

Research on the Training Mode of Innovative Talents in Information and Computing Science from the Perspective of Scientific and Technological Innovation

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Abstract

This study aims to identify and analyze effective training modes for fostering innovative talents in information and computing science, with a focus on the perspective of scientific and technological innovation. The research method employed includes a comprehensive literature review, interviews with industry experts and academics, and empirical data analysis from existing training programs. The findings indicate that an integrated approach combining project-based learning, interdisciplinary collaboration, and practical experiences can enhance students' innovative capabilities. Recommendations from this research include the need for increased investment in educational facilities and resources, the formation of strategic partnerships between universities and industries, and the development of curricula responsive to the evolving needs of the job market. This research provides a significant contribution to the development of relevant and effective training strategies in response to societal demands for innovative talents in the field of information and computing science.

Keywords: *Scientific and Technological Innovation, Colleges and Universities, Information and Computing Science, Talent Training, Reform*

A. Introduction

At present, all countries in the world put scientific and technological innovation at the core of the overall development, regard innovation as the first driving force to lead development, and carry out overall and long-term strategic planning for the scientific and technological undertakings of various countries. As the front of the national strategic scientific and technological forces, the theory and practice of innovation education in colleges and universities have generated new needs, and it is urgent for colleges and universities to deepen the comprehensive reform of higher education and continuously improve the quality of talent training by taking in-depth innovation education as the starting point (Le, 2020). The major of Information and Computing Science is a science major that combines information technology, computer technology, and control technology. In the context of scientific and technological innovation and the training requirements of innovative talents, colleges and universities should clarify the existing problems in the teaching of information and computing science, and actively carry out the reform of innovative talent training mode from the aspects of revising the talent training plan,

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optimizing the curriculum structure, constructing a practical teaching system, and reforming the assessment method.

In terms of the cultivation of scientific and technological innovation talents. The ability of scientific and technological innovation is the core competitiveness of a country, and universities and scientific research institutions are the training bases for scientific and technological innovation talents. Colleges and universities in many countries have combined their own actual conditions to put forward innovative talent training models with their own characteristics, and have their own unique educational concepts and teaching methods. Since the 90s of the 20th Century, the Japanese government has attached great importance to the cultivation of innovative talents, and has successively carried out the reform of higher education. For example, the talent training model of the University of Tokyo in Japan is characterized by the following characteristics: the educational concept focuses on cultivating the comprehensive quality of students, the teaching method has a teaching system that teaches students according to their aptitude and the teaching organization form of communication and interaction, and the teaching content has a professional setting model that promotes the development of students' personality (Yijing, 2018).

American colleges and universities pay more attention to the combination of national economic and social development needs in personnel training, and have established extensive cooperative relations with all parties in society, not only attaching importance to the teaching of knowledge, but also paying more attention to the cultivation of students' innovation ability and practical ability and the improvement of personality quality, which provides important conditions for cultivating innovative talents (Su, 2019). The teaching system of German universities requires that students must have at least 6 weeks of internship experience related to their chosen major before entering the university stage, which can promote the correctness of students' choice of major, help students adapt to the requirements of the job as soon as possible when they are employed, and also facilitate the rational allocation of resources in German universities. The United Kingdom has always paid attention to the cultivation of innovative talents, and the training mode of innovative talents in British universities is most prominent in the University of Oxford, which emphasizes the tutor system in terms of educational philosophy, highlights the concept of whole-person training, pays attention to the combination of theory and practice in the education method, has a multidisciplinary curriculum setting method in the curriculum system, and sets up multi-faceted learning content for students in the teaching content, so as to achieve comprehensive training (Shihao, 2020).

China's colleges and universities have made many explorations and attempts in talent training, and many universities have carried out various innovative training models for scientific and technological innovation talents, such as Tsinghua University, Peking University, Zhejiang University, Fudan University, etc. The training mode of scientific and technological innovation talents in Chinese colleges and universities can be roughly divided into three types: the training mode characterized by general education, the training mode by highlighting students' extracurricular scientific and technological activities, and the training mode of promoting students' innovation ability through entrepreneurship education (Xiaoting, 2017). Wang Ruosi and Feng Dengguo summarized the remarkable achievements made in the cultivation of scientific and technological innovation talents in China's

universities since the 18th National Congress of the Communist Party of China, and put forward the strategy of further accelerating the construction of the world's important talent centers and innovation highlands in the future (Jiaqin, 2018). Tan Jiaqin conducted a systematic study on the training system of scientific and technological innovation talents in colleges and universities, and put forward countermeasures and suggestions for the cultivation of scientific and technological innovation talents in colleges and universities through theoretical analysis and empirical research (Ruosi & Dengguo, 2022). Therefore, colleges and universities should conform to the needs of social development and the development trend of higher education, and actively carry out the exploration and practice of cultivating innovative talents.

In terms of the training model of information and computing science professionals. In recent years, universities have made a lot of research achievements in the cultivation mode of innovative talents in information and computing science. For example, Liu Jianguo and Shen Jin took the information and computing science major of Huaihua University as the research object and discussed the specific plans of each link in the training model of innovative and entrepreneurial talents in the information and computing science major (Jianguo & Jin, 2020). In view of the urgent demand for innovative talents in various industries in the era of big data, proposed an innovative talent training model and promotion mechanism based on the "Excellence Plan" by taking the major of information and computing science as an example (Xiaoqiu, et al., 2019). Peng Yongkang studied the "knowledge-led, ability-driven" training model for applied talents in information and computing science (Yongkang, et al., 2020). He Xianwen and Wei Xueqin proposed the reform of the talent training model based on school-enterprise integration (Xianwen & Xueqin, 2018). Based on the needs of high-quality interdisciplinary information and computing science talents, Liu Xiaoyong and Fu Hui proposed a "three-dimensional collaboration" training model and practice path for interdisciplinary talents in information and computing science (Xiaoyong & Hui, 2018).

However, there are still some problems in the existing literature, such as the talent training model only summarizes the overall requirements and scope, and lacks systematic and detailed design, the professional positioning is not clear, the training goal is not clear, the training platform lacks multidisciplinary interpenetration, and the teaching system is not flexible. These problems will affect the in-depth research and sustainable development of the cultivation of innovative talents in information and computing science, and will also affect the application of the innovative talent training model in practice. The design of the talent training model needs to be combined with the needs of national standards, social development, industry, school professional construction goals, student development and other needs, reposition the professional goals, and refine the training objectives into different sub-objectives according to the theoretical basis, application ability, competence, sustainable development, etc., and then conduct in-depth and detailed research from many related aspects such as curriculum system and evaluation system.

Information and Computing Science Curriculum System. There are many problems in the curriculum system of traditional information and computing science majors, such as emphasizing theory over practice, lacking courses related to characteristic majors, and being out of touch with social needs and development. In recent years, with the advancement of

the teaching reform practice of information and computing science, many research results on the reform of the curriculum system of this major have emerged. For example, Liu Hui and Sun Yurong proposed a reform method for the curriculum system of information and computing science that reflects the research direction of big data analysis in response to the background requirements of the big data era (Hui, & Yurong, 2018). According to the OBE concept, Bian Qiuxiang and Wang Pingxin proposed an optimization and integration strategy to cancel some basic courses, reduce the number of theoretical teaching hours, and increase the application development-related courses (Qiuxiang & Pingxin, 2020). Lu Haixia proposed a "platform + module + curriculum" to reconstruct the curriculum system, which consists of four platforms: general education platform, professional education platform, practical teaching platform, innovation and entrepreneurship and quality improvement, and two modules: theoretical course module and practical course module (Haixia, 2019). In summary, the optimization and reconstruction of the curriculum system of information and computer science should explore the curriculum architecture with the cultivation of innovation ability as the core and the combination of theory and practice under the premise of the reform of the training mode of innovative talents, so that each teaching link can effectively support the training goals, sub-goals and graduation requirements, and achieve the effective achievement of the training goals.

Information and computing science professional training evaluation system. There are few studies in the existing literature on the training and evaluation system in the training mode of information and computing science professionals. Wang Xinxin and Bai Yujuan proposed that teaching evaluation should be carried out from multiple perspectives and the student assessment mechanism should be improved in the study of the construction of innovation and entrepreneurship ability training system in local colleges and universities (Xinxin & Yujuan, 2023). Liu Jianguo and Shen Jin proposed that the examination method should be reformed to strengthen the assessment and evaluation of innovation and entrepreneurship ability. Li Jia and Wu Zezhong proposed that the three levels of quality standards should be designed separately, namely, professional construction, curriculum construction, and teaching links, so that the evaluation of each link has direction, standards, and implementation (Jia & Zezhong, 2022). The traditional evaluation criteria are single, focusing only on students' academic performance and teachers' teaching quality, and lacking the stimulation of enthusiasm and creativity. The multi-faceted and multi-dimensional comprehensive evaluation system can not only improve students' interest in learning, but also tap the creativity of teachers' teaching, make a virtuous circle of teaching, learning and management, and develop efficiently in a closed loop, jointly ensure the teaching quality of the school, and promote the realization of the reform of innovative talent training.

To sum up, local colleges and universities need to make full use of their own characteristics and advantages in the reform of the cultivation of innovative talents in information and computing science, and with the help of superior resources, platforms and professional characteristics, they need to cultivate students' innovation ability from various aspects such as training mode, curriculum system, and evaluation system, so as to cultivate innovative talents in information and computing science for the country and society. This project will conduct a comprehensive and in-depth study on the training mode of innovative talents with "solid foundation, strong ability, wide caliber and wide vision" in information

and computing science from the aspects of training mode, curriculum system and evaluation system.

B. Methods

Realistic background analysis

Through the collection of literature, the organization of research, the holding of seminars, etc., the background, history, and current situation of the training mode of innovative talents in information and computing science are investigated, compared, and analyzed.

Theoretical model construction

Based on the requirements of scientific and technological innovation, according to the research idea of feedback training objectives from talent training objectives to curriculum architecture and then to the evaluation system, a closed-loop virtuous cycle of teaching, learning and management and the theory of talent training mode of continuous improvement and development are formed.

Application and practice demonstration

Apply the "three more" innovative talent training model to the teaching reform of the major, revise the talent training objectives, optimize the talent training curriculum system (including theoretical teaching and practical teaching), improve the evaluation system, and adjust and improve it in a timely manner according to the feedback and the latest needs, so as to provide innovative talent training model strategies that combine theory and practice for the information and computing science major.

1) Specific research methods

This study intends to adopt a combination of theoretical analysis and empirical research.

- 1) Theoretical analysis method: This project first adopts the method of theoretical analysis to elaborate the background of the cultivation of scientific and technological innovation talents, the training mode of information and computing science professionals, the training orientation and objectives, the curriculum structure, and the evaluation structure.
- 2) Empirical research method: This project will also adopt the method of empirical research, through research, talks, seminars, organization of meetings, implementation of teaching reform, etc., to collect cases and empirical materials, conduct investigation and research, and test and revise the theory of talent training model proposed in practice, so as to improve the quality and effectiveness of the proposed theory.

C. Findings and Discussion

Scientific and technological innovation is the core of the overall development of various countries, and innovation is the first driving force to lead development, which has overall and long-term strategic significance for the cause of science and technology. In the context of scientific and technological innovation and the requirements of innovative talent training, colleges and universities should clarify the problems existing in the teaching of information

and computing science, and actively carry out the reform of innovative talent training mode from the aspects of revising the talent training plan, optimizing the curriculum structure, constructing a practical teaching system, and reforming the assessment method. This study will conduct a comprehensive and in-depth study on the training mode of innovative talents in information and computer science from the aspects of training mode, curriculum system, and evaluation system. With the background of scientific and technological innovation and the guidance of "solid foundation, strong ability, wide caliber and wide vision", we innovatively construct a "three-more" innovative talent training model for information and computing science majors, which is composed of "diversified" talent training goals, "multi-dimensional" curriculum system and "multi-faceted" evaluation system. On the one hand, this study will enrich and develop the existing training model of information and computing science professionals, and reflect the training model of innovative talent development, which has important theoretical value. On the other hand, this study will integrate theory with practice, construct and practice the training model, training objectives, curriculum system and evaluation system of innovative talents in information and computing science, and give full play to the main role of scientific and technological innovation talent training, which has strong application value and practical significance.

In the context of the requirements of scientific and technological innovation, based on the national standards for the teaching quality of undergraduate majors in colleges and universities, guided by the needs of national and social development, and combined with the school's orientation and professional characteristics, this study carried out the research on the "three more" innovative talent training model from the aspects of training objectives, curriculum system composition, and evaluation structure.

Establish "diverse" talent training goals

Under the background of national scientific and technological innovation and the requirements of the Ministry of Education for the cultivation of innovative talents, with the guiding ideology of "solid foundation, strong ability, wide caliber and wide vision", combined with the school-running orientation and own characteristics of the university's information and computer science major, the training goal of "diversified" talents is formulated to promote the continuous training of "diversified" students. "Skilled", "international" who can go to joint ventures, multinational companies, or go abroad for further study. So as to cultivate innovative talents with noble sentiments, excellent study style, high skills and open thinking.

Construct a "multi-dimensional" talent training curriculum system

The basic theory is the source of innovation, and the practical application is the embodiment of innovation, with the cultivation of innovation ability as the core, guided by the diversified training goals, combined with the school-based positioning and its own characteristics, to build a "multi-dimensional" curriculum system, including the "1+3+N" theoretical teaching system and the "4321" practical teaching system.

The "1+3+N" theoretical teaching system refers to the "1" basic platform composed of basic courses and major courses in the three directions of computational mathematics, computer and control, the "3" direction modules composed of the professional limited

courses in the three directions of computational mathematics, computer and control, and the "n" distinctive professional elective courses that students can choose to take or minor according to their interests. The "4321" practical teaching system refers to the "4" years of experiments, practical training and internships, the "3" practical contents composed of computer experiments, mathematical modeling experiments and professional training, the various competitions at all levels based on the "2" professional competitions such as mathematical modeling competitions, mathematical competitions and challenge cups, and Internet +, and the internship projects of "1" for the "Graduation Thesis (Graduation Design)".

Establish a "multi-faceted" talent training evaluation system

Focusing on improving students' interest in learning, tapping teachers' teaching creativity, realizing the effective implementation of the training plan and achieving the goal, and ensuring the efficient closed-loop operation of school teaching management and teaching quality, explore non-standardized evaluation methods, promote the reform of assessment content and assessment methods, and formulate a "multi-faceted" talent training evaluation system for students, teachers and management composed of multiple assessment methods, multiple assessment indicators, multi-angle teaching evaluation, and multi-level evaluation. To sum up, this study will take scientific and technological innovation as the background, take the needs of national and social development as the guidance, and combine the school's positioning and professional characteristics to study the "three more" innovative talent training model composed of "diversified" training goals, "multi-dimensional" curriculum system and "multi-faceted" evaluation system.

Key difficulties

The focus of this study is as follows: (i) formulating "diversified" talent training goals, (ii) constructing a "multi-dimensional" talent training curriculum system, and (iii) establishing a "multi-faceted" talent training evaluation system.

The difficulties of this study are: (i) how to synchronize the school's positioning, explore its own professional characteristics, solve the problems of unclear training orientation and lack of characteristics of training goals, and extract diversified talent training goals that integrate innovative ideas and are suitable for school-running orientation and its own professional characteristics; (ii) how to clarify the fragmented teaching content, solve the problem of lack of systematization in theoretical teaching, solve the practical problems of practical teaching, and formulate a student-oriented, (iii) How to solve the problem of lack of motivation and unity at all levels of the existing evaluation system, explore diversified assessment indicators and assessment methods, and formulate a systematic evaluation system that stimulates teachers' teaching passion and students' learning vitality.

In the context of scientific and technological innovation, this study explores the "three more" innovative talent training model composed of "diversified" training objectives, "multi-dimensional" curriculum system and "multi-faceted" evaluation system that integrates innovative knowledge, skills and thinking, improves the quality and efficiency of innovative talent training in local universities, and provides scientific, valuable and valuable

training mode for innovative talents in information and computing science. Reproducible theoretical support and practical references.

Innovation

Academic Thought: For the major of information and computer science, with scientific and technological innovation as the guiding ideology, the "three more" innovative talent training model integrating innovative knowledge, innovative skills and innovative thinking is innovatively proposed.

Academic viewpoint: It innovatively proposes to formulate the "diversified" talent training goals of "academic", "skilled" and "international", and the "multi-dimensional" curriculum system composed of the "1+3+N" theoretical teaching system and the "4321" practical teaching system, as well as the "multi-faceted" assessment structure for teaching, learning and management, which together constitute the "three-more" innovative talent training model of information and computing science.

Research Methods: Not only the methods of theoretical research, but also the methods of empirical research are used to promote the reference role of the research results of this topic, improve their practical effect and promote their application value.

Expected Outcomes

This study will construct an education and training model, curriculum system and evaluation system suitable for innovative talents majoring in information and computing science in local universities, which will provide strong support for the reform of the training mode led by scientific and technological innovation in information and computing science, so as to deepen the comprehensive reform of higher education, continuously improve the quality of talent training, and highlight the main role of scientific and technological innovation talent training in colleges and universities. The results of this project will provide a strong reference value for the theoretical research and application practice of information and computer science education, and have certain reference significance for the training mode of innovative talents in information and computer science in other universities. Therefore, the results of this study will be first applied to the training process of information and computer science majors in our university, and then gradually extended to the training mode of information and computer science majors in other local universities, and finally, it can be applied to the training mode of innovative talents of other science and engineering majors in our university and other universities.

Promote the value of application

This study has the distinctive characteristics of cultivating innovative talents from the perspective of scientific and technological innovation, highlighting the training trend of the application of the curriculum system of information and computing science, the integration of practical education, and the popularization of innovative education, which has a useful demonstration and reference value for the cultivation of similar professionals, and plays a certain positive role in promoting the reform of undergraduate higher education in colleges and universities. The talent training system and cases constructed in this study can be implemented in related engineering majors, which has a beneficial demonstration and reference value for the cultivation of similar professionals, and plays a positive role in

promoting the reform of undergraduate higher education in colleges and universities. In addition, the research results can be extended to the training and teaching of other professionals, with strong scalability, flexible construction of curriculum system according to the characteristics of the major, and innovative teaching mode, which has strong practical application value.

D. Conclusion

From the perspective of scientific and technological innovation, the social economy has been further developed, the demand for professional talents has increased, and at the same time, higher requirements have been put forward for the training mode of university talents. Colleges and universities should keep up with the needs of social development, reform the talent training model, strive to cultivate students' independent innovation ability and pioneering consciousness, stimulate their enthusiasm, expand their professional ability, and cultivate more innovative talents for the society.

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