relying on interdisciplinary students and joint projects to explore the intersection of disciplines and jointly cultivate graduate students, a series of representative results across disciplines have been achieved.

Under the guidance of multi-disciplinary teachers, the team has extensively participated in various competitions led by Challenge Cup, Creative youth and Internet +. The team's master students have won a national second prize of 2021 China Sensor Innovation and Entrepreneurship Competition, two first prizes and one second prize of South China Competition and have won a national second prize in the 2018 China (International) Sensor Innovation and Entrepreneurship Competition and a first prize in South China, which enhanced the innovation ability of graduate students.

2.3. In-depth cooperation in industry-university-research projects to promote joint training of postgraduate students

In recent years, the interdisciplinary team has worked closely with leading offshore equipment enterprises to provide students with an interdisciplinary practice environment through major projects as a demand traction, cultivate interdisciplinary integration awareness, and rely on cooperative projects to enable graduate students with interdisciplinary topics. Postgraduate students are trained with the characteristics of focusing on foundation, practice and frontier, so as to form a multidisciplinary dimension of high-level innovation results, cultivate relevant thinking and ability.

Relying on the joint training base of graduate students jointly built by universities and enterprises, it has been approved by the project of Guangdong Graduate Education Innovation Plan in 2022. Since 2018, there are 8 postgraduate students who have been jointly trained by Guangzhou Shipyard International Company Limited for a long time, one of which 1 has won the school-level outstanding graduation thesis, and many postgraduate students have participated in the "Challenge Cup" extracurricular science and technology competition for college students, and won the second prize of provincial and ministerial level for two consecutive years.

3. Conclusion

Reforms such as multi-disciplinary (platform, tutor team, etc.) intersection, integration of undergrad and postgraduate and industry-university-research (project and joint guidance) combination fully mobilize the enthusiasm of interdisciplinary tutors and extract the key scientific problems from the industry-university-research joint project for postgraduate research projects and providing guidance. Integration of undergrad and postgraduate guarantees the innovation continuity of graduate students, and cultivates engineering practical ability and innovation ability in solving project problems. It has formed postgraduate developing mode within innovation chain coordination such as "multi-disciplinary teachers' collaborative guidance, integration of undergrad and postgraduate, and industry-university-research collaboration", which has comprehensively improved the innovative ability of postgraduate students.

Acknowledgement

We would like to express our sincere gratitude for the support and funding received from the Cultivation Project for Postgraduate Education and Teaching Achievements Award at South China University of Technology in 2022 (No. C9228147) and the Undergraduate Teaching Reform Project at South China University of Technology in 2022 (No. C9223072). These projects have played a crucial role in the successful completion of our research and the development of this manuscript. Additionally, we would like to extend our thanks to the reviewers for their constructive suggestions, which significantly improved the manuscript. Finally, we shall express our appreciation to the journal for providing us with the opportunity to share our findings with the scientific community.

References

- [1] Xu Linyu,Zhang Xing,Zheng Hanzhong,et al.A preliminary study on the innovative training mode of environmental graduate students in colleges and universities[J].Environmental Education, 2023, No.263(04):52-54.(in Chinese)
- [2] ZHAO Gai.Reach on Demand-driven Interdisciplinary Postgraduate Collaboration Training Model:Taking Electromagnetical System as an Example[J].Education Teaching Forum, 2023, No.613(10):177-180.(in Chinese)
- [3] LIANG Baoying,WANG Yongqing,LIU Peiyun.Research and practice on the training mode of professional degree postgraduates based on industry-university-research cooperation[J]. Education Teaching Forum,2023,No.281(03):98-101.(in Chinese)
- [4] Ke Qinfei,Fang Yongzheng,Zhai Yuming.Innovation and Practice of“Dual Synergism”Industry-education Cultivation Mode for Postgraduate Students of Engineering Professional Degree, 2023, No.200(03):53-58.(in Chinese)
- [5] LI Feng, ZHOU Liang, YIN Jie. Research on collaborative innovation mode of generic technology in high-tech ship industry[J].Science-Technology and Management, 2023,25(01):45-56. DOI:10.16315/j.stm.2023.01.004.(in Chinese)
- [6] LIANG Wenliang,HUANG Ruiling.The Connotation Structure and Dynamic Factors of the “Two Chain”Integration of the Industrial of the Industrial Chain and Innovation Chain[J]. Science Technology and Industry,2023,23(03):62-68.(in Chinese)
- [7] Li Jingwen,Jiang Jianwu,Gao Ertao,et al.Research on collaborative training mode of composite talents of surveying and mapping geographic information professional group[J].Chinese Journal of Multimedia and Network Teaching(last ten days),2022(08):172-175.(in Chinese)