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A Comparative Study on the Reform of Interdisciplinary Talents Training Model under the Background of New Liberal Arts

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Abstract: With the rapid development in various fields such as economy and technology, the problems faced by society have gradually exceeded the scope of a single discipline. Nowadays and in the future, society requires talents with diverse abilities and qualities. The cultivation of interdisciplinary talents has become a trend in the development of higher education worldwide. Many universities are exploring models for talent cultivation in the context of new liberal arts. This article reviews and compares the current models of interdisciplinary talent cultivation in different universities and the latest theoretical research achievements of scholars. It is found that the talent training model of four universities in the world is scientific in structure and clear in planning, but it depends on students' practical ability and independent learning ability, which may have negative effects on some students. Chinese five universities have positive awareness of interdisciplinary cultivation and break professional boundaries, but there are differences in resources among them, and there is still a long way to go. It summarizes the reform experience in cultivating interdisciplinary talents through comparison and inspiration, addressing the current "new liberal arts construction" and the requirements and practices of constructing first-class undergraduate majors.

Keywords: New Liberal Arts; Talent Development Model; Interdisciplinary; Undergraduate Construction

1. The introduction of New Liberal Arts

The new liberal arts is the reorganization of the curriculum of various majors in the subject based on existing traditional liberal arts to form a liberal arts and science intersection, that is, integrating modern information technology into courses such as management, economics, literature, philosophy, etc., to provide students with comprehensive interdisciplinary learning to expand their knowledge and cultivate innovative thinking.

The task of constructing new liberal arts disciplines is arduous, requiring the efficient production and reproduction of liberal arts knowledge based on highly integrated knowledge, streamlined processes, and digitized procedures. The construction should be driven by cross-disciplinary frontiers, strategic demands, modern technology, regional advantages, and other factors, leading to the restructuring of professional and curriculum systems, establishment of interdisciplinary teaching teams, formulation of new teaching and research evaluation standards, and optimization of talent development program operation modes. In accordance with the four core elements mentioned above, diversified and innovative talents in liberal arts should be cultivated [1]. Enhance students' comprehensive literacy, explore new modes and mechanisms of knowledge production through innovative methodologies, and construct a new disciplinary system to serve strategies.

Sociologist Jean Piaget believes that disciplines such as scientific psychology, sociology, ethnography, linguistics, economics, and demography can form this kind of discipline that explores “rules,” and can be expressed in everyday language or in more or less formal language (logic, etc.). Its meaning sometimes refers to being able to express relative constant relationships in the form of mathematical functions, but it also refers to general factual or ordinal relationships, structural analysis, etc.

The “new” of the new liberal arts should first be the new educational philosophy of liberal arts, which is reflected in four aspects: in terms

of training goals, striving to achieve the unification of cultivating "people" and "a certain kind of person"; in terms of teaching content, striving to unify the inheritance of civilization and innovation; in terms of educational concepts, striving to achieve the unification of ability and character development; and in terms of talent evaluation, striving to achieve the unification of "going up" and "coming down" [2].

New liberal arts is a dynamic and promising new disciplinary model that holds significant importance for disciplinary innovation and socio-economic development. However, it also faces challenges due to the complexities and forward-looking nature of interdisciplinary studies. Overcoming these limitations requires policy guidance and support from relevant organizations. Furthermore, continuous exploration and refinement through practical experience are necessary to further develop the field.

2. Interdisciplinary Talent Development Model for Universities in the World

"Interdisciplinary" first appeared in the 1920s. It mainly refers to going beyond the basic methods and combination forms of previous subject classification and carrying out collaborative research in multiple fields in interdisciplinary forms. "Integration or synthesis of knowledge" is seen as a fundamental characteristic of interdiscipline. The training model mainly refers to the setting of training goals for different disciplines and majors, the components and basic links in the training process, and the core paths and practical methods for achieving talent training in the context of the development of the times and the needs of education construction.

2.1 Talent Development Model of Harvard University

Multiple interdisciplinary and intercollegiate doctoral, dual degree, and joint degree programs have been established with a formal tone and attention to logical language. Seventeen intercollegiate doctoral degree programs have been successively created, such as the Doctor of Education program introduced in 2012 [3]. This program was jointly established by the Harvard Graduate School of Education and the Harvard Faculty of Arts and Sciences. The curriculum primarily includes seminars, core courses, research methods courses, reading courses, and elective courses, covering various professional fields such as sociology, art, anthropology, statistics, and education.

2.2 Talent Development Model of Cambridge

The Social Sciences Doctoral Program has been jointly established by the Faculty of Science and Technology, the Faculty of Humanities and Social Sciences, the Faculty of Biological Sciences, the Faculty of Physical Sciences, and the Faculty of Arts and Humanities at the University of Cambridge. In addition, a Center for Social Science Research Methods has been established. The center is responsible for the development and management of courses related to the Social Sciences Doctoral Program.The program consists of two types of courses [4]. The first type is the core module courses, which are applicable to all disciplines within the social sciences. The second type is the open courses, which are offered by different departments and are only applicable to the departments offering the courses.

2.3 Talent Development Model of University of Tokyo

Establish a graduate school for innovative science in new fields, with "academic integration" as the basic concept, focusing on the integration and restructuring of disciplines, and the leapfrogging of different disciplines to form new academic fields [5]. The Institute has the Department of Interdisciplinary Sciences, the Department of Biological Sciences, the Department of Environmental Science, and the Department of Computational Biology. The research directions under each department cover 14 different fields of study. The aim is to conduct in-depth research on various complex social issues through multidisciplinary perspectives, knowledge and methods.

2.4 Talent Development Model of Duke University

The Bass Connections Program is a new interdisciplinary curriculum education model that gives students at different levels the opportunity to contact and solve complex social problems under the guidance of outstanding faculty and staff. It is a problem-

oriented teamwork learning model based on different subject backgrounds and is a problem-oriented teamwork learning model. The education model of this project is quite unique [6]. Different subjects such as undergraduate students, graduate students, postdocs, and teachers can all contact and cooperate with each other to form close ties with the community, stakeholders, and decision-makers. Based on easy collaboration and interdisciplinary research, students need to complete teamwork and interact with external partners in project research.

The comparative analysis of talent training models of universities in the world is shown in the following table (e.g., Table 1. Comparison of interdisciplinary talent development models in world).

Table 1. Comparison of Interdisciplinary Talent Development Models in World

School	Training model	Curriculum settings
Harvard University	Establishing interdisciplinary, intercollegiate doctoral, dual degree, and joint degree programs	Seminars, major core courses, research methods courses, reading courses, and elective courses
Cambridge University	Set up a doctoral program in social science and establish social science Research Methodology Center	Core module courses, open courses
The University of Tokyo	Establishing a graduate school for innovative science in new fields	Department of Interdisciplinary Sciences, Department of Biological Sciences, Department of Environmental Science and Department of Computational Biology
Duke University	Bass Connections project	Problem-oriented teamwork based on different subject backgrounds

3. Interdisciplinary Talent Training Model for Universities in China

3.1 Talent Development Model of Tsinghua University

Tsinghua University has numerous interdisciplinary research platforms, such as the Intelligent Connected Vehicles and Transportation Research Center, and the Intelligent Unmanned Systems Research Center. These interdisciplinary research platforms not only have distinctive operational models but also focus closely on their targeted research areas. They cover a wide range of fields and involve multiple disciplines, including electronics, neuroscience, computer science, and control theory, among many other advantageous disciplines. Together, they contribute to the development of interdisciplinary research platforms at Tsinghua University.

The specific training models are as follows: First, break professional boundaries, integrate departmental resources, and cultivate interdisciplinary research talents. Tsinghua University promotes the development of interdisciplinary research by breaking down subject barriers and implementing major training programs. In 2017, Tsinghua University began implementing a major admissions training program, merging all individual undergraduate admissions into 16 major categories, implementing training plans for major subject categories throughout the university, vigorously promoting the integration of general education and college, revising the syllabuses of all basic undergraduate courses and core majors throughout the university, and establishing chief professors to guide them on this basis. Second, build a platform for sharing subject knowledge and promote cutting-edge scientific and technological innovation through interdisciplinary research [7]. Third, improve the training system for interdisciplinary research talents. Tsinghua University's interdisciplinary talent training system establishes a school-wide interdisciplinary talent training network through mergers of majors, comprehensive implementation of major training and management, and the establishment of interdisciplinary training programs for undergraduate interdisciplinary majors and graduate students. By establishing

a complete interdisciplinary talent training route from undergraduate students to graduate students, it is a good guarantee that there will be no gaps in interdisciplinary talent training. Fourth, improve the management system for interdisciplinary research platforms. Establish a special interdisciplinary research management agency, clarify the division of management, refine management work, and improve the operation system of the interdisciplinary research platform.

3.2 Talent Development Model of Peking University

Peking University (hereinafter referred to as "PKU") is at the forefront of interdisciplinary talent cultivation among domestic universities and meets the typical criteria required for case studies. Firstly, it provides comprehensive coverage at all levels, including undergraduate, master's, and doctoral stages. Secondly, it offers diverse models, encompassing cross-departmental courses, interdisciplinary projects, interdisciplinary majors, and minors/double degrees. Thirdly, it promotes freedom and creativity, allowing students to find personalized development paths that suit their interests and aspirations through a variety of learning opportunities at PKU. Fourthly, it benefits a wide range of students. For example, since the 2016 teaching reform, PKU has opened up campus-wide cross-departmental elective courses [8]. In terms of double degrees, in 2017, over one-third of undergraduate students pursued a second degree. Fifthly, the university establishes interdisciplinary programs and hosts interdisciplinary lectures to cultivate students' interdisciplinary qualities. Lastly, PKU implements joint appointments and dual appointment systems for faculty, enabling the sharing and utilization of teaching resources, and allowing students engaged in interdisciplinary studies to choose mentors from different departments. Interdisciplinary talent cultivation involves training individuals in two or more disciplines or fields, with multidisciplinarity serving as an important foundation and prerequisite.

3.3 Talent Development Model of Zhejiang University of Technology

Zhejiang University of Technology has established an interdisciplinary and complex talent training model based on the development needs of the new financial industry. First, change the concept of training. Introduce multi-disciplinary non-financial courses such as statistics majors and computer majors, such as “data mining” and “artificial intelligence”, etc., to consolidate students' abilities in statistics, numerical analysis, and computer programming applications. We offer quantitative finance courses that combine theory and practice, such as “quantitative strategy development” and “programmatic trading strategies”. By actively exploring interdisciplinary curriculum and practical training such as “quantification+finance+practice”, etc., we broaden students' horizons, focus on comprehensive quality improvement, and enable students to develop an advantage in interdisciplinary integration. Second, explore new models of collaborative education and build a team of teachers specializing in quantitative finance. Using in-school interdisciplinary teachers as mentors and industry experts as off-campus mentors, a dual mentoring system for quantitative finance has been established. At the same time, cooperation outside schools was strengthened to carry out teacher training; seminars on financial mathematics and quantitative investment were held jointly with the China Institute of Quantitative Investment and Cathay Pacific, which broadened the horizons of quantitative finance teachers. Thirdly, we strengthen practical training to enhance the integration of industry, academia, and research, and reinforce the guidance towards applications [9]. Alongside teaching quantitative financial theories, we incorporate training using financial trading software on the financial teaching platform to enhance students' practical financial skills. We also encourage students to actively participate in extracurricular scientific and technological competitions to cultivate their ability to apply acquired knowledge to real-world problems.

3.4 Talent Development Model of Jiangsu Normal University

Jiangsu Normal University organized a series of summer language science activities in 2023. The first is the expert discussion section, the Neurolinguistics Summit Forum, which focuses on the deep integration of neurolinguistics with cutting-edge technology

in fields such as artificial intelligence and molecular biology; the second is the student learning and exchange section, which hosts the National Language Science Experience Camp for Outstanding High School Students, the 8th National Outstanding College Student Summer Camp, and the 2023 Jiangsu Postgraduate Neurolinguistics Academic Innovation Forum. The purpose of this section is to learn and exchange basic knowledge in language science and cutting-edge linguistics science. It covers three relatively independent activities for high school students, college students, and graduate students; third, the advanced technology training section in neurolinguistics, including a neurolinguistic EEG technology training camp and a workshop on linguistic brain mechanisms and large models [10].

3.5 Talent Development Model of Zhejiang University

On the basis of admissions in various college categories, Zhejiang University broke through the "boundaries" of colleges to carry out cross-college enrollment and introduced five major categories: engineering pilot courses, humanities pilot courses, biological science, applied biosciences, and art design [11]. In addition, Zhejiang University replaced the previous practice of transferring or transferring majors with a confirmation system for major, dual, and minor studies, initiated a cycle of core courses and general education courses, and set up more than 4,000 courses for students to choose from.

The comparative analysis of talent training models of universities in China is shown in the following table.

Table 2. Comparison of Interdisciplinary Talent Training Models in Chinese Universities

School	Training model
Tsinghua University	Break professional boundaries, integrate departmental resources, and cultivate interdisciplinary research talents Build a platform for sharing subject knowledge and promote cutting-edge scientific and technological innovation through interdisciplinary research Improve the training system for interdisciplinary research talents Improve the management system for interdisciplinary research platforms
Peking University	Full level coverage, covering the three stages of undergraduate, master's, and doctorate Diverse models, including interdepartmental courses, interdisciplinary programs, interdisciplinary majors, minors/double degrees Free creation. Regardless of their interests, students can use diverse learning opportunities at Peking University to find a personalized career path that suits them Wide range of benefits Organize multi-disciplinary and interdisciplinary lectures A system of joint appointment and double employment of teachers has been implemented
Zhejiang University	Break through the "boundaries" of colleges to enroll students across colleges The confirmation system for major, dual, and minor training has replaced the previous practice of transferring or transferring majors
Zhejiang University of Technology	Change the concept of training. Introduce relevant non-major courses Explore new models of collaborative education, use in-school interdisciplinary teachers as in-school mentors, and hire industry experts as off-campus mentors Strengthen practical training, enhance industry-university-research integration, and strengthen application guidance
Jiangsu Normal University	Organize an interdisciplinary summit Organize an interdisciplinary experience camp

4. Conclusions and Implications

The cultivation of interdisciplinary talents in universities is not only the need of The Times development, but also the focus of higher education reform. At present, all the universities in the world are exploring the new model of interdisciplinary talent training, and many innovative ways have been applied, but there are still places that need to be improved and broken.

The interdisciplinary talent development models in the four universities, derived from foreign reform models, embody the educational concept of "integration." They

effectively combine various disciplines that can be interconnected, establish a scientific interdisciplinary curriculum system, emphasize practicality, and value feedback on teaching outcomes. These models are well-structured, clearly planned, and conducive to cultivating versatile and applied talents. However, these talent development models currently have some limitations. Overall, the models in the four universities are relatively homogeneous, as they mainly integrate different disciplines with certain connections for teaching. Additionally, these models heavily rely on students' practical and self-learning abilities, which may have counterproductive effects on some students.

From the perspective of domestic reform models, both positive and negative aspects can be elucidated. Firstly, on the positive side, Chinese universities generally possess a proactive awareness of interdisciplinary education, breaking down the boundaries between disciplines and truly integrating knowledge from various fields to cultivate well-rounded, comprehensive talents. Secondly, on the negative side, while the idea is commendable, the strength of faculty and resources varies among different universities. Currently, many universities do not have complete disciplinary categories and professional settings. In addition, teachers involved in interdisciplinary teaching may not necessarily possess the capability for such instruction. Even if universities implement interdisciplinary teaching, it may not truly achieve the desired effects. Therefore, interdisciplinary talent development remains a daunting task for the majority of Chinese universities.

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