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Innovation of Higher Education Curriculum System Based on Interdisciplinary Integration

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Abstract: This study discusses the innovation of higher education curriculum system based on interdisciplinary integration. Interdisciplinary integration helps to break the boundaries of disciplines, promotes knowledge fusion, and enhances students' comprehensive literacy and innovation ability. Its main forms include single-discipline expansion, multidisciplinary cross-discipline and discipline group integration, which are applicable to different teaching scenarios and objectives. In the construction of the framework of the curriculum system, the objectives are clearly defined, the logic and relevance of the structural design are emphasized, the integration strategy of organic fusion is adopted, and a comprehensive and objective evaluation system is constructed in order to guarantee the scientificity and effectiveness of the curriculum system. In terms of teaching methods, project-based and problem-based learning are promoted, interdisciplinary teaching team building is strengthened, and digital resources and technologies are fully utilized. These initiatives aim to improve teaching quality and enhance students' interdisciplinary thinking and practical ability. This paper provides theoretical and practical guidance for the innovation of higher education curriculum system, and helps to cultivate composite talents adapted to the needs of society.

Keywords: Interdisciplinary Integration; Higher Education; Curriculum Design.

1. Introduction

The demand for talents in all walks of life is changing profoundly due to rapid scientific and technological advances, globalisation and the development of IT. The traditional single-discipline curriculum system is reaching its limits. Single disciplinary knowledge is inadequate to address complex, changing social problems and challenges. Interdisciplinary curriculum innovation is vital. Interdisciplinary integration breaks down barriers between different subjects, promotes cross-disciplinary integration, cultivates students' literacy and ability to understand different subjects, and provides a broader vision and deeper understanding. It enhances students' ability to solve problems, adapt to future challenges, and promotes the development of society. Higher education institutions must respond by offering students a more diverse, comprehensive learning platform through an interdisciplinary, integrated curriculum. This cultivates high-quality talents who can adapt to the needs of the new era, promoting the connotative development of education and the sustainable and prosperous development of society. The interdisciplinary integration of higher education curriculum system innovation is an essential component of current education reform.

2. Advantages of Innovation in Higher Education Curriculum System based on Interdisciplinary Integration

The higher education curriculum system innovation of interdisciplinary integration has significant advantages. First of all, the establishment and development of synergistic relationships in different disciplinary fields can stimulate the synergistic effect of interdisciplinary resource integration and make the curriculum more competitive in knowledge creation. This kind of synergy not only promotes the contact and communication between researchers, but also improves the utilization efficiency of disciplinary resources within the university, thus substantially increasing the output efficiency of overall knowledge innovation.

Interdisciplinary integration plays a key role in the process of disciplinary knowledge creation. Through the exchange of experience and resource support with other disciplines, interdisciplinary problems that transcend the field of the discipline and have higher research value can be captured at the problem discovery stage. Subsequently, in the systematization stage of knowledge, new problems and theories are optimized and integrated to form new knowledge systems, which can not only be extended and applied to other disciplines, but also promote interdisciplinary crossover and integration.

In addition, interdisciplinary integration contributes to disciplinary transformation and development. Every discipline goes through growth, maturity and decline, and in the decline stage, the problems within the discipline gradually decrease and the value of knowledge decreases (Wang & Tang, 2019). At this time, through communication and integration with other disciplines, new opportunities for disciplinary transformation can be obtained more quickly through knowledge complementation. At the same time, active participation in the problem-solving process of other disciplines not only helps to maintain the research vitality of the discipline, but also brings new development momentum to the discipline.

3. The Main Forms of Innovation in the Higher Education Curriculum System based on Interdisciplinary Integration

In higher education, interdisciplinary integration is a major trend in curriculum innovation. This encourages cross-pollination of knowledge and cultivates high-quality talent. Integration promotes complementarity and synergy through diverse forms such as single-discipline expansion, multidisciplinary crossover and disciplinary fusion, providing

useful references for the reform of higher education (Cheng & Zhang, 2024).

3.1. Single-discipline Expansion

Single-discipline expansion interdisciplinary theme teaching takes a single discipline as the carrier, emphasizes that teaching needs to expand and develop the related topics of one or some teaching units within the discipline, extends its tentacles to other subject contents related to the unit, and forms an extended teaching activity centered on the content of a specific unit of the discipline and takes into account the related content of other disciplines. It is worth noting that the single-discipline extended interdisciplinary theme teaching focuses on the thematic unit of the central discipline, "mainly from the knowledge, skills, ideas, methods of the discipline to determine the theme and objectives, design activities and evaluation, and mainly from the standpoint of the discipline and the realization of teaching goals to actively choose to" cross "to other disciplines." It is actually a local extension based on the specific unit topic content of a certain subject. The single-discipline extended interdisciplinary theme teaching encourages teachers to examine the teaching content of the discipline from the perspective of "cross-discipline". It is a form of interdisciplinary theme teaching based on the discipline (" self-oriented ") and actively establish contact with related disciplines to better understand the basic structure and thought of the discipline (" for my use ").

3.2. Multidisciplinary Cross-Discipline

Multidisciplinary cross-disciplinary is another way of teaching interdisciplinary themes. This involves combining the contents of two or more related disciplines. In other words, it breaks through the single-discipline expansion of interdisciplinary teaching. It no longer focuses on the main position of a central discipline. Instead, it emphasizes the overlap between disciplines. It does this to reconstruct the learning theme or unit. So students can explore multidisciplinary cross-cutting learning themes. This allows them to discover, analyse, understand, and solve problems using integrated multidisciplinary knowledge. It also allows them to achieve a more in-depth learning and teaching experience. However, it is worth noting that, although multidisciplinary cross-cutting interdisciplinary teaching emphasizes integration, it mainly focuses on overlapping concepts and does not change the original disciplinary form. It just requires teachers to reorganize the corresponding contents. In this way, the boundaries between disciplines are not dissolved.

3.3. Discipline Group Integration

The discipline group integration centered on a major theme is another form of interdisciplinary thematic teaching. It takes "big concepts, tasks or problems" with interdisciplinary characteristics as the core theme, and organizes teaching by integrating the contents of related disciplines and real-world problems, so as to break through the knowledge boundaries between disciplines and build a bridge between the teaching of academic knowledge in schools and the solving of real-world problems. Objectively speaking, the implementation of interdisciplinary thematic teaching with subject clusters is more difficult than that of single-subject extension and multidisciplinary cross-cutting teaching, and it requires a higher level of collaborative ability and pedagogical level of the participating teachers. It requires teachers not only to have a clear grasp of the content structure of their own discipline, but also to have a deep understanding of the content, methodology, and overall structure of other disciplines with "big concepts, tasks, or problems" as the core theme. In the case of interdisciplinary thematic teaching, a real-life problem closely related to the students' learning life is usually chosen as the theme of inquiry.

The above three kinds of interdisciplinary thematic teaching range from one to many disciplines, range from small to large themes, and go deeper and deeper in the depth of interdisciplinary dimensions. Single subject expansion type focuses on the central unit's theme, while its "cross" focus remains on knowledge, skills, ideas and methods for determining theme, objectives, design activities and evaluation. These take a subject-discipline standpoint to teaching objectives, achieving the point of view to initiate cross-discipline choices. The "cross-disciplinary" to other disciplines is actively chosen from the standpoint of one subject discipline and the achievement of teaching objectives. The multidisciplinary cross-cutting style, on the other hand, emphasizes the thematic features common to several similar disciplines.

4. Construction of Higher Education Curriculum System Innovation based on Interdisciplinary Integration

The innovative construction of higher education curriculum system based on interdisciplinary integration promotes the development of students' comprehensive literacy and innovation ability through the core links of curriculum goal orientation, structural design, content integration and the construction of evaluation system (Figure 1).

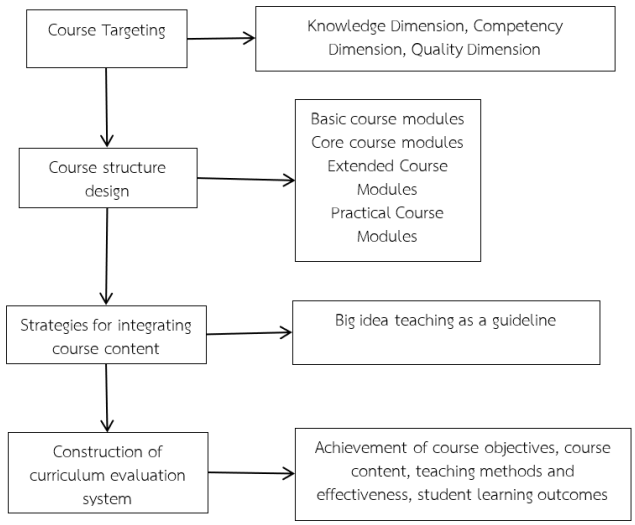

Figure 1. Innovative construction of higher education curriculum system with interdisciplinary integration

4.1. Orientation of Course Objectives

The integrated curriculum system aims to cultivate students' literacy by breaking down disciplinary boundaries and integrating theories and methods from multiple subjects. This builds a broad and deep knowledge base. It also fosters students' interdisciplinary thinking and problem-solving and teamwork skills by analyzing and dealing with problems from diverse disciplinary viewpoints, integrating multidisciplinary knowledge and proposing innovative solutions to complex

real-world problems, and working with students from multidisciplinary and interdisciplinary backgrounds. Furthermore, the objectives of science and engineering courses should be refined according to discipline-specific and societal needs. Liberal arts courses should focus on cultivating critical thinking and intercultural communication skills (Trisdiono et al., 2019). At the same time, in response to the social demand for data analysis and other talents, the course objectives should be specified as mastering the relevant tools, having skills such as data interpretation and insight, in order to meet the social demand for various types of professionals.

4.2. Course Structure Design

The foundation course module is the cornerstone curriculum. By introducing interdisciplinary courses, students are stimulated to be interested in interdisciplinary subjects (Yang & Ren, 2025). The Philosophy and Critical Thinking course cultivates logical reasoning, critical analysis and independent thinking. The Mathematics and Logical Thinking course provides rigorous thinking training and quantitative analysis tools. The Natural Science Foundation course covers the basic knowledge of multiple subjects, providing a foundation for professional learning.

Core course modules are closely organized around specific interdisciplinary areas. Taking Artificial Intelligence and Social Sciences as an example, the courses may cover various aspects such as machine learning algorithms, social network analysis, AI ethics, etc., so that students can have an in-depth understanding of the application of AI technology in social science research and practice; while the field of Biomedical Science and Engineering involves courses on biomaterials, medical device design, tissue engineering, etc., so as to cultivate the students' professionalism and innovation ability in biomedical engineering; The Environmental Science and Economics program integrates multidisciplinary knowledge in ecology, economics, policies and regulations, enabling students to analyze and solve environmental problems from both economic and environmental perspectives.

The extended course modules provide students with a broad space for independent learning and exploration (Yang & Ren, 2025). Frontier lectures invite renowned experts and scholars in various fields to introduce the latest research results and development trends to broaden students' horizons; seminar courses are centered on specific interdisciplinary themes, encouraging students to carry out in-depth research and discussion to cultivate their academic thinking and innovation; practical projects allow students to step out of the classroom and participate in actual scientific research projects, corporate internships, or social practices, applying what they have learned to real-world contexts and gaining Practical experience.

The practical course module is an important part of the interdisciplinary curriculum system. Interdisciplinary integrated practice courses allow students to comprehensively apply multidisciplinary knowledge and skills in projects to improve their ability to solve complex problems by designing comprehensive and innovative practice projects; internship training provides students with opportunities to exercise in real working environments such as enterprises and scientific research institutes, so that they can understand the needs of the industry and improve their professionalism; graduation design requires students to combine their majors and directions of interest to carry out graduation design projects with a certain depth and breadth, demonstrating their ability to comprehensively apply interdisciplinary knowledge and innovative ability. Graduation design requires students to carry out graduation design projects with a certain depth and breadth in combination with their majors and interests, demonstrating their ability to comprehensively apply interdisciplinary knowledge and innovation.

4.3. Strategies for Integrating Course Content

When building an interdisciplinary curriculum system, the first thing to do is to take the big concept as the integration point. Interdisciplinary curriculum construction in the view of big concepts, as the direction of curriculum reform in the new era, refers to the model of curriculum construction with energizing knowledge as interdisciplinary curricular knowledge, high access migration as curricular competence, expert thinking as interdisciplinary curricular literacy, and in-depth teaching as interdisciplinary curricular teaching (Guo et al.). Energy issues, for example, can be analyzed using multidisciplinary approaches such as physics, economics and sociology. The course content integrates knowledge from multiple disciplines. An urban planning course tackles traffic congestion using perspectives from disciplines including traffic engineering, urban planning, environmental science and sociology, integrating methods and thinking across different disciplines. Students use experimental methods from the natural sciences, investigation and analysis methods from the social sciences, and cost-benefit analysis methods from economics, for instance. This enables them to analyse problems deeply and propose comprehensive solutions.

4.4. Construction of Course Evaluation System

The construction of a comprehensive, scientific and reasonable evaluation system for interdisciplinary courses needs to be considered in multiple dimensions, such as the degree of achievement of course objectives, course content, teaching methods and effects, and student learning outcomes (Zhou, 2024). Meanwhile, the following aspects are paid attention to: firstly, clarify the evaluation indexes and standards to assess whether the course teaching achieves the expected goals. Second, ensure that the course content is scientific, systematic, practical and interdisciplinary to meet the needs of students and society. Teaching methods should be diversified and effective, focusing on student participation and motivation, and evaluating learning outcomes. Students' learning outcomes should not only be based on examination results, but also on comprehensive qualities such as practice, innovation and teamwork ability. Evaluation methods should be diversified, combining quantitative and qualitative evaluation, formative and summative evaluation, as well as teacher evaluation and students' self-assessment and mutual evaluation. Through quantitative data such as examination results and assignments, and qualitative information such as teacher observation and work analysis, the course and students' conditions are comprehensively reflected. In the teaching process, feedback is collected in a timely manner, and dynamic adjustments are made for improvement, while the overall learning outcomes of students are comprehensively assessed. Teachers provide professional evaluation and students' self-assessment and mutual evaluation promote self-growth, thus comprehensively and objectively reflecting the implementation of the curriculum and students' learning status, and providing a basis for continuous improvement of the curriculum.

5. Methods and Strategies of Higher Education Curriculum System Innovation Based on Interdisciplinary Integration

5.1. Project-based Learning and Problem-Based Learning

Project-Based Learning (PBL) and Problem-Based Learning (PBL) are both student-centered instructional methods designed to develop higher-order thinking and practical skills by solving complex problems. Project-Based Learning is a dynamic approach to learning in which the teacher, through support, advice, and guidance, provides students with some key materials to build an environment in which students actively explore in groups. Its implementation steps usually include: identifying the project topic, organizing teamwork, conducting independent inquiry, collecting information, designing experiments, analyzing data, presenting results and evaluating and reflecting (Chang et al., 2022). Project-based learning emphasizes the student's main role, and the project usually ends with a work to present, such as a multimedia work, a mini-report or a mini-essay. Problem-based learning, on the other hand, is problem-driven, placing students in a poorly structured problem that maps a real situation, and enables students to develop problem-solving skills in the process of solving the problem by asking them to work together in small groups to solve some simulated real-life problems (Chang et al., 2022). The implementation steps of problem-based learning include: creating scenarios to pose problems, analyzing problems, solving problems and internalizing problems. It emphasizes problem-centeredness, organizes relevant teaching based on problems, and is an open teaching system.

Both learning approaches are widely used in interdisciplinary programs. Taking "Smart City Planning" as an example, students need to comprehensively utilize the knowledge of urban planning, computer science, environmental science, sociology and other disciplines. Through teamwork, they conduct independent inquiry, collect relevant information, design experimental schemes, analyze data, and finally form a feasible smart city planning plan. In the process, students not only solved complex problems, but also developed interdisciplinary collaboration skills.

5.2. Interdisciplinary Teaching Team Building

The formation of interdisciplinary teaching teams is crucial to improving quality of higher education, though challenges exist. Interdisciplinary teaching faces many barriers: serious disciplinary differences; insufficient interdisciplinary teacher literacy; unsound teamwork mechanisms, which limit development. To overcome these challenges, explore the mode and mechanism of formation and operation. Select team members based on interdisciplinary experience and academic ability, encouraging those from different disciplinary backgrounds to join. Establish regular teaching seminars and training activities, promoting exchange and sharing among teachers, enhancing the team's interdisciplinary teaching ability. Define team member responsibilities and division of labour, ensuring smooth teaching tasks. Through the scientific formation mode and effective operation mechanism, the interdisciplinary teaching team can break the disciplinary barriers, promote interdisciplinary cooperation among teachers, improve the quality and effect of teaching, and provide strong support for the cultivation of composite talents with interdisciplinary literacy.

5.3. Digital Teaching Resources and Technology Applications

The digital era brings many opportunities and challenges for teaching interdisciplinary courses. Various types of digital teaching resources have wide applications in interdisciplinary courses (Petrenko & Malakhov, 2024). Online course platforms like Coursera and edX provide rich learning materials. Virtual laboratories remove the time and space limitations of traditional experiments, allowing students to do various experiments in a virtual environment. Databases like Web of Science, PubMed, etc. provide academic literature resources. Intelligent technology enhances interdisciplinary courses. Artificial intelligence-assisted teaching systems provide students with personalised learning suggestions and recommendations, according to their progress. Adaptive learning platforms adjust the difficulty and content of teaching to meet students' needs by analysing their behaviour. Big data analysis can help teachers understand students' learning characteristics and patterns. This optimises teaching strategies.

6. Conclusion

Interdisciplinary integration is of great significance in the innovation of higher education curriculum system, which can optimize the knowledge structure, cultivate students' comprehensive ability and adapt to the needs of social development. Its main forms are diverse and can be flexibly selected according to the characteristics of different specialties. When constructing the framework of the curriculum system, from the goal, structure, content to evaluation, it is necessary to reflect interdisciplinary thinking and realize the organic integration of knowledge and the comprehensive enhancement of students' abilities. In terms of teaching methods and strategies, project-based and problem-based learning can stimulate students' initiative, interdisciplinary teaching team can guarantee the quality of teaching, and digital resources and technology can expand the teaching space. In the future, it is necessary to continue to optimize the curriculum system, deepen cross-disciplinary integration, explore emerging fields, cultivate more complex talents, and promote higher education to play a greater role in knowledge innovation, talent cultivation and social services.

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