

# Exploration of the integration of science and education between scientific research institutes and universities

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**Abstract:** The integration of science and education between scientific research institutes and universities is a new model of collaborative education of science and education. Based on the perspectives of organizational synergy, teaching synergy, resource synergy and overall synergy of strategic management theory, this paper proposes to deepen and innovate the cooperation mechanism between science and education: establish a model of integration of science and education, stimulate the motivation of school-institute co-governance, optimize education and teaching methods to promote deep learning, improve teachers' innovation ability, and form a path of science and education integration and collaborative education with local university characteristics.

**Keywords:** school-enterprise cooperation; talent training; collaborative education; integration of science and education

## 1 introduction

Talent is the primary productive force, application-oriented, compound and innovative talent training is the focus of education reform at home and abroad in order to cope with the large demand for talents in economic and industrial development and continue to pay attention to and research and promote, colleges and universities and scientific research institutes are responsible for talent training and scientific research, should make full use of their respective resources, give full play to their respective advantages, break through institutional barriers, and explore high-level, high-quality science and education integration and collaborative education model. In recent years, China's institutions of higher learning, scientific research institutes and other institutions have explored new ways of integrating science and education into collaborative education, and have gained a lot of experience for reference and reference. School-enterprise cooperation is an effective model for deepening the reform of graduate education and improving the quality of talent training [1-2], which aims to cultivate high-level talents with good problem-solving ability and innovation ability through teaching and scientific research that are closely integrated with practice to meet the development needs of society and industry.

## 2 The policy and development status of the integration of science and education in China

As the most important and active subjects in the process of knowledge innovation and talent training, universities and research institutes have both differences and consistency. In order to deepen the cooperation between institutions of higher learning and scientific research institutes and achieve win-win development, the state has issued a number of important documents to further promote the development of the integration of science and education and collaborative education, and create a good policy environment and atmosphere for cooperation. The Outline of the National Medium and Long-term Education Reform and Development Plan (2010-2020) proposes to "promote the sharing of science and technology

education resources among universities, scientific research institutes and enterprises, and promote the innovative organizational model of colleges and universities". In the same year, the Ministry of Education and the Chinese Academy of Sciences jointly issued the Action Plan for Combining Science and Education with Collaborative Education, which initiated the cooperation between colleges and universities and the Chinese Academy of Sciences in talent training, and further enhanced the synergistic interaction between talent training in colleges and universities and scientific research institutes. The main purpose of the "Action Plan for Combining Science and Education with Collaborative Education" is to improve students' practical ability and enhance students' innovative spirit through joint training of talents by schools, and to promote mutual cooperation and mutual support in education and scientific research through talent training. It is necessary to strengthen the cooperation between scientific research institutes and universities, so that goal-oriented research and free exploration can connect each other and complement each other's advantages, form a new model of teaching and research and collaborative education, and lay a solid scientific and talent foundation for China's scientific and technological innovation.

With the deepening of the cooperation between science and education in China, it has become an urgent need for colleges and universities and research institutes to further explore the cooperation mechanism for the cultivation of new innovative talents on the basis of the original model of joint training of graduate students and scientific and technological talent classes. In June 2018, the Ministry of Science and Technology and the Ministry of Education held a conference on the coordination of science and education and a symposium for presidents of colleges and universities to establish a collaborative working mechanism for science and education, study and promote scientific and technological innovation in colleges and universities, and strengthen the collaborative integration of science and education in the new era. In August 2018, the Ministry of Education, the Ministry of Finance and the National Development and Reform Commission issued the "Guiding Opinions on Accelerating the Construction of "Double First-Class" in Colleges and Universities, which clearly stated that "strengthen scientific

research and education, combine national key and major scientific and technological planning tasks, establish a collaborative training mechanism that integrates science and education and promotes each other, and promotes the organic combination of knowledge learning, scientific research and ability training".

Under the guidance of the concept of synergy and integration, colleges and universities and scientific research institutes at all levels have gradually transformed into strategic partnerships, opening up a deeper and larger range of science and education integration and collaborative education between universities and scientific research institutes, and cultivating various types of high-level talents for the major needs of the country and the needs of social development.

### 3 Analysis of the elements of school-institute co-construction and integration in collaborative governance

The integration model of science and education jointly built by the university is the carrier of a more in-depth and comprehensive collaborative education system between the heterogeneous organizations of colleges and universities and scientific research institutes, which requires the partners to collaborate on the resources of co-construction and interactive sharing, break the limitations of multi-dimensional attributes and understanding of resources among heterogeneous organizations, and integrate to form a new collaborative education force. The integration of science and education is not a static and linear process, and this integration and innovation model must be viewed from a dynamic perspective. Institutions of higher learning and scientific research institutes continue to optimize themselves while maintaining their own development tension, promote self-development within the organization, strengthen the dynamic reorganization and update iteration of scientific research resources and innovative forces and educational resources, improve the efficiency of scientific and technological innovation and talent training, and finally realize the common improvement of both universities and scientific research institutes in the quality of talent training, the growth mechanism of internal innovative talents, the overall scientific research ability, and the service of major strategic needs, and finally establish a platform for the integration of science and education and collaborative education for co-construction, co-governance and sharing. Promote the modernization of the education governance system and governance capacity.

Synergy in educating people is the core of the integration of science and education. The purpose of the integration of science and education is to cultivate talents better and more efficiently, and educating people is the core goal of the integration of science and education. Colleges and universities have the characteristics of rich experience in running schools, a good educational environment, and a complete range of disciplines; The scientific research institute has the advantages of distinctive discipline characteristics and profound scientific research fields; The integration of science and education is a community of education and knowledge innovation based on the combination of a dominant discipline of higher education and scientific research institutes based on cutting-edge knowledge. In the overall enrollment of the cooperative universities, the student status is managed by the cooperative universities, and the graduation and

degree awarding of students are implemented by the cooperative universities, and the degree sub-committee of the College of Science and Education Integration composed of personnel from both sides is jointly deliberated. Colleges and universities can break through the boundaries between disciplines, majors, and between the first classroom and the second classroom, and form a sharing mechanism for the talent training system within universities. The formation of a strong alliance and complementary advantages of schools and institutes not only improves the talent training and scientific research capabilities of colleges and universities, but also enhances the R&D concentration and talent supply level of scientific research institutes, further improves the level of source innovation, and realizes talent training and knowledge innovation production.

Resource coordination is the foundation of the integration of science and education. It is necessary to break through the traditional joint training model and the "point-type" cooperation model of the science and technology talent class, effectively co-build and co-govern and share the resources of colleges and universities and scientific research institutes, form interaction and cooperation between each other, and establish a resource base for the integration of science and education and collaborative education. The tutors of scientific research institutes are also the mentors of cooperative universities, and the scientific research platform of scientific research institutes is also the scientific research and innovation platform of cooperative universities. Colleges and universities can establish a collaborative innovation mechanism integrating "openness, diversity, flexibility and efficiency" for the society, connect the cooperation mechanism between the main body of science and education collaboration and other subjects, and give full play to the role of the college of science and education integration as a bridge between colleges and universities and scientific research institutes

### 4 Thoughts and suggestions on deepening the integration of science and education and collaborative education

The integration of science and education and collaborative education is a systematic project, which involves many parties and involves many aspects. Based on the orientation of talent training in local colleges and universities, this paper returns to the essence of the integration of science and education and collaborative education, and puts forward the following suggestions for the implementation of the integration of science and education in local universities.

#### 4.1 Innovate cooperation mechanisms, improve organizational structure, and achieve organizational coordination

Universities and research institutes have their own unique structures and internal organizations, and in the process of mutual cooperation, the combination of internal organizations of universities and institutes is diverse, and their respective institutions sometimes reflect exclusion and sometimes collaboration. Collaborative governance is to realize the collaboration between heterogeneous organizations, and then give full play to the maximum effectiveness of the organizational system.

In the process of jointly building a college of integration of science and education, through the expansion of national innovation platform resources and government resources, strengthen cooperation with universities and research institutes at home and abroad, and promote the deep integration of innovation chain, talent training chain and industrial chain. Institutions of higher learning, scientific research institutes, industry enterprises, and the government jointly establish a steering committee for professional construction, and design and establish a student-centered personalized training program, management mode and operation mechanism. Through the implementation of the cooperation declaration of various national and local R&D projects, combined with the advantages of both sides, to undertake R&D tasks, it has also formed a carrier and base for multi-party joint talent training and scientific research. Establish a joint conference system, with leaders of cooperative institutions, leaders in charge of the university and heads of relevant departments as members of the joint committee, and hold regular meetings to promote the sharing of resources such as research and education platforms, bases, research facilities, equipment and instruments with complementary characteristics of all parties. The establishment of independent liaison institutions between schools and institutes is convenient for each other to actively seek cooperation opportunities, create cooperation conditions and coordinate specific work in scientific research and development, high-end talent introduction, talent training, etc. Promote the joint establishment of innovative research platforms (including joint laboratories) by institutions of higher learning and scientific research institutes, and promote the joint application of innovation platforms such as national and local key laboratories and engineering research centers, so as to become an incubator for universities to cultivate interdisciplinary and emerging technologies.

#### **4.2 Optimize the training mode, strengthen the knowledge system, and establish teaching collaboration**

Colleges and universities and scientific research institutes have different teaching and scientific research resources and different performance goals, which leads to the plurality of collaborative goals among schools and institutes, and the diversity of means for different subjects to achieve their goals.

The goal of talent training is to cultivate innovative and compound talents, and full participation, effective cooperation and collaborative innovation are important means to achieve the goal. Colleges and universities should take advantage of the advantages of scientific research institutes to explore and promote the "three early" education model of early entry of undergraduates, early entry into the team, and early entry into the laboratory. According to the student's development wishes, each student is equipped with an instructor, participates in the discussion of the tutor's research group as early as possible, assists the research group to carry out basic scientific research work, etc., through scientific research and education, strengthens the cultivation of morality, forms personalized guidance, and promotes students' independent learning, in-depth learning and production. According to the student's development intention, each student is equipped with an instructor, participates in the discussion of the tutor's research group as early as possible, assists the research group to carry out basic scientific research work, etc., through scientific research education,

strengthens the cultivation of morality, forms personalized guidance, promotes students' independent learning and in-depth learning, and leads the development of students. Comprehensively promote the classroom revolution, reform the traditional education and teaching form, widely carry out inquiry-based and participatory teaching, and turn one-way teaching into an interactive space for colliding ideas and enlightening wisdom. On the one hand, teachers participate in the whole process of talent training such as enrollment, training, and employment, and support the all-round development of students' morality, intelligence, physical fitness, art and labor. On the other hand, with the help of the scientific research advantages of scientific research institutes, the majority of teachers are guided to effectively condense the latest research results into teaching content, promote the reform of research-based teaching mode, and cultivate the awareness of innovation and entrepreneurship in an all-round way. 3. Strengthen interdisciplinarity, stimulate the motivation for cooperation, create resource synergy, establish and improve the scientific research and teaching system of interdisciplinarity, integration of science and education, and integration of teaching and research, improve the interdisciplinary student management system, accelerate the construction of interdisciplinary sharing courses in the integration of science and education, promote the update of curriculum content, and cultivate a sense of innovation and entrepreneurship.

#### **4.3 Strengthen interdisciplinarity, stimulate the motivation of cooperation, and create resource synergy**

Establish and improve the scientific research and teaching system of interdisciplinarity, integration of science and education, and integration of teaching and research, improve the interdisciplinary student management system, accelerate the construction of interdisciplinary shared courses in the integration of science and education, promote the updating of curriculum content, and build a comprehensive, problem-oriented, and interdisciplinary new curriculum group, and timely incorporate teaching materials for new progress in discipline research, new experience in technological development, and new changes in social needs, so as to form an effective connection between basic knowledge and cutting-edge knowledge.

Schools and research institutes should be encouraged to cooperate in setting up interdisciplinary teaching and research positions, improve the effective flow mechanism of interdisciplinary teaching and research personnel, and improve the part-time employment system of teachers in schools. Support teachers to carry out high-level teaching and research work across disciplines and fields, improve the recognition system for interdisciplinary research results, increase teachers' enthusiasm for interdisciplinary research on frontier and major applied issues, and strengthen incentives for interdisciplinary cooperation. Fully tap and release the potential of scientific research institutes and scientific research personnel in colleges and universities, build a comprehensive, problem-oriented, interdisciplinary new curriculum group, and timely incorporate teaching materials for new progress in discipline research, new experience in technological development, and new changes in social needs, so as to form an effective connection between basic knowledge and cutting-edge knowledge. Schools and research institutes should be encouraged to cooperate in setting up interdisciplinary teaching and research positions, improve

the effective flow mechanism of interdisciplinary teaching and research personnel, and improve the part-time employment system of teachers in schools. Support teachers to carry out high-level teaching and research work across disciplines and fields, improve the recognition system for interdisciplinary research results, increase teachers' enthusiasm for interdisciplinary research on frontier and major applied issues, and strengthen incentives for interdisciplinary cooperation. Fully tap and release the potential of scientific research institutes and scientific research personnel in colleges and universities, and the two sides will send outstanding talents to serve as full-time and part-time tutors and carry out cooperative research, so as to form an internal synergy between scientific research and talent training. Strengthen the introduction and training of high-end talents, and build a team of teachers with high innovation ability through "internal training and external introduction". Jointly organize annual seminars on the integration of science and education, jointly organize high-level academic conferences and science and technology forums and other activities to promote the integration of scientific and technological innovation cooperation between the two sides, build a harmonious development ecology of disciplines, especially with the help of the superior innovation resources and capabilities of scientific research institutes, and improve the innovation awareness and level of college teachers.

#### **4.4 Follow comprehensive optimization, pay attention to dynamic adjustment, and implement education coordination**

In the system of integration of science and education, it is necessary to establish and promote the reform of the mode of personnel training, strengthen the innovation ability of the system as a whole, and improve the quality of personnel training, which inevitably requires that the system of integrating science and education and the general environment of the times be regarded as a unified whole. In the practice of reform exploration, it is necessary to build a system of integration of science and education in connection with the overall environment at all times, and pay attention to the interaction between educational administrative departments, colleges, scientific research institutes, enterprises, tutors, students and other parts. Especially in the process of

optimizing the dynamic system, we should adhere to the overall perspective to promote the orderly and endogenous evolution of the system. Each component element and subsystem of the system has its own operating mechanism and function, but the integration system of science and education is not a simple and low-level superposition of the functions of various elements and subsystems, but has the special functions of the whole, and the special functions of the system are closely related to the interaction of various elements and subsystems. In the process of constructing the implementation of science and education cooperation and education in the form of science and education integration college, it is necessary to take the principle of integrity as the basic starting point of system design, adhere to the scientific point of view and practical point of view, pay attention to the hierarchical structure of the system, take the principle of dynamic development as the core content of system construction, and realize the overall optimization and comprehensive optimization of the system. In the process of construction and operation of the science and education integration college, it is necessary to take into account the dynamic connection and action law between the various constituent elements and promote the development of the elements themselves.

In the process of construction and development of the integration of science and education, it is necessary to pay attention to scientific practical methods, according to the different characteristics of different disciplines, and at the same time take into account the differences of various scientific research institutes and enterprises, emphasize the dynamic structure and interaction between the elements of the integration of science and education, pay attention to induction and summary, and adhere to the scientific method of "practice, understanding, re-practice, and re-understanding" in exploration. As the main force of talent training, colleges and universities can combine the characteristics of regional social and economic development and the actual situation of schools to carry out the exploration and practice of integrating science and education into collaborative education, which is of far-reaching significance for improving the talent training ability of local colleges and universities, promoting the development of local colleges and universities, and cultivating application-oriented, compound and innovative talents required for the upgrading of the industry and regional social and economic development.

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