

Research on the Path of Cultivating Innovative Entrepreneurship of Undergraduate and Graduate Students Based on Scientific Research Platform

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Abstract: In the background of the new era, innovation and entrepreneurship education for college students is the way to deepen the reform of college education and teaching, improve the quality of high-level talent cultivation, and promote the national innovation-driven development strategy and the development of entrepreneurial economy. The article researches the current situation of innovation and entrepreneurship education development of college students in China, sorts out its main problems, and proposes the cultivation mode of using a scientific research platform for dual-innovation education, which not only provides a practice base for college students' innovation and entrepreneurship, but also forms a cross-gradient learning team based on scientific research platform, realizes the complementary advantages of undergraduate and graduate students in innovation and entrepreneurship work, and provides a reference for innovation and entrepreneurship cultivation in local colleges and universities.

1. Introduction

Colleges and universities are important bases for innovation and entrepreneurship education.[1,2] The strengthening of innovation and entrepreneurship education in colleges and universities is an urgent need for the country to implement the innovation-driven development strategy and promote the upgrading of the economy in terms of quality and efficiency, as well as an important measure to promote the comprehensive reform of higher education and to promote higher quality employment and entrepreneurship for college graduates. In their attempts to improve the comprehensive quality of students to improve the reform exploration, various universities have proposed that scientific research platforms play a key role in cultivating students' innovation and entrepreneurship, and the research platforms include key laboratories, practice bases and engineering centres at all levels.[3-6] These research platforms have accumulated a wealth of hardware resources, space resources, and human resources. The research platform not only enhances the innovation and entrepreneurship of undergraduate students, but also provides a unique advantage for the training of postgraduate students in research and innovation, while continuing to provide technical support for regional economic development.[7-11] This paper explores how to cultivate students' innovation and

entrepreneurship ability based on a scientific research platform to improve the quality of talent training.

2. Current Situation of New Entrepreneurship Education for College Students

The survey found that there are a series of problems in innovation and entrepreneurship education for college students in local applied colleges and universities, such as the contradiction between innovation and entrepreneurship, cognition and behavior, confusion in innovation and entrepreneurship thinking, lack of innovation and entrepreneurship knowledge, and lack of professionalism and direction in innovation and entrepreneurship course education. The direct factor leading to the development of innovation and entrepreneurship among students is the small number of innovation and entrepreneurship bases, which absorb a limited number of students and cannot provide students with a suitable space for innovation and entrepreneurship. The innovation of postgraduate students has unique advantages, such as strong independent learning ability, mature thinking, flexible time arrangement, more comprehensive professional knowledge structure, and stronger practical and hands-on abilities. The graduate students are in the tutor's laboratory, and the research team they rely on can provide a certain practice place. However, in the actual training process of postgraduate students, postgraduate students mainly focus on the publication of papers and the completion of projects, etc., The innovation of postgraduate students basically copy the model of undergraduate students, but cannot play their own advantages, which also hinders the development of innovation and entrepreneurship. At present, the problems of innovation and entrepreneurship of college students mainly focus on two aspects. First, there is a lack of high-level innovation and entrepreneurship guidance for teachers. Most of the mentor teams in higher education are made up of teachers and counsellors on campus, and there is a lack of influential academic leaders and internationally competitive high-level mentors. Most mentors are only theoretically qualified and lack practical experience in innovation and entrepreneurship, and do little to inspire the student body to be innovative and entrepreneurial, a situation that is related to the pressure of performance appraisal on teachers in universities. Secondly, there are too few independent innovation and entrepreneurship bases that can serve students. There are few innovation and entrepreneurship platforms and practice bases, and the development of innovation and entrepreneurship is scattered and cannot form innovation and entrepreneurship teams of a certain scale. Moreover, innovation and entrepreneurship platforms are generally slow to be updated and cannot be the most cutting-edge technology fields in line with each other, nor can they integrate well with multidisciplinary professional education, leading to a slow process of promoting innovation and entrepreneurship in universities, and unsatisfactory results of innovation and entrepreneurship.

3. Integrating Research Platforms and Playing Their Leading Role in the Innovation and Entrepreneurship Process

The establishment of a research platform should meet the diversified and multilevel education needs. The establishment of scientific research platforms should meet the diversified and multilevel education needs. And the collaboration of multiple research platforms can be better integrated resources and play the role of teamwork. According to the method of cluster sampling, this paper selects the undergraduate and graduate students of Bohai University (hereinafter referred to as "our University") as the survey objects to conduct a questionnaire survey. This survey was randomly selected in the second and third grade undergraduate and graduate students to issue 500 questionnaires, 448 questionnaires were collected. After removing the waste papers, a total of 405

valid questionnaires were collected, with an effective recovery rate of over 80%.The specific results are shown in Table 1.

Table 1: Findings on external factors affecting students' innovation and entrepreneurship

Factors	Expressive connotations	Proportion
Basic Services	Research platforms, laboratories and other hardware facilities	53.72%
Institution building system	Rules and principles	27.54%
Organisational Service System	Organizational structure for the management and operation of innovation and entrepreneurship	18.74%

Table 1 shows that most of the surveyed students believe that the basic service support system plays a crucial role in the cultivation of innovation and entrepreneurship ability, and the research platform is an important part of the basic service support system. The hardware and software construction of research platforms is an essential element of scientific research and technology transformation.

The scientific research platform of our university is rich in resources. The School of Physical Science and Technology alone has eight provincial research centres, including the Liaoning Provincial Key Laboratory of Microelectronics Process Control, Liaoning Provincial Key Laboratory of Optoelectronic Functional Materials Testing and Technology, Liaoning Provincial Engineering Research Centre of Silicon Materials, Liaoning Provincial Engineering Research Centre of Photovoltaic Technology, and Liaoning Provincial Engineering Research Centre of Optoelectronic Integration Control Technology and Equipment Manufacturing. In addition, there are three university-level research centres, including the Institute of Theoretical Physics, and the "Civic Crowd" specialised innovation and integration base, which provides a number of important platforms for students to cultivate their innovative and entrepreneurial abilities. Compared to ordinary teaching laboratories and research laboratories, the research platform not only includes rich teaching resources, but is also richer in terms of talent ratio, which makes it easy to attract and gather high-level talents, and is a cradle for the cultivation of teams with strong innovation ability and high research level, which provides a good platform for the cultivation of innovative talents. By December 2022, there are more than 1200 professional teachers in our university, of whom no less than 70% are engaged in scientific research, and their scientific research depends on various research platforms of our university.

From the above data, it can be seen that the scientific research platform, by integrating high-quality hardware resources of our school and attracting teachers with high enthusiasm for scientific research in our school, can undertake a variety of scientific research projects, deal with the basic problems of each discipline and frontier problems with practical applications, cooperate with enterprises and perform social service duties.

This way, the research platform can well solve the practical difficulties such as the shortage of innovation and entrepreneurship funds, the shortage of practice space, and the lack of innovation and entrepreneurship awareness of graduate students. Therefore, the research platform is perfectly suited as an important base for the development of our discipline and the training of innovative and entrepreneurial talents.

4. Innovation and Entrepreneurship Cultivation of Science and Engineering Students Based On Scientific Research Platform

4.1. All-Round, Multi-Level, Large-Scale Research Platform Construction

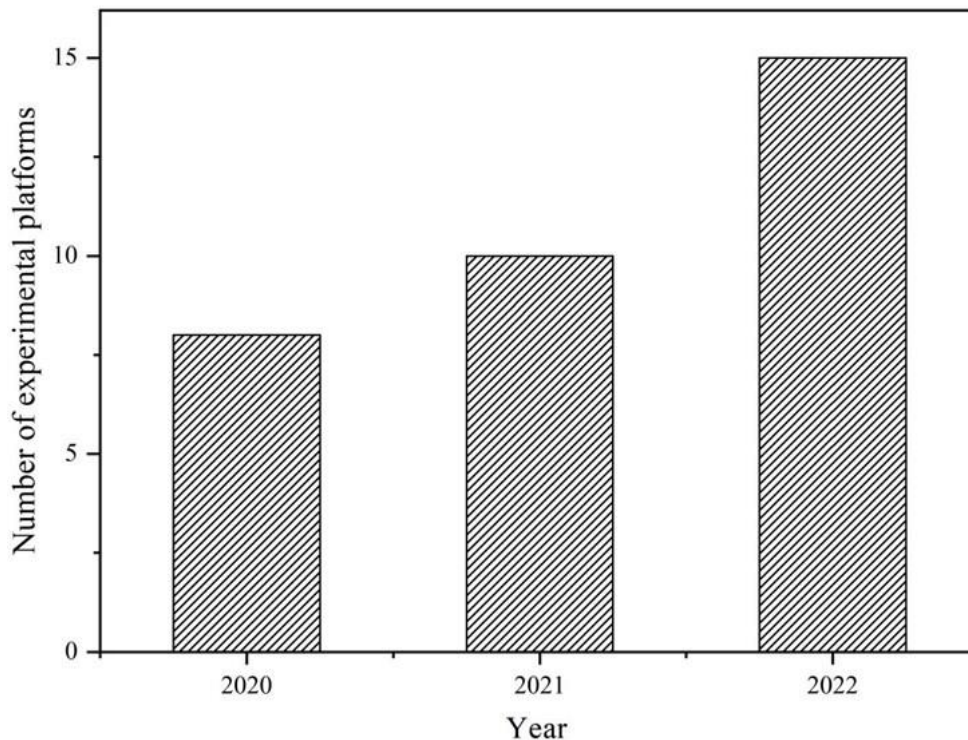


Figure 1: Changes in the number of research platforms in our institute in the past three years.

At the beginning of the establishment of our research platform, the utilization rate of the platform was taken into consideration and an integrated platform for teaching and research was built. The platform carries the dual role of teaching and research, such as a large experimental platform in the ultra-clean room, as a research laboratory for the device team and a teaching laboratory for microelectronics and new energy materials and devices majors. Figure 1 shows the changes in the number of research platforms in our institute in the past three years. In addition, taking into account the characteristics of the various disciplines of the university, a multidisciplinary laboratory platform has been built, such as the Materials Testing Centre, which includes a photovoltaic testing centre, a silicon materials testing centre and a microelectronics process laboratory. The research resources of the School of Control Science and Engineering, the School of Physics, and the School of Chemical and Materials Engineering have been integrated to form a large research platform for the preparation, testing, and characterization of optoelectronic functional materials along the whole industrial chain.

4.2. Perfect Innovation and Entrepreneurship Management Team and Incentive Mechanism

In the process of building a cross-faculty research platform, the university and the faculty provide strong support in terms of policy. In the process of making the student training program, innovation and entrepreneurship courses are added. Taking undergraduate students majoring in Microelectronics as an example, 2-credit innovation and entrepreneurship courses are arranged in the training program before. With the establishment of the scientific research platform, independent

practice courses are added to the training program. Increase students' interest in innovation and entrepreneurship. At the same time, the school sets credits for innovation and entrepreneurship for students, requiring them to complete at least one innovation and entrepreneurship activity and achieve certain results, which will serve as the basis for students' GPA. In the training program of graduate students, innovation and entrepreneurship education runs through the whole training program. For example, the condensed matter physics major in physics arranges students to study on the scientific research platform at the entrance education, and then carries out scientific research on this basis. In the postgraduate training program, additional elective course modules, students according to their own research direction to study stage by stage, level by level. The three-year academic evaluation of postgraduate students is carried out by sections. The innovative spirit is reflected in the proposal report of the first stage, and the whole research and paper after that can continue this view. In the process of graduate training, an interdisciplinary and multitutor joint training mode is encouraged, so that graduate students can develop innovative and entrepreneurial thinking in different atmospheres. Compared with postgraduates, the time for innovation and entrepreneurship of undergraduates is relatively short and their knowledge scope is limited. Here, the students are trained in an echelon style by forming a project team with postgraduates and undergraduates. The members of the project team should be composed of a supervisor group and a student group to carry out the research work of innovation and entrepreneurship in a large team. Figure 2 shows the composition ratio of each type of instructors.

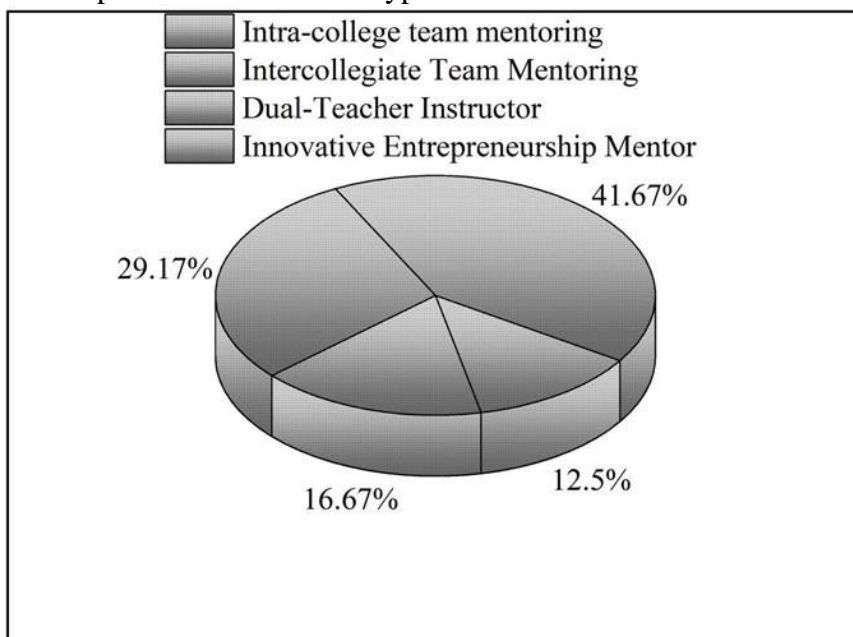


Figure 2: The composition ratio of instructors.

4.3. The Organic Combination of Scientific Research Platform and Specialized Innovation and Integration Base

Incubators are needed to cultivate college students' innovation and entrepreneurship ability, and the goal of the construction of innovation and entrepreneurship practice base is to stimulate graduate students' innovative thinking, so that they can train their innovation quality in the process of continuous thinking and repeated practice. The University has established a number of important innovation and entrepreneurship bases for the training of undergraduate and postgraduate students. These bases follow the operation mechanism of "open time, open space, and open resources", and

adopt the combination of the research platform of the research team and the University's specialised innovation and integration base, the combination of the University's experimental technology centre and the combination of professional related enterprises to carry out collaborative teaching and research work. In the past three years, more than 200 students have won prizes in various innovation and entrepreneurship competitions based on the research platform and the specialised innovation base, Figure 3 shows the number of awards won by students at all levels in the last three years, through the study, enabling postgraduate students to complete their innovation and entrepreneurship education while participating in research tasks, thus satisfying teaching needs and giving back to society.

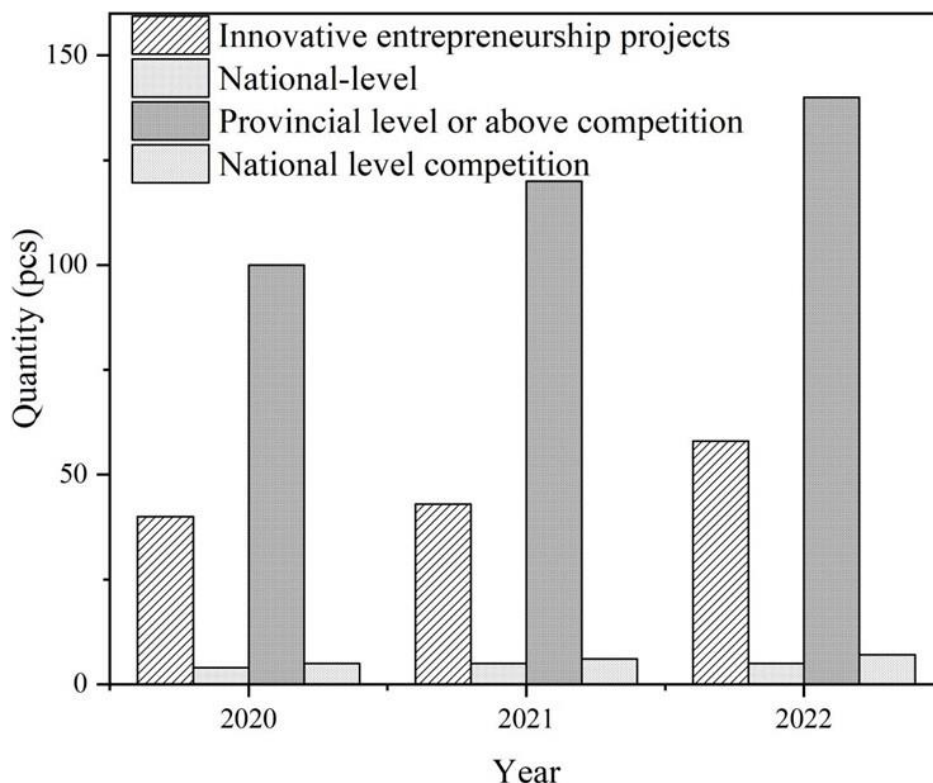


Figure 3: Number of awards won by students at all levels in the last three years.

4.4. The Important Role of Research Platform in Students' Graduation Thesis (Design)

The establishment of a joint research platform provides students with a wider choice of graduation designs for different majors. For majors that focus on the application of professional skills, such as electronics, information, etc., the professional graduation project can not only be based on the thesis of the major, but also can design products according to the scientific research platform, self-programming, etc., it can also be related to the professional skills certificate, high-level competition awards, etc. The existence of scientific research platform can expand the scope of topics for students' graduation design. Through the project research carried out by students on the research platform, students can independently design their graduation design and choose their own topics in the process of graduation design, which can encourage students to be good at observation and analytical thinking, good at finding the actual problems, and obtain the topic selection inspiration from the actual production activities. Fully mobilize students' subjective initiative, enthusiasm, and enthusiasm for innovation. With the help of a scientific research platforms, students not only regard the graduation design as a task to complete, but also as a

demonstration of their own ability, a way to train their thinking, and a kind of innovative activity, so that students' personality and innovative thinking can be fully developed. At the same time, the research platform can also be combined with enterprises. The school encourages students to do graduation projects in cooperative enterprises. The production technology problems encountered in the internship are taken as graduation project topics, and the graduation project is completed under the joint guidance of the technical staff and instructors of the enterprise. In the process of the graduation project, on the one hand, students can exercise their practical application ability and improve their interest in applied research. At the same time, in the process of hands-on practice, students will improve the investigation, scientific analysis, independent thinking, problem finding, problem solving, interpersonal communication, professional quality, and other abilities. Figure 4 shows the survey of the direct correlation between this major thesis and this professional knowledge, and by 2022, the degree of chiseling between the undergraduate thesis and this major reached 100%. On the other hand, students complete their graduation design in enterprises, so that enterprises have a basic understanding of the knowledge, ability, and quality of graduates, which facilitates the selection of talents and improves the employability of students. This not only improves the employment rate of graduates, but also saves the recruitment cost of enterprises.

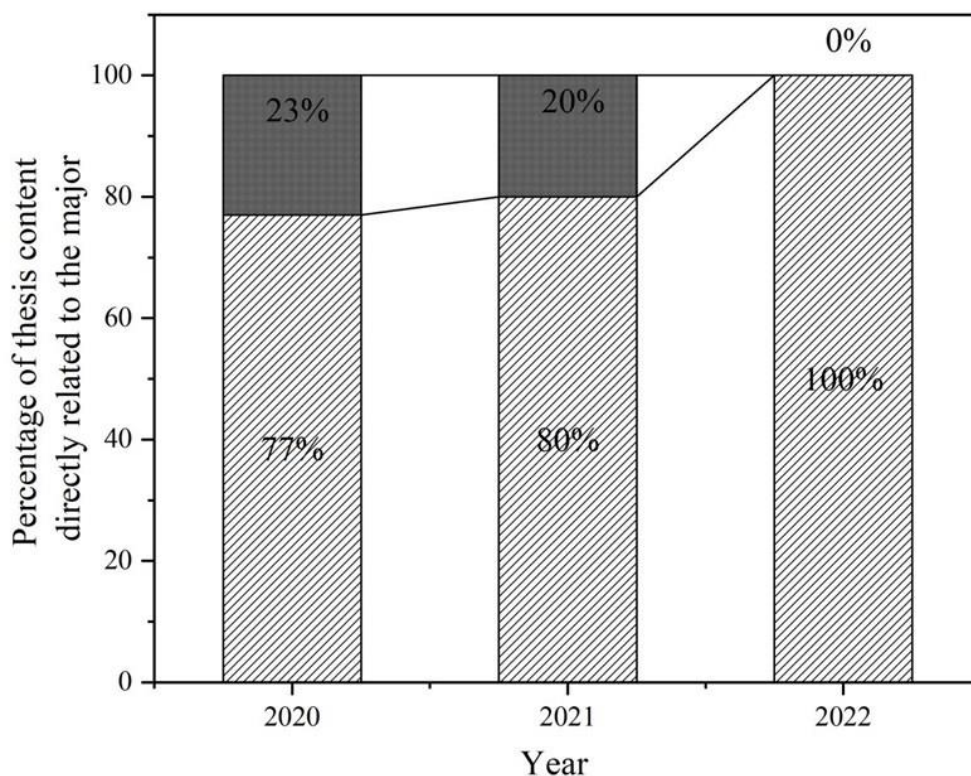


Figure 4: The degree of relevance of the thesis to professional knowledge.

At the same time, in the process of cultivating academics according to the scientific research platform, the graduation design work of students is carried out in teams, which is an innovation and development of the graduation design work, and is an effective measure to cultivate students' innovation ability, comprehensive ability and cooperation spirit. Each student can not only get training in scientific research methods and approaches in their own research, but also get systematic technical knowledge from other related research, which expands the technical space of their research content. During the graduation design period, the team members have been able to share the work with others, share the results, and help each other in the process of mutual help, and

implicitly appreciate the importance of teamwork, thus enhancing their own sense of responsibility, cooperation and collaboration.

5. Conclusions

In short, relying on the scientific research platform to combine the scientific research work with the training of first-class innovative talents to promote the innovation and entrepreneurship education reform of college students, providing a reference for the cultivation of college students' innovation and entrepreneurship ability.

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