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Study on Innovation and Entrepreneurship Education of Colleges and Universities in Guangdong Based on Regional Collaborative Innovation

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***Abstract*—In the context of the construction of the Guangdong-Hong Kong-Macao Greater Bay Area, the reform of the innovation and entrepreneurship education model in Guangdong universities will directly affect the industrial structure and economic development quality of the Bay Area. Qualified innovation and entrepreneurial talents are the new force to maintain the economic vitality of the Bay Area. The development of multi-level university innovation and entrepreneurship education should start from the status quo of science and technology innovation in Guangdong, Hong Kong and Macao. Under the concept of collaborative innovation, it puts forward new requirements for the integration of regional science and technology innovation and university innovation education. Based on the actual situation of Guangdong universities, this paper deeply analyzes the problems and development defects of innovation and entrepreneurship education, and explores the optimization path from the aspects of innovation education system construction, innovation tutor specialization level, innovation team connotation training, and innovation training open education.**

Keywords—collaborative innovation; colleges and universities; innovation and entrepreneurship education

I. INTRODUCTION

Since China's "Development of the Silk Road Economic Belt and the Vision and Action of the 21st Century Maritime Silk Road" clearly stated that the development goal of Guangdong-Hong Kong-Macao Greater Bay Area has been promoted, the strategic position of Guangdong-Hong Kong-Macao Greater Bay Area has been continuously improved. "Building the Guangdong-Hong Kong-Macao Greater Bay Area and building a world-class urban agglomeration" has gradually turned from planning to reality. From the practical experience of the world-class Bay Area such as the San Francisco Bay Area and the New York Bay Area, encouraging innovation and entrepreneurship, cultivating entrepreneurial talents, and improving economic vitality are among the key factors for their success. It can be said that the spirit of innovation plays the role of the economic engine of the Bay Area and is the key to leading the international leaping development in the Greater Bay Area. As an important core position of Greater Bay Area, Guangdong Province has carried out research on innovation and entrepreneurship education for college students, accelerated the innovation education of colleges and universities, cultivated innovative talents, created an innovation platform, and provided strong talents and technical support for the scientific and technological innovation in the Bay Area. The provision of strategic consulting and decision support by universities has important practical significance for the smooth realization of the development goals of Guangdong-Hong Kong-Macao Greater Bay Area.

*Fund Project: Provincial Key Platforms and Major Scientific Research Projects of Guangdong Universities in 2018: Guangdong University Innovation Education Research Based on Guangdong-Hong Kong-Macao Greater Bay Area (Project No.: 2018WQNCX256); Innovation and Cultivation Project of Zhuhai College of Jilin University in 2018; Optimization analysis of innovative education in Guangdong universities in the context of Guangdong-Hong Kong-Macao Greater Bay Area (Project No.: 2018XJCQ045).

II. CURRENT STATUS OF SCIENTIFIC AND TECHNOLOGICAL INNOVATION IN GUANGDONG AND SURROUNDING AREAS

A. The Status Quo of Technological Innovation in the Pearl River Delta

The overall economic strength of the Pearl River Delta city is outstanding, coupled with the convenient geographical location, close to Hong Kong and Macao and facing the sea, providing a fertile ground for technological innovation. The friendly and healthy economic development pattern has promoted the rapid development of innovation and

technology in various fields, and the development has been full of stamina. The educational resources in the Pearl River Delta region are highly concentrated, and a number of well-known key universities in China are gathered. Many outstanding college students are the backbone of the cultivation and reserve of innovative talents for technological innovation.

The Pearl River Delta government has formulated a series of technological innovation strategies to create a relaxed and free innovation environment. The investment in science and technology funds is high, and scientific research institutions have risen rapidly year by year, forming a docking relationship with the enterprises for the supply and demand of scientific and technological achievements, and accelerating the transformation of scientific and technological achievements. Relying on the advantages of economic education resources, the technological innovation mechanism of the Pearl River Delta has been continuously improved and the cause of innovation has been lengthwise advanced.

B. Status Quo of Scientific and Technological Innovation in Hong Kong and Macao

The Hong Kong and Macao region has a solid economic foundation and possesses a wealth of scientific and technological information resources. It has standardized, professional and international scientific and technological information services, and a large number of scientific research institutions. In the era of big data, the cutting-edge scientific and technological information resources held by Hong Kong and Macao are important strategic resources for the development of science and technology innovation, which will become the bargaining chip for the future transformation and reuse of scientific and technological data values. Close interaction with the international community, the interconnection of information elements and the mutual sharing of scientific and technological resources have provided an advanced reserve of scientific and technological resources for Hong Kong and Macao. The scientific and technological achievements in major areas are remarkable, the data resource mining technology is advanced, and the science and technology construction system in Hong Kong and Macao continues to mature.

III. THE NECESSITY OF REGIONAL SCIENCE AND TECHNOLOGY INNOVATION AND UNIVERSITY INNOVATION AND ENTREPRENEURSHIP EDUCATION

A. The Importance of Coordinated Innovation in Regional Development

The construction of the Guangdong-Hong Kong-Macao Greater Bay Area is an important strategic step for China to form a new pattern of opening up to the outside world. It is a trend of the world to build it into a world-class international Grand Bay area. Without exception, the International Grand Bay Area has the ability to continuously achieve self-transcendence and transformation and upgrading in a fierce competitive landscape. If Guangdong-Hong Kong-Macao Greater Bay Area wants to play an engine role in leading the regional and even national value chain, it must form a development pattern of coordinated innovation, innovation and coordination in various fields.

Innovation is the first driving force to lead development. Science and technology innovation requires the integration of various innovation entities and various innovation elements in the region. At the same time, it is also guided by the strategic vision of the government, the transformation of scientific research achievements in the natural sciences and social sciences of university research institutes, and the collaborative development of enterprises' investment and entrepreneurship platforms. The regional innovation system needs to create a niche of scientific and technological innovation, combined with the integration advantages of the state, enterprises, universities, research institutes and talents, which is conducive to promoting the construction of various types of innovative capabilities in the local area. In turn, it will acquire more and greater scientific and technological information resources and technological transformation value for the region.

The circulation of energy, such as scientific and technological resources, economic capital, and knowledge reserves among various innovation entities in the region, forms an innovative ecological circle with dynamic balance and active vitality, which provides the best strategic choice for integrating regional innovation elements, enhancing regional innovation capabilities, and increasing regional quality innovation resources. Guangdong-Hong Kong-Macao Greater Bay Area has gathered a large number of high-quality innovative resources, attaches importance to the supporting role of colleges and universities in science and technology construction, conducts inter-school entrepreneurship education cooperation, and coordinates the reciprocal symbiosis of innovative subjects in various fields. It is an indispensable measure in the process of developing into the International Grand Bay Area.

B. The Importance of Innovation and Entrepreneurship Education in Colleges and Universities in Regional Development

As the group with the highest level of thinking activity, the best exploration spirit and the strongest awareness of innovation and entrepreneurship, college students are the backbone of innovative talents training and promotion. Therefore, if Guangdong-Hong Kong-Macao Greater Bay Area wants to rank among the world's leading international Grand Bay Areas, it must attach importance to the supporting role of innovation and entrepreneurship in scientific research and construction, and promote the quality of innovative talents through the development of innovative education.

At present, the scientific and technological information resources of the regional science parks and enterprise research institutes rely heavily on the innovation of scientific research achievements in universities. The establishment of a successful interaction model between industry, academia and research is also inseparable from the scientific and technological cooperation mechanism formed by universities

in terms of discipline construction, personnel training, technical services and transformation of achievements. Colleges and universities are the cradle of regional science and technology innovation talents training. They not only undertake the functions of scientific research, but also shoulder the burden of implementing higher education. Reforming the institutional mechanism of innovative education is a necessary measure to strengthen the construction of innovative talents.

In addition, the development of innovation and entrepreneurship education in colleges and universities can fully exert the scientific and technological service capabilities of colleges and universities, facilitate the dissemination and absorption of resources such as technology and information in the innovation network, and make up for the shortage of diffusion of knowledge and technology in the region. Local SMEs can gain the help of innovative networks, reduce the cost of technology investment, accelerate the pace of product development and innovation, and promote the transformation of technical knowledge into market demand. At the same time, it is easy to improve the traditional scientific and technological research mechanism of colleges and universities, so that the research of researchers can be more integrated with market demand and enterprise innovation. In addition, it will achieve integration and optimization of various types of entities in the region, collaborative innovation, and complete regional integration of scientific and technological innovation resources.

IV. The Status Quo of Innovation and Entrepreneurship Education in Guangdong

A. The Institution Construction of the Synergy Mechanism of Innovation and Entrepreneurship Education in Colleges and Universities Is Imperfect

In recent years, more and more foreign companies in Guangdong have cooperated with universities to establish scientific research centers. However, its technological innovation capability still has a big gap compared with the world-class high-tech parks. The efficiency of transforming scientific and technological achievements into market demand products is not high, and it is difficult to meet the needs of enterprises to adapt to market changes for product development and production. This does not match the mission of contributing to the development of regional economic quality. Because the research methods of colleges and universities are relatively traditional, lack of communication with enterprises, the industry and market information are occluded, and the rate of responding to market changes is slow, resulting in inconsistent R&D results with the products required by enterprises, resulting in the loss of their respective cost inputs.

At this stage, the cooperation between Guangdong universities and other R&D institutions in scientific research is in a spontaneous state, and there is no overall strategic plan for mutual cooperation. It is difficult to achieve a pattern of institutionalization, routinization, and large-scale cooperation. Decentralized research is also not conducive to the integration and utilization of scientific and technological information resources. The service system of inter-regional science and technology innovation education intermediaries is difficult to coordinate, unable to provide advice and technical guidance for teachers and students to innovate and start businesses, and the service potential that should be available is difficult to play. At the same time, a strong trust mechanism has not been established between Guangdong universities, science parks, and enterprises. Trusted regional collaborative innovation culture also requires the implementation of corresponding organizational guarantees. The innovation and entrepreneurship education of colleges and universities should not be limited to the closed scientific research exchanges within the school, and the collaborative innovation with other innovative subjects is a difficult problem that must be broken.

B. The Lack of Double-type Teachers in Innovation and Entrepreneurship Education

The state's plan for education reform has clearly stated that it is necessary to create "double-type" teachers in many aspects (that is, teachers who have both theoretical teaching and practical teaching skills). For colleges and universities in innovation and entrepreneurship education, it is obviously an important measure to improve the quality of teachers with high-quality "double-type" teachers. However, it is undeniable that the teachers of Guangdong universities cannot meet the requirements for the high-quality development of innovation and entrepreneurship education. First of all, the age of teachers is generally younger, and most of them still stay at the level of theoretical knowledge. They lack certain practical experience and cannot provide practical teaching guidance to students. In addition, some colleges and universities do not pay attention to the strengthening of the construction of the teaching staff. The funds are insufficient, the teachers' salary is not high, and the teachers' teaching enthusiasm is frustrated.

At present, the construction of the "double-type" teacher team in Guangdong universities is still at the stage of exploration. The problems are: the lack of perfect management system, the unreasonable structure of the title team, and the lack of standard training standards for ordinary teachers. In addition, the sources of college teachers are complex, and the teaching ability and professional level of teachers in different departments are different, which makes it difficult to unify the training model. The emergence of these problems will not only affect the high-quality development of the teaching staff, but also limit the ability of colleges and universities to provide technological innovation services to enterprises. Therefore, if the higher vocational colleges cannot establish the planning and management system for the "double-type" teacher training, it is difficult to achieve long-term innovation and entrepreneurship education without teaching guidance.

C. The Comprehensive Quality of Students' Innovation and Entrepreneurship Is Not High

At present, the awareness of innovation among college students in Guangdong is still too narrow. They believe that

innovation is the deep scientific research and invention and creation, which is what scientists in the laboratory do. These are far away from the actual learning of college students themselves, subjectively do not pay attention to innovation, leading to the lack of self-confidence to put ideas into reality, which to some extent hinders the divergence of innovation consciousness. Students lack certain innovative thinking ability training, their own professional knowledge is incomplete, their learning ability is weak, they do not have strong self-learning desire and exploration spirit, and the quality of innovation is difficult to improve. Students often refuse to interact with teachers during class learning, lacking forward-looking cognition of external social development, and having a closed mindset, so students' ability to innovate creative quality is not high.

The campus environment of colleges and universities has a subtle influence on students. In the process of cultivating innovative talents, the educational methods of colleges and universities in Guangdong still present many shortcomings. The investment in teaching funds is not high, the existing educational facilities are not perfect, students are not exposed to scientific research equipment, means and information, and lack of innovative ability. The current teaching model still retains the style of old-style education. Students receive the teacher's filled teaching in a single way. The thinking stays on the teaching materials, the innovative thinking cannot be expanded and extended, and their creative ideas are not valued and adopted, and the enthusiasm for innovation is reduced.

D. Innovative and Entrepreneurial Projects Have Insufficient Core Competitiveness

Under the background of the new era, China promotes the development concept of "mass entrepreneurship and innovation". The means of competition is not only simple product development and conception, but also competition between technologies with innovation as the core. If the breakthrough technology innovation is not enough, the core competitiveness of the project is not high.

At present, there are few breakthrough innovation projects in the research institutes of Guangdong universities, so there is a lack of samples of academic research for teachers and students. Moreover, the breakthrough technology innovation project has a long development cycle, and it needs to be tracked and evaluated on a long-term basis. However, the investment in scientific research in Guangdong universities is insufficient and the academic atmosphere is impetuous, so it is difficult to fully implement the project. On the other hand, China's scientific research community emphasizes the gradual technological innovation as the main research model, which also hinders the development of breakthrough technological innovation to some extent. Of course, Guangdong universities themselves have not enough knowledge of core technology innovations, lack of relevant experience, technical aspects are relatively backward, and they start late, and there are few research results. At the same time, the organization and management methods and operational mechanisms of core technology innovation projects in Guangdong universities have not yet been completed. The method of handover between the upper and lower levels is conservative and lacks flexibility. The decision-making model involving innovation projects and risk assessment are inconsistent. When the information feedback is not timely, the project implementation progress is slow and inefficient. The core competitiveness of the innovation project is complex, and the unilateral research on a technology cannot be optimized. It is necessary to coordinate the integration and matching of various factors. And if the technology R&D innovation model does not match the market product update, the project will not have a competitive advantage.

V. Optimized Path of Innovation and Entrepreneurship Education in Guangdong Universities Under the Concept of Collaborative Innovation

A. To Promote the Systematic Construction of Innovative Education

Focusing on the future, Guangdong universities need to pay attention to the original innovation ability of basic research, explore a scientific research road of independent innovation, and form an innovative education system with stable positions, stable teams, stable platforms and stable support. First of all, on the base and platform, colleges and universities need to establish a research platform for special scientific research projects. The layout of the base is adhering to the development pattern of "pre-research, construction, and operation". In terms of R&D allocation, the government needs to pay close attention to it, invest in setting up special funds, and organize several forward-looking and leading research projects as key research projects proposed to the country. It is necessary to increase policy support, improve the service capacity of comprehensive management and support, and launch project evaluation cycles and assessment standards to promote the transformation of scientific research results.

From the perspective of the scientific and technological service of innovative education in colleges and universities, Guangdong universities need to solve the problems of core technology innovation and technology application innovation. They need to adhere to the organic integration of the two, optimize the ecological circle of technological innovation, promote the emergence of major scientific research achievements in various fields, and effectively support the strategy of enterprise innovation and entrepreneurship. On the one hand, it is necessary to focus on improving the innovation system and mechanism of colleges and universities, speed up the establishment of a collaborative innovation education center within Guangdong Province, optimize the system of collaborative innovation education, do a good job of the integration of university and enterprise collaborative innovation, and promote the establishment of high-level decision-making and consulting mechanisms. On the other hand, Guangdong universities need to constantly improve the organization and security system, initiate the development mode of the provincial and ministerial joint promotion of innovative education, and establish an

international scientific research innovation exchange platform. Therefore, it provides powerful technical support for college teachers and students to create innovative ideas, and forms a systematic and innovative education.

B. To Enhance the Professionalism Level of Innovative Entrepreneurial Tutors

The cultivation of technical talents in innovative entrepreneurship projects is inseparable from a team of teachers with both theoretical knowledge and technical application quality. That is to say, when colleges and universities are equipped with tutors, they must profoundly grasp and enhance the requirements of "double-teacher ability", construct clear and reasonable "double-type" teacher training ideas, focus on improving the professional level of instructors in innovative and entrepreneurial projects, and provide students with powerful teaching guarantees.

From a macroscopic point of view, Guangdong universities can apply the orientation-oriented training mechanism for students to the implementation of the construction of teachers, and establish a variety of project training and training bases for industry-university integration through school-enterprise cooperation. Colleges and universities can use the "theory education + post-internship" training mode to enhance teachers' professional skills and practice levels, and effectively promote teacher training more targeted. In addition, institutions should improve the corresponding performance evaluation mechanism to maximize the value of teaching, and develop corresponding training plans for teachers with different professional titles and professional standards, and improve professional ability in stages.

From a micro level, Guangdong colleges and universities should adjust the professional settings of innovative and entrepreneurial projects in a timely manner, and strive to build key professional clusters related to enterprise product research and development, and train corresponding tutors in a targeted manner, ensure that the instructor's professional skills are not out of touch with the professionalism required by economic development. On the other hand, the school should provide necessary support for the cultivation of the professional competence of the "double-skilled" tutors, guarantee the "part-time with salary" benefits for the training of teachers, and mobilize the enthusiasm of teachers, thus actively pursuing the learning of their professional skills and the improvement of professionalism.

C. To Improve the Connotative Training of Innovative and Entrepreneurial Teams

In the era of technology and entrepreneurship, the difficulty of transforming knowledge and technology into scientific research results has greatly increased, and entrepreneurial activities have become more complicated. Guangdong universities' innovation and entrepreneurship projects are under pressure from commercial competition. An innovative and innovative entrepreneurial team is the core of an entrepreneurial project. Whether it can resist pressure and sustain long-term development lies in the connotative training of innovative and entrepreneurial teams.

The key point is that Guangdong's college entrepreneurial team should promote peer-group education, recruit students with the same level of education and the same innovative ideas to share information, ideas or professional skills, and achieve information exchange and emotional communication of team members. Different from traditional education methods, peer-group education is committed to equal educational status between the teams. Both the host and the client can give each other academic guidance and emotional support, so that students with different entrepreneurial characteristics can give full play to their unique advantages, and improve the ability to organize and manage themselves. In addition, entrepreneurial role models can be established in college entrepreneurial teams. Excellent peer groups can drive the entrepreneurial passion of the entrepreneurial team members, and the peer-group awareness of innovation and entrepreneurship can also be passed on, thus forming a good entrepreneurial atmosphere within the team. At the same time, peer education is almost a hierarchical structure with zero barriers. It is easier for peers to express their own opinions and ideas, which is conducive to the emergence of innovative behavior. In addition, members confide in each other's confusion and release emotions, and also reduce team conflicts. Therefore, the peer-group education group has strong cohesiveness, sense of identity, and a sense of belonging. The members are more willing to actively cooperate with innovation, and the innovation quality of the entrepreneurial team will be higher and higher.

D. To Create an Open Education for Innovative Entrepreneurship Training

For innovative entrepreneurship training, the education community generally believes that open education can promote the level of educational effectiveness. Compared with closed education, open education eliminates and breaks through the limitations and obstacles of learning from various factors, and solves the multiple needs of entrepreneurial students in time, geography and learning level, so that they can freely choose the appropriate learning time and place and learning method according to their needs. At the same time, students have to have certain autonomy in the choice of entrepreneurship training courses, the use of multiple media, and the choice of modern information technology, which is conducive to training a large number of innovative and entrepreneurial talents.

In combination with the existing multi-channel open education work, it is necessary for Guangdong universities to carry out rigorous and comprehensive planning for the professional positioning, talent training programs and quality of innovation and entrepreneurship training, and accelerate the progress of practical research. Based on the open education and training model, colleges and universities can adopt a variety of media integration design and implement online education courses. The university adopts the micro-course form of unit-based knowledge points, and uses online lectures as a carrier to facilitate the fragmented learning and mobile learning of entrepreneurial training students, making

the training method more humane. At the same time, colleges and universities can increase the "online + offline, self-study + face-to-face" hybrid entrepreneurship training model, build and implement a student-centered self-learning, remote Q&A, classroom face-to-face guidance and other training systems. In addition, a monitoring system for the quality of entrepreneurship training and the progress and feedback of student entrepreneurship should be established to ensure that the implementation of the open education and training program remains highly responsible for the quality of student's learning.

VI. CONCLUSION

In order to better respond to and implement the national "mass entrepreneurship, innovation" development strategy, provide technical services and talent support for the construction of Guangdong-Hong Kong-Macao Greater Bay Area. Guangdong universities have tried in various ways in the construction of innovation and entrepreneurship education system, quality improvement, and collaborative innovation. Through the targeted discussion of the synergy mechanism, the professional level of the instructors, the comprehensive quality of students, and the core competitiveness of the projects in the development of innovation and entrepreneurship in Guangdong universities, Guangdong universities need to coordinate the strategic layout of the regional planning of the Bay Area, and do a good job in personnel training and technology services. Guangdong universities can carry out innovation and entrepreneurship education training in a targeted manner, reform and innovate education models, methods and strategies, and break through innovations from the education system, tutor level, team training, and open education. At the same time, it is necessary to establish a monitoring system to track and feedback the quality of entrepreneurship training and the progress of student entrepreneurship, to ensure the implementation of open education training programs, and to maintain a high degree of responsibility for the quality of students' learning.

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