

Original Paper

Research on the Training Mechanism of Top-Notch Innovative Talents Based on Interdisciplinary

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Abstract

The construction of interdisciplinary top-notch innovative talent training mechanism is conducive to the cultivation of high-level interdisciplinary talents in my country, especially after the establishment of interdisciplinary categories, it puts forward new requirements for the integration of interdisciplinary development and talent training in universities. On the basis of the existing research, this paper puts forward the construction of five aspects of the training mechanism of interdisciplinary graduate student enrollment mechanism, interdisciplinary tutor allocation mechanism, interdisciplinary course setting mechanism, interdisciplinary expert organization and interdisciplinary quality assurance mechanism, in order to provide a certain basis for standardizing the cultivation of interdisciplinary top-notch innovative talents.

Keywords

Interdisciplinary, top-notch innovative talents, training mechanism

The report of the 20th National Congress of the Communist Party of China pointed out that “we must adhere to the principle that science and technology are the primary productive forces, human resources are the primary resources, and innovation is the primary driving force. We must fully implement the strategy of rejuvenating the country through science and education, the strategy of strengthening the country through human resources, and the strategy of innovation-driven development, open up new

areas and new tracks for development, and constantly create new drivers and advantages for development.” Since entering the 21st century, interdisciplinary integration is an important feature of the current development of science and technology, an effective means to train top-notch innovative talents, an important cornerstone of new disciplines, and an internal driving force for economic and social development. In the face of the emerging new round of scientific and technological revolution and industrial reform, it is necessary to build a training mechanism for interdisciplinary top-notch innovative talents, improve the degree and graduate education system, promote the construction of the national innovation system, and realize the strategy of rejuvenating the country through science and education. It is the key to adhere to the concept of “talent is the first resource” and promote the strategy of strengthening the country through talent. It is the core support for training top-notch innovative talents and implementing the innovation-driven development strategy, which has become an urgent need.

Nowadays, Chinese universities have formed a complete and mature mechanism for cultivating graduate students in traditional disciplines. However, the training of top-notch innovative talents in the existing universities is still in its initial stage. Therefore, establishing a scientific training mechanism for top-notch innovative talents in the cross-disciplines has become a key issue that universities need to pay attention to at present.

1. The Necessity and Importance of Interdisciplinary Top-notch Innovative Talent Training

1.1 The Cultivation of Interdisciplinary Top-notch Innovative Talents is the Internal Demand of National Strategy

The report of the 20th National Congress of the CPC proposed to “comprehensively improve the quality of independent training of talents and focus on cultivating top-notch innovative talents”. Further arrangements were made at the National Conference on Education Work in 2023, calling for “first and foremost trials in comprehensively improving the quality of independent training of talents, cultivating top-notch innovative talents, serving regional economic and social development, and optimizing the layout structure”. These requirements are reflected in the campus training paradigm which is the basic connotation of cross-disciplinary training. As the new round of scientific and technological revolution and industrial transformation accelerates, the development of science and technology in the world has entered an era of unprecedentedly dynamic innovation. Some important scientific issues and key core technologies have shown the harbinger of revolutionary breakthroughs. New disciplinary branches and new growth points keep emerging, and the deep interdisciplinary integration of disciplines is unstoppable. Economic and social development has put forward more urgent demand for high-level innovative, compound and applied talents, and the requirements for the quality of these talents are becoming stricter. The realization of major breakthroughs in scientific and technological innovation and the development of strategic emerging industries urgently need the strong support of interdisciplinary top-notch innovative talents.

1.2 The Talent Training Model of A Single Discipline has Encountered Major Challenges

The continuous strengthening of discipline institutionalization and the accompanying university discipline system make the training of talents in traditional disciplines tend to be specialized, specialized and fragmented, which has become a huge obstacle to cross-discipline training in a long time. The continuous differentiation, formation barriers, solidification and rigidity of disciplines make it more and more difficult to communicate among disciplines. Education and teaching resources (such as teachers, venues, courses and platforms) are limited in a small scope, and the comprehensive characteristics of the training process are difficult to show. Although cross-disciplinary talent training is not equal to “general education”, let alone “generalist education”, a large span of resource investment is still a necessary condition for cultivating top-notch professional talents. Cross-discipline training will enable postgraduates to acquire knowledge, skills, potentials and qualities that cannot be obtained by learning a single discipline, so as to fully respond to the major needs of current high-end talents. At the same time, cross-discipline also provides the most advanced educational resources for personnel training. Under the background of highly differentiated disciplinary resources, the result of graduate training can only be specialized rather than compound talents, which is not conducive to the development of interdisciplinary research and the formation of academic community on campus, let alone to meet the social demand for high-level talents. From the perspective of talent training and social career connection, the change of career demand for top-notch innovative talents in the future (gradually evolving to high-level, elite and advanced, and showing the trend of interdisciplinary field) is also forcing the innovation of talent training process.

1.3 Interdisciplinary Talent Training has become a Global Trend

In the 21st century, there is a global trend of integrating innovation activities with talent training activities. The integration of education, research and transformation is also the common denominator of many new platforms, special zones, parks and pilot zones. In foreign countries, many universities have established Entrepreneurship centers, which are more like learning communities where researchers, entrepreneurs, celebrities and students from various disciplines and social circles study together. In response to emerging technologies and future challenges, some world-class universities have been focusing on building high-end talent training carriers and strengthening educational and scientific research activities based on strategic innovation. For example, MIT Media Lab constructs an interdisciplinary teaching and research platform based on the integration of media, science, art, technology and design, which even goes far beyond the traditional interdisciplinary scope. Another example is Russia’s “Skolkovo Institute of Technology” (Skolkovo Tech) to establish an innovation center science and technology development zone, strengthen “knowledge-driven innovation”, and through the deep integration of education, scientific research and enterprise participation, cultivate future leaders for change; Another example is King Abdullah University of Science and Technology (KAUST) in Saudi Arabia, which invested a huge amount of money to build. It abandons the traditional single-school system and establishes a high-level interdisciplinary research institute, only enrolling

master's and doctor's students, so as to respond to the major needs of economic development in Saudi Arabia and the Middle East through cross-disciplinary talent cultivation.

2. Analysis of the Characteristics of Interdisciplinary Top-notch Innovative Talents Training

Interdisciplinary top innovative talents should have the ability of academic innovation, practical innovation, global competence and the ability to take root in society. To analyze the characteristics of training top-notch innovative talents in cross-disciplines, we should start with enrollment, teaching and research and management, which is the key to training top-notch innovative talents in cross-disciplines. The purpose of training top-notch innovative talents in cross-disciplines is to broaden the academic horizon of graduate students, cultivate their interests and hobbies in cross-disciplines, solve practical problems by the cross-integration of multi-disciplines, and improve their independent innovation ability. Therefore, for the training of top-notch innovative talents in interdisciplinary disciplines, it is different from the training of graduate students in traditional disciplines in terms of curriculum, professional background and scientific research:

2.1 The Curriculum is Cross-Cutting

Interdisciplinary is generally the comprehensive use of two or more disciplines to analyze and research, seeking better methods to solve a problem theoretically, its essence is the cross of discipline. Therefore, the curriculum setting for the cultivation of top innovative talents in cross-disciplines often involves multiple disciplines. In addition, the content is more cutting-edge, and the speed of knowledge update is often faster than that of traditional disciplines. Hot issues of research change with the changes of external environment in different periods, new research directions and results are constantly appearing, and the breadth of interdisciplinary integration is increasingly broad. The rapid development of cross-disciplines and the increase in the coverage of knowledge will also put forward higher requirements for teachers, who need to constantly adjust their own knowledge structure, judge the latest development trend of cross-disciplines, and ensure the frontier of cross-discipline courses. Otherwise, there will be a large disconnect between teaching and the development of practical technology, which is not conducive to curriculum teaching.

2.2 Students Have Diverse Professional Backgrounds

Interdisciplinary top innovators usually have different professional backgrounds and will pursue different research directions in the future. In particular, Since the Academic Degrees Committee of The State Council and the Ministry of Education issued the Notice on Setting up the first-level disciplines of "Interdisciplinary Disciplines", "Integrated Circuit Science and Engineering" and "National Security" in December 2020, the Measures for the Establishment and Management of Cross-disciplines (Trial) in November 2021 and the Catalogue of Postgraduate Education Disciplines (2022) in September 2022, cross-disciplines have entered a new stage of institutionalization and standardization. The recruitment and training of interdisciplinary top innovative talents will also be carried out in accordance with the new edition of the catalog. How to integrate students' different theoretical

backgrounds and learning objectives and further promote the cooperative research and academic exchange among different disciplines is an issue that universities need to consider when designing the training program for interdisciplinary top innovative talents.

2.3 Scientific Research Achievements are Innovative and Practical

The theoretical system, knowledge structure and research paradigm of interdisciplinary top-notch innovative talents have not yet formed a consistent understanding, but they contain huge innovation potential and are prone to breakthrough academic progress and subversive application technology. The purpose of training top-notch innovative talents in cross-disciplines is to cultivate the awareness of cross-disciplines among graduate students, to find the entry point of cross-disciplines and to produce high-level scientific research results. Therefore, the importance of postgraduate participation in scientific research practice should always be emphasized in the curriculum, and graduate students should be encouraged to carry out independent research. In course teaching, students should be encouraged to apply curriculum knowledge to scientific research practice.

3. Difficulties and Problems in Training Top-notch Interdisciplinary Innovative Talents

Cross-discipline is a research field with highly concentrated knowledge, wisdom, skills and scientific and technological resources, which requires the integration of multidisciplinary knowledge and the participation of experts and scholars from multiple disciplines, and is characterized by complexity and synthesis. Therefore, compared with the relatively mature traditional disciplines, there are still some difficulties and problems in the process of talent training.

3.1 Lack of Excellent Interdisciplinary Graduate Students

High quality students are the basis for the cultivation of top innovative talents, but there is a serious shortage of excellent interdisciplinary graduate students. On the one hand, it is subject to the existing way of selecting graduate students, ignoring the assessment of students' practical application ability, subject interest and innovative quality. Guan Guofeng and Wu Songqiang of Nanjing University of Technology believe that at present, postgraduate admission is determined by the preliminary selection of unified examination, and the unified examination questions tend to emphasize knowledge over application, foundation over ability, and there is a certain lack of examination on students' innovation ability. Second, due to the unique nature of interdisciplinary integration, it has high requirements on the comprehensive quality and scientific research ability of postgraduates. Students trained in traditional disciplines may not be suitable for interdisciplinary research. Zhao Can of Hunan University of Science and Technology believes that because the quality of graduate students directly affects the subject curriculum setting, teaching plan and planning, etc., the shortage of excellent graduate students has become one of the important problems faced by current interdisciplinary teaching.

3.2 Problems in the Construction of Teaching Staff

The construction of teaching staff is the key to the training quality of top-notch innovative talents. Chen Changkun of Central South University believes that the knowledge structure, knowledge level, insight

into frontier disciplines and ability to communicate with experts in other disciplines are directly related to the quality of training top-of-the-line innovative talents in cross-disciplines. However, from the current situation, due to the limitation of personal research direction and research project, some tutors are not familiar with the “cross integration” part of the knowledge system in cross disciplines. Therefore, the training of top innovative talents in cross-disciplines involves two or more disciplines, which is difficult to be completed only under the guidance of a certain mentor. Whether in terms of quantity or quality, the number and quality of interdisciplinary instructors cannot be quickly supplemented or improved in a short period of time, so they cannot meet the requirements of the rapid development of interdisciplinary disciplines.

3.3 Difficulties and Problems in Subject Curriculum Setting

Interdisciplinary research is not the simple cooperation and splicing of multiple disciplines, and the synergistic effect it produces is not the linear superposition of multidisciplinary knowledge, but the evolution of knowledge and the birth of new knowledge. Ju Dianchun et al. from Jiangsu University of Science and Technology believe that if the interdisciplinary research is not strong and broad enough, it will be difficult to achieve the crossover and integration of multiple knowledge, talents, methods and research means in the setting of graduate professional courses.

4. Establishment of Training Mechanism for Interdisciplinary Top-notch Innovative Talents

The training mechanism of interdisciplinary top-notch innovative talents should grasp the relationship between interdisciplinary and top-notch innovative talents, and the mechanism of interaction. Scientific management and institutional incentives are needed to establish the training mechanism of interdisciplinary top-notch innovative talents. It is suggested to start from the following aspects: enrollment, tutor assignment, curriculum setting, scientific research mechanism and academic exchange mechanism.

4.1 Establish an Interdisciplinary Graduate Enrollment Mechanism

Enrolling high - quality graduate students is the basis of training top - notch innovative talents. In order to improve tutors' enthusiasm for interdisciplinary graduate training, universities clearly list some interdisciplinary research directions in their admission policies, and give preference to outstanding students with interdisciplinary background. For example, undergraduate students majoring in mathematics are admitted to graduate students majoring in finance, etc. The direction of academic research can be broader, which is of great significance to seize the commanding heights of academic research. In addition, we should further improve the recruitment selection method, strengthen the investigation of students' comprehensive quality and cross-disciplinary innovation potential, and ensure the quality of enrollment. For the cross-disciplines in the pilot setting stage, colleges and universities should specify examination subjects and basic requirements according to the discipline basis and talent training objectives, and choose a compliance and effective recruitment and selection method, mainly by recommending the form of exemption from the examination to recruit doctoral or master students. For

the interdisciplinary enrollment which has been listed in the catalog, the characteristics of the interdisciplinary enrollment should be reflected.

4.2 Establish an Interdisciplinary Tutor Allocation Mechanism

In the allocation of graduate supervisors, they should first have some understanding of the research of cross-disciplines and a certain scientific research foundation. Only in this way can they find the research hotspot of cross-disciplines with theoretical and practical significance, which is conducive to the cultivation of top-notch innovative talents. Secondly, the training of interdisciplinary top innovative talents can be carried out by the way of multi-disciplinary tutor team construction. For example, scientific and reasonable interdisciplinary research guidance methods should be formulated in the form of “double tutor system”, “tutor group” and “interdisciplinary tutor system”. In addition, the construction of a multidisciplinary tutor team can promote the cooperation among teachers, so that diversified knowledge can be effectively imparted to graduate students, which is of great significance for the cultivation of innovative ability.

4.3 Establish an Interdisciplinary Curriculum Setting Mechanism

Strengthen the construction of training process system, follow the law of interdisciplinary postgraduate education, and build a training program that reflects the academic frontier and discipline development direction. We should attach importance to the construction of interdisciplinary curriculum system, timely update course content, enrich course types, and improve course teaching quality. We will encourage the introduction of cutting-edge courses from world-class universities, and use high-level education and opening up to the outside world to boost the development of a system for cultivating high-quality, top-notch and innovative personnel. For example, Central University of Finance and Economics has introduced a series of cutting-edge courses such as digital economy to enrich its interdisciplinary international curriculum system. Handle the relationship between the original knowledge and the new knowledge of cross-discipline graduate students, clarify the positioning of various courses, and guide cross-discipline graduate students to realize the purpose of knowledge transformation on the basis of mastering the theoretical knowledge and research methods of new disciplines. In addition, we should establish and perfect the mid-term assessment system, and give full play to its screening function in the process of training top-notch innovative talents in cross-disciplines.

4.4 Establish an Organization of Interdisciplinary Experts

On September 20, 2000, the Interdisciplinary Research Center of Natural Sciences and Social Sciences of the Chinese Academy of Sciences was officially established, which provides a practical reference for the establishment of interdisciplinary and interdisciplinary research centers. In 2006, Peking University established the Institute of Frontier Interdisciplinary Studies, which has begun to take shape after more than ten years of exploration and operation. In 2011, Tsinghua University established the Cross-Information Research Institute; In 2018, the School of Artificial Intelligence was established at Nanjing University. In February 2022, the Ministry of Education issued Key Points of the Ministry of

Education in 2022, which explicitly proposed the pilot construction of a number of interdisciplinary centers, sending a signal that cross-disciplinary research institutes led by universities are moving to a higher level. The establishment of interdisciplinary center is to enable graduate supervisors to fully communicate in disciplines and learn from each other. Second, it can create an atmosphere for graduate students to improve their academic level and generate innovative ideas, so that they can participate in a wide range of academic activities, cultivate their thinking ability, logical reasoning ability and independent innovation ability, and create a good academic atmosphere. Third, it can provide an interdisciplinary platform for research, so that creative social scientists and natural scientists can communicate closely, strive for breakthrough innovation in theory, method and practice, cultivate new growth points in interdisciplinary research, and promote the cultivation of a new generation of interdisciplinary top-notch innovative talents.

4.5 Establish an Interdisciplinary Quality Assurance Mechanism

To develop interdisciplinary construction, the quality of personnel training should be guaranteed first. It is necessary to improve the quality assurance system of degree awarding, formulate a feasible system of interdisciplinary thesis proposal, evaluation, pre-defense and defense, and set up interdisciplinary degree evaluation sub-committee or special working group to ensure the quality of degree awarding. It is necessary to strengthen tracking management, regularly conduct self-assessment on the training of top-notch innovative talents in cross-disciplines, timely correct problems in the training process, and publicize the results of cross-discipline construction and talent training to the society in an appropriate way. In addition, we should improve the guarantee policy, encourage diversified investment, comprehensively use a variety of incentive means, and guide multiple subjects to participate in the construction of emerging interdisciplinary disciplines and the cultivation of top-notch innovative talents in universities.

5. Conclusion

At present, China is in the critical period for the great rejuvenation of the Chinese nation. The gap between our scientific and technological economic strength and the developed countries is mainly reflected in the innovation capability. The nation prospers when science and technology flourish, and the country is strong when science and technology flourish. To achieve the “Two Centenary Goals” and realize the Chinese dream of great national renewal, we must stick to the path of independent innovation with Chinese characteristics and fully implement the strategy of innovation-driven development. To implement the strategy of innovation-driven development, we need to cultivate a large number of innovative, versatile and application-oriented talents. It is an effective way to train high-level innovative, composite and applied talents needed by economic and social development to carry out interdisciplinary top-notch innovative talents education.

To sum up, the mission of cultivating top innovative interdisciplinary talents must rely on a more mature and perfect interdisciplinary talent education system that breaks the original disciplinary

barriers. Standing at a new historical starting point, the training of top-level innovative talents in cross-disciplines must be based on the economic and social development and the changes in the needs of technological industry transformation. At the same time, the advanced experience of countries around the world should be effectively learned to train innovative talents who can adapt to the trend of cross-disciplinary integration, so as to make new historical contributions to the smooth implementation of the strategy of innovation-driven development, the strategy of rejuvenating the country through science and education and the strategy of strengthening the country by talents.

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