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Designing a “Course Cube” for Interdisciplinary Information Resource Management Under the “New Liberal Arts” Initiative: A Case Study of Renmin University of China (Postprint)

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Abstract

[Purpose/Significance] The new liberal arts construction imposes higher requirements on the cross-disciplinary integration and systematic coordination of curriculum groups in the information resource management discipline; traditional curriculum group construction models can no longer meet these needs. Based on first-hand undergraduate teaching practices at the School of Information Resource Management, Renmin University of China, this study proposes a novel curriculum construction model named “curriculum cube” to effectively support the construction of new-type curriculum groups for the information resource management discipline.

[Method/Process] First, it thoroughly analyzes the internal mechanisms through which traditional curriculum groups fail to support interdisciplinary curriculum construction in information resource management under the new liberal arts background. Second, it proposes the core concepts for constructing the curriculum cube to address the identified core problems. Then, based on these concepts, it presents a model design methodology for the curriculum cube. Furthermore, it elaborates on the implementation methods and effects of this model through teaching practice examples. Finally, it constructs a supporting system required for curriculum cube development.

[Results/Conclusion] The study summarizes two construction models of traditional curriculum groups—the “one-dimensional curriculum chain” and the “two-dimensional curriculum set”—revealing a common problem of inadequate systematicity and coordination. It clarifies the functional positioning of the curriculum cube as a basic constituent unit of emerging curriculum groups and its dual-helix teaching objectives of knowledge connection and competency composition. The model design methodology for the curriculum cube comprises

hierarchical structure design, curriculum coupling methods, and curriculum coordination mechanisms. The practical operability and implementation effects of this model are verified through the “one-line-three-levels-four-courses” practice example at Renmin University of China. Finally, a supporting system for the curriculum cube is proposed. The research results can provide scientific reference and strong support for the construction and practical implementation of new-type curriculum groups for interdisciplinary disciplines represented by information resource management under the new liberal arts background.

Full Text

Abstract

[Purpose/Significance] New liberal arts construction has placed higher demands on the cross-integration and systematic collaboration of curriculum groups in information resource management disciplines, rendering traditional curriculum group construction models inadequate. Based on first-hand undergraduate teaching practice at Renmin University of China’s School of Information Resource Management, this study proposes a novel curriculum construction model called the “Curriculum Cube” to effectively support the development of new curriculum groups for information resource management disciplines. [Method/Process] The study first analyzes the intrinsic mechanisms underlying why traditional curriculum groups fail to support interdisciplinary curriculum construction in information resource management under the new liberal arts context. It then proposes the core concept of Curriculum Cube construction to address identified key problems, presents a design methodology for the Curriculum Cube model, illustrates implementation methods and effects through teaching practice examples, and finally constructs a supporting system required for Curriculum Cube development. [Result/Conclusion] The research identifies two construction modes of traditional curriculum groups—“one-dimensional curriculum chains” and “two-dimensional curriculum clusters”—and reveals their common problem of insufficient systematicity and synergy. It clarifies the functional positioning of the Curriculum Cube as the basic unit of new curriculum groups and establishes its dual-helix teaching objectives of knowledge linking and competency integration. The design methodology comprises hierarchical structure design, course coupling methods, and course collaboration mechanisms. The “One Line, Three Tiers, Four Courses” practice example from Renmin University verifies the model’s practical operability and effectiveness. Finally, the study proposes a supporting system for Curriculum Cube construction. The findings provide scientific reference and robust support for constructing and implementing new curriculum groups for interdisciplinary disciplines represented by information resource management in the new liberal arts context.

1. Introduction

As a new round of global technological revolution and industrial transformation advances, emerging information technologies represented by big data, artificial intelligence, the Internet of Things, and quantum information have rapidly emerged. In this context, research and talent cultivation in philosophy and social sciences face both important development opportunities and unprecedented challenges. At the symposium on philosophy and social sciences work on May 17, 2016, General Secretary Xi Jinping pointed out: “A country’s development level depends not only on the level of natural sciences but also on the level of philosophy and social sciences. To uphold and develop socialism with Chinese characteristics, we must attach great importance to philosophy and social sciences.” In April 2019, the Ministry of Education and 12 other departments jointly launched the “Six Excellences and One Top-notch” Plan 2.0 to comprehensively promote the construction of new engineering, new medical science, new agricultural science, and new liberal arts [1]. Since then, new liberal arts construction has officially commenced. Compared with traditional liberal arts, new liberal arts requires breaking through traditional models, promoting interdisciplinary integration and deep fusion with innovative thinking, particularly embracing emerging information technologies and integrating them into the talent cultivation model of traditional liberal arts majors to achieve transformation and upgrading [2]. In November 2020, the Ministry of Education’s New Liberal Arts Construction Working Group issued the “New Liberal Arts Construction Declaration,” emphasizing the need to “encourage and support universities to offer interdisciplinary and cross-major emerging courses and practical teaching courses, and cultivate students’ cross-domain knowledge integration ability and practical ability” [3]. Evidently, the “cross-integration” of information science and traditional social sciences and the construction of “new curriculum groups” have become two major themes of new liberal arts construction.

Information resource management is one of the most representative major disciplines in new liberal arts construction. On the one hand, this discipline primarily emerges from the intersection of management science and information science, which have the broadest scope in social sciences. Ma Feicheng et al. propose that information resource management disciplines, represented by library and information science, have possessed the characteristic of interdisciplinary integration between liberal arts and sciences since their inception [2]. As the discipline continues to develop and expand, the broad information resource management discipline as a major category not only encompasses traditional disciplines such as library science, information science, and archival science, but also covers many new disciplinary directions including information resource management, information analysis, digital humanities, and data science [4-5]. Thus, “cross-integration” is evidently one of the fundamental characteristics of information resource management disciplines. On the other hand, “new curriculum group” construction is also an internal requirement for information resource management discipline development. “Upholding fundamentals while innovating” is

another important basic characteristic of information resource management disciplines. Scholars in information resource management have long advocated that while adhering to the professional core of the discipline, they must also have the courage and daring to innovate [2]. Notably, the “new” in new liberal arts construction refers precisely to innovation [6]. In fact, compared with other new liberal arts developments, undergraduate education development in information resource management started relatively early, with typical undergraduate majors including “Information Management and Information Systems” and “Information Resource Management,” established in 1998 and 2012 respectively. Both are typical cross-integration majors supported by management science, information science, computer science, and systems science [7-8]. Against the backdrop of rapid development of emerging information technologies and new liberal arts construction, the extension of undergraduate education in information resource management disciplines has gradually expanded, and its endogenous demand for innovation as an interdisciplinary discipline has become increasingly prominent. In recent years, key universities nationwide have begun active exploration in the undergraduate talent cultivation process of information resource management disciplines, particularly focusing on reforming curriculum system construction. Among these, “new curriculum group” construction has always been regarded as an important innovative approach for both traditional liberal arts majors and interdisciplinary majors, attracting widespread attention [9-10].

However, scholars have pointed out that curriculum construction in information resource management disciplines faces numerous challenges, including fragmented course content, lack of systematicity, insufficient connections between courses, few interdisciplinary comprehensive courses, monotonous teaching methods, lack of in-class practical components, and inadequate adaptation to students’ professional differences [11-13]. Among these, a particularly prominent common problem is the insufficient deep coupling capability between courses within traditional curriculum groups, making it difficult to meet the two core requirements of knowledge linking and competency integration proposed by new liberal arts construction for talent cultivation. To address this, this study aims to innovate and improve the construction method of “new curriculum groups” by proposing a curriculum construction model called “Curriculum Cube.” This model seeks to instantiate the basic components of curriculum groups, forming a concrete and operational design and implementation method for the “Curriculum Cube,” which can serve as an exemplary model for ultimately constructing “new curriculum groups” in the new liberal arts context with several “Curriculum Cubes” as the new basic units.

2. Related Research

Curriculum group construction for information resource management disciplines is a hot research topic. Currently, most studies employ survey methods. In terms of research objects, iSchool, established in 2005 as a global university alliance dedicated to promoting the development of information resource manage-

ment disciplines, had 123 member units by 2021, including 35 in the Asia-Pacific region, 54 in North America, and 34 in Europe. Due to its relatively long history and extensive global influence, iSchool members are often used as subjects for curriculum survey research. For example, V. Ortiz-Repiso et al. conducted a comprehensive analysis of data-related courses in information science programs at 65 iSchool member universities worldwide to identify common trends and propose improvement recommendations [13]. I. Song et al. explored the opportunities and challenges of iSchools in data science education against the background of society's digital transformation [16]. Yang Ruixian et al. investigated 42 data science courses in the curriculum group at UIUC iSchool from four perspectives: object type, teaching format, teaching cooperation degree, and course content [17]. Additionally, iSchools are often used as benchmarking references for domestic university curriculum reform. Zhou Yaolin et al. identified problems in talent cultivation for information resource management disciplines in China and proposed recommendations for adjusting curriculum groups by benchmarking iSchools [15]. Schools of information resource management in U.S. universities are also frequently surveyed. I. Song et al. conducted a broad survey of the current state of data science education in the United States, proposing recommendations on teaching content such as big data modeling and research methods, and on teaching methods such as adopting more online teaching platforms and increasing project experiences [11]. Li Jing et al. analyzed 308 health informatics courses offered by U.S. schools of information resource management and proposed recommendations for curriculum development in Chinese universities [18]. Some scholars have expanded the scope of their surveys even further. For instance, Chao Lemen et al. investigated and analyzed data science curriculum groups at 19 universities worldwide, identified consensus, experiences, and challenges, and proposed corresponding countermeasures and suggestions [12].

Some scholars have shifted their research focus to domestic universities. For example, Zhou Linxing et al. conducted online surveys and content analysis of graduate data literacy courses and course content in library, information, and archival management programs at 10 double-first-class universities in China, identified deficiencies in data literacy education, and proposed corresponding recommendations [14]. Shen Jiujiu et al. used questionnaire surveys to analyze the relationship between information literacy and data literacy courses for information management and information systems majors at Nanchang University, and proposed adding six data literacy-related courses to address the insufficient attention to data literacy in existing curricula [19]. Li Haibo et al., based on investigations of data science core curriculum offerings at 33 domestic universities, proposed a curriculum design scheme for the information management major at Southwest University of Science and Technology [10].

It is not difficult to find that in current research on curriculum offerings, particularly curriculum groups, for information resource management disciplines, attention to domestic universities is significantly less than to foreign universities. The School of Information Resource Management at Renmin University of China, as a supporting unit for first-class discipline construction in China,

became one of the earliest Chinese institutions to join iSchool in 2016. Therefore, this study focuses on the undergraduate education practice of the School of Information Resource Management at Renmin University of China for analysis.

Existing research on curriculum group models for information resource management disciplines can be summarized into two types: “one-dimensional curriculum chain model” and “two-dimensional curriculum cluster model,” as shown in Figure 1 [Figure 1: see original paper]. On the one hand, the one-dimensional curriculum chain model emphasizes the sequence of student learning, considering prerequisite and subsequent relationships in curriculum design. For example, Li Haibo et al. adopted a chain structure in their proposed data science curriculum group design, progressing from freshman-year Introduction to Data Science and C Programming, to sophomore-year Data Structures, Database Technology, Python Programming, and Statistics, to junior-year Data Visualization and Utilization, NoSQL Databases, and domain-specific practice, and finally to senior-year graduation thesis and design [10]. Chao Lemen et al. also adopted the curriculum chain model, dividing courses in the curriculum group into upstream courses, core courses, and downstream courses based on students’ sequential understanding of knowledge and the degree of application emphasis in courses [12]. On the other hand, the two-dimensional curriculum cluster model focuses more on relationships between courses. For example, Shen Jiujiu et al. understood curriculum groups as small clusters formed by several courses with certain characteristics or similar functions [19]. Li Jing et al., using a two-dimensional curriculum cluster model, divided the health informatics curriculum group in their study into three clusters: health information core courses, information management-related courses, and healthcare-related courses [18]. Zhou Yaolin et al. divided information resource management-related curriculum groups into three major categories: theoretical, technical, and applied [15]. Yang Ruixian et al. divided the surveyed curriculum group into six clusters: data exploration and preparation, data representation and transformation, data computation, etc. [17].

However, scholars in information resource management disciplines have found that traditional one-dimensional and two-dimensional curriculum group construction models still suffer from insufficient systematicity and synergy. For example, Zhou Yaolin et al. pointed out that the curriculum design 思路 for information resource management discipline higher education in China is not clear enough, with a prominent characteristic being “numerous and miscellaneous”—although the coverage is broad, there is insufficient targeted and precise curriculum design [15]. Chao Lemen et al. argued that current curriculum group models lack systematicity, courses lack connections, and the adaptability to interdisciplinary majors is insufficient, therefore advocating for overall design of curriculum groups [12]. Similarly, V. Ortiz-Repiso et al. found that iSchool members generally paid insufficient attention to courses with interdisciplinary nature during the construction of data-related courses, while the authors believe that strengthening the construction of interdisciplinary courses will bring profound positive impact to information resource management discipline education [13].

In terms of improvement methods, I. Song et al. believed that courses within curriculum groups lack articulation and advocated that courses should be well connected to generate synergistic effects [11]. Zhou Linxing et al. pointed out that curriculum groups should not be simple collections of courses but should be a reasonably structured, clearly leveled, and mutually supportive chain-like course group composed of three or more related courses based on single courses. Curriculum group construction is conducive to the overall optimization and coordinated development of educational curricula, as well as to course learning and teaching [14].

It is evident that researchers in information resource management-related disciplines have clear expectations for the improvement direction of traditional curriculum groups. However, limited by the current research focus on status surveys, there is a relative lack of research on design methods and best practices, making the implementation of “new curriculum groups” under the new liberal arts context lack effective theoretical support and reference basis. Moreover, in most studies, the basic unit of curriculum groups is defined as a single course, making the goals of course coupling and synergy difficult to achieve in one step. Therefore, to change this mindset, this study proposes a curriculum design model called “Curriculum Cube” based on the big concept paradigm [20] to replace single courses as the basic unit of new curriculum groups, and provides a 落地 implementation method example tested by first-hand teaching practice.

3. Core Concepts of Curriculum Cube Construction

3.1 Functional Positioning of Curriculum Cube

The overall teaching objective of the “Curriculum Cube” focuses on serving the needs of the Party, the country, and society for talent while also closely connecting with students’ personal development needs. Education scholars have pointed out that a basic criterion for good curriculum design is whether it meets students’ development and learning needs, and whether it can solve students’ learning problems and promote effective learning [22]. Therefore, to achieve effective Curriculum Cube design, it is necessary not only to grasp teaching objectives holistically but also to refine and decompose them. This study decomposes the teaching objectives of the “Curriculum Cube” into a dual-dimensional spiral structure of knowledge linking and competency integration.

The first dimension is knowledge linking. New liberal arts construction has brought new opportunities and challenges for new scenarios, new perspectives, new methods, and new tools in the development of philosophy and social sciences in China. In addressing these challenges, it is first necessary to recognize that science itself is an integrated whole, and the entire scientific system is moving from multi-category segmentation to integration in the new era [2]. Similarly, from the perspective of society’s actual needs for talent cultivation, with the rapid development of technology and society, various emerging information technologies

represented by big data have emerged. New technologies have brought about changes in productivity, which in turn have promoted social transformation. A large number of scientific and social problems increasingly rely on the integration of multi-disciplinary and multi-domain knowledge. Meanwhile, the complex and changing environment faced by national economic construction and social governance has also put forward new requirements for talent cultivation. Society's demand for interdisciplinary comprehensive high-quality talents is increasing. In the process of cultivating high-quality innovative, composite, and applied talents, the construction of cross-integrated knowledge and thinking systems becomes a key link. This requires breaking down disciplinary and professional barriers in curriculum design and organically linking and transforming traditional courses from management science, information science, computer science, data science, and other information resource management disciplines through innovative integration. Moreover, a major bottleneck of traditional curriculum group models is the problem of synergy and articulation between courses. The key to synergy and articulation between courses lies in finding contact points between them. Only by using these contact points for organic knowledge linking in the teaching process can systematic and deep articulation between interdisciplinary courses be achieved. Therefore, using knowledge linking for multi-course synergy will be a basic prerequisite for effectively supporting the cultivation of high-quality interdisciplinary talents in information resource management. This study will focus on solving the problem of knowledge linking in the Curriculum Cube model design.

The second dimension is competency integration. Human thinking and action abilities are often interdependent and inseparable, manifesting as a spiral upward and mutually reinforcing pattern in their formation process. Specifically, for undergraduate talent cultivation in information resource management disciplines under the new liberal arts context, while focusing on cultivating students' macro vision for information resource management and their ability to understand the core laws of information society operation, it is even more important to focus on the externalization of thinking abilities, emphasizing their mastery of micro-skills such as information construction and information analysis, as well as shaping their comprehensive innovative problem-solving abilities for complex problems. From the perspective of students' personal development and needs, this is mainly reflected in two aspects: further education and employment capability cultivation. In the process of graduate school applications and assessments, a broad and solid knowledge system, practical hands-on ability, and innovative research-oriented thinking have become new core competitiveness elements. In terms of employment, the demand for diversified position competency capabilities has become prominent, and being "specialized in one field while competent in many" has become a new expectation for talent from employers. iSchool members have been continuously conducting curriculum reforms, with their primary motivation being to meet society's demand for professional competency capabilities in the new data-driven environment [13]. Currently, some research on curriculum design for information resource management disci-

plines has begun to focus on the cultivation of talent composite capabilities. For example, M. Almrgebi et al., by comparing more than 14,000 job postings and over 3,600 online course information scraped from the internet, analyzed the matching between occupational competency demands and course teaching content, finding that capabilities such as marketing analytics, business intelligence analysis, and project management have surpassed software development capabilities to become the most needed professional skills for information analysis and data analysis talents [24]. Similarly, I. Song et al. found that for students majoring in big data, data science, and other information resource management-related fields, requirements modeling and management capabilities, information system analysis and design capabilities have also surpassed programming and development capabilities to become more important core skills [11]. Similar trends can be observed in China's actual employment market. Taking the information and management crossover industry as an example, in IT and internet industries, traditional pure development positions have gradually been replaced by composite research and development positions. This means that in addition to basic programming and software development capabilities, information analysis and algorithm design capabilities have become another essential skill. For higher-level technical management positions, even higher requirements have been put forward for business understanding capabilities, information processing and decision-making capabilities, project macro control capabilities, and even team collaboration and management coordination capabilities.

The functional positioning of the "Curriculum Cube" is as the basic unit of new interdisciplinary curriculum groups. In June 2018, the Ministry of Education convened the National Undergraduate Education Conference in the New Era, explicitly proposing to strengthen first-class undergraduate education in the "double first-class" construction and encouraging the construction of comprehensive, problem-oriented, and interdisciplinary new curriculum groups [23]. It is not difficult to see that new curriculum groups have higher requirements for the overall comprehensiveness and interdisciplinarity of curriculum systems. In other words, the relational structure between courses should also change accordingly. In traditional curriculum group design, using single courses as the basic design unit and adopting one-dimensional curriculum chains or two-dimensional curriculum clusters makes it difficult to directly reuse them. The construction of "new curriculum groups" under the new liberal arts context requires new basic units and thus requires new design models to achieve. This design model is the "Curriculum Cube." It is worth noting that the "Curriculum Cube" has clear interdisciplinary characteristics and curriculum comprehensive synergy features. It is not a collection of general education or professional courses for a specific major in the traditional sense, but rather a specially designed multi-course combination for talent cultivation in broad information resource management-related interdisciplinary disciplines.

3.2 Teaching Objectives: Dual-Helix of Knowledge Linking and Competency Integration

The overall teaching objective of the “Curriculum Cube” focuses on serving the needs of the Party, the country, and society for talent while also closely connecting with students’ personal development needs. Education scholars have pointed out that a basic criterion for good curriculum design is whether it meets students’ development and learning needs, and whether it can solve students’ learning problems and promote effective learning [22]. Therefore, to achieve effective Curriculum Cube design, it is necessary not only to grasp teaching objectives holistically but also to refine and decompose them. This study decomposes the teaching objectives of the “Curriculum Cube” into a dual-dimensional spiral structure of knowledge linking and competency integration.

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abilities are often interdependent and inseparable, manifesting as a spiral upward and mutually reinforcing pattern in their formation process. Specifically, for undergraduate talent cultivation in information resource management disciplines under the new liberal arts context, while focusing on cultivating students' macro vision for information resource management and their ability to understand the core laws of information society operation, it is even more important to focus on the externalization of thinking abilities, emphasizing their mastery of micro-skills such as information construction and information analysis, as well as shaping their comprehensive innovative problem-solving abilities for complex problems. From the perspective of students' personal development and needs, this is mainly reflected in two aspects: further education and employment capability cultivation. In the process of graduate school applications and assessments, a broad and solid knowledge system, practical hands-on ability, and innovative research-oriented thinking have become new core competitiveness elements. In terms of employment, the demand for diversified position competency capabilities has become prominent, and being "specialized in one field while competent in many" has become a new expectation for talent from employers. School members have been continuously conducting curriculum reforms, with their primary motivation being to meet society's demand for professional competency capabilities in the new data-driven environment [13]. Currently, some research on curriculum design for information resource management disciplines has begun to focus on the cultivation of talent composite capabilities. For example, M. Almrgebi et al., by comparing more than 14,000 job postings and over 3,600 online course information scraped from the internet, analyzed the matching between occupational competency demands and course teaching content, finding that capabilities such as marketing analytics, business intelligence analysis, and project management have surpassed software development capabilities to become the most needed professional skills for information analysis and data analysis talents [24]. Similarly, I. Song et al. found that for students majoring in big data, data science, and other information resource management-related fields, requirements modeling and management capabilities, information system analysis and design capabilities have also surpassed programming and development capabilities to become more important core skills [11]. Similar trends can be observed in China's actual employment market. Taking the information and management crossover industry as an example, in IT and internet industries, traditional pure development positions have gradually been replaced by composite research and development positions. This means that in addition to basic programming and software development capabilities, information analysis and algorithm design capabilities have become another essential skill. For higher-level technical management positions, even higher requirements have been put forward for business understanding capabilities, information processing and decision-making capabilities, project macro control capabilities, and even team collaboration and management coordination capabilities.

4. Curriculum Cube Model Design and Implementation

4.1 Curriculum Cube Model Design

The model design of the Curriculum Cube is the concrete expression of its core construction concepts. Closely aligned with its functional positioning and construction objectives, it can effectively compensate for the common problems in traditional curriculum groups that its core concepts target.

4.1.1 Hierarchical Structure of Curriculum Cube Traditional curriculum groups are often simplistically understood as “course collections.” Even when attention is paid to connections between courses, it is often difficult to go beyond one-dimensional curriculum chains focusing on course sequence or two-dimensional curriculum clusters focusing on course relevance. These two models still cannot achieve deep coupling and systematic synergy of courses. The fundamental reason is that traditional curriculum group construction thinking often uses single courses as the smallest basic teaching design unit. However, under the new liberal arts context, interdisciplinary undergraduate courses are deeply integrated, and the granularity requirements for their combined design have long surpassed the level of single courses, reaching deep into the knowledge module level within courses. Therefore, when designing “new curriculum groups,” it is necessary to clearly recognize that using single courses as their basic units can no longer meet the needs of interdisciplinary information resource management disciplines. The design should use knowledge modules as the reference base point, with “Curriculum Cubes” formed through deep coupling of multiple courses as the new minimum unit to construct complete new curriculum groups. Within the Curriculum Cube, single courses still exist, but their new role is merely as “containers” for knowledge modules and teaching tasks. Inside the Curriculum Cube, boundaries between courses gradually become blurred, and the clearly demarcated “components” in traditional curriculum groups are gradually broken down. Overall, the “new curriculum group” for information resource management disciplines under the new liberal arts context is composed of several Curriculum Cubes, each consisting of three or more deeply coupled and systematically coordinated courses. Single course containers are filled with several knowledge modules, and the overall hierarchical structure of the curriculum group construction model is shown in Figure 2 [Figure 2: see original paper].

How to achieve “static” deep coupling and “dynamic” systematic synergy of courses within the Curriculum Cube becomes the other two key points of model design.

4.1.2 Curriculum Coupling Method in Curriculum Cube The Curriculum Cube primarily adopts a knowledge module linking method based on the big concept paradigm to achieve “static” deep coupling of internal courses, thereby achieving the teaching objective of “knowledge linking” in the Curriculum Cube. The “big concept” is a coherent knowledge system paradigm, consisting of a set

of relatively abstract upper-level key concepts and surrounding implicit lower-level concepts. Essentially, it is a knowledge framework built around important concepts. Education scholars have pointed out that comprehensive coverage of traditional knowledge points should no longer be the focus of curriculum design. Instead, the big concept approach should be adopted more to impart main ideas and thinking methods to students, establishing a lens through which they can view the world [20]. Big concept linking and articulation often play an anchoring role for a knowledge system in actual Curriculum Cube design. Through the governance of lower-level concepts by upper-level concepts and the association of concepts and knowledge between different levels, the integration of tree-shaped knowledge systems in different courses is achieved, forming a “knowledge forest” structure with intersecting roots. The final effect is that surrounding concepts under the 统领 of big concepts synthesize into concrete knowledge modules. These knowledge modules are distributed vertically in various course “containers” according to traditional structures. At the same time, due to the linking role of big concepts, new horizontal links are naturally formed, creating coupling effects between courses and constituting a complete Curriculum Cube. Finally, several Curriculum Cubes combine to form the new curriculum group for information resource management disciplines. This study will further illustrate this method with the undergraduate education practice of Renmin University of China.

4.1.3 Curriculum Collaboration Mechanism in Curriculum Cube The Curriculum Cube mainly relies on a unified practical task-driven approach based on backward design [22] to achieve “dynamic” systematic synergy of internal courses, thereby achieving the teaching objective of “competency integration” in the Curriculum Cube. In the specific implementation process, the entire teaching process of all courses within the cube is guided by a unified practical task shared by multiple courses, and the results of the “comprehensive curriculum practice project” are used as the guide to stimulate students’ learning initiative, ultimately forming a complete experience of open active learning. Open active learning breaks the situation of passive learning through 灌输 in traditional classroom teaching and is key to promoting effective student learning in a targeted manner [3]. Clear tasks will greatly motivate students to think and reduce situations where students passively receive knowledge, reflecting the core value of higher education, which is not to shape students into knowers or actors, but more importantly, to cultivate them into thinkers [25]. The backward design approach also forces courses to collaborate. Unlike traditional curriculum groups where course teaching is relatively independent, multiple core courses in the Curriculum Cube are taught simultaneously, and the teaching progress of multiple courses is adjusted according to students’ progress in completing unified practical tasks, achieving “dynamic” synergy between courses. In addition, to achieve systematic synergy of courses from both teaching process and knowledge system perspectives, ensuring the scientificity and systematicity of the cube’s structure is equally crucial. Therefore, in the instantiation process of Curriculum Cube

construction, based on the three-dimensional teaching model theory [26], the study distinguishes what students must know at the factual level, what they should understand at the conceptual level, and what they can do at the strategic and skill levels. Based on this, the functional levels of knowledge modules within course containers are divided, and systematic synergy between courses is achieved from the knowledge system perspective through organic combination of knowledge modules at different levels. Ultimately, talents cultivated in information resource management disciplines will possess comprehensive capabilities to actively create value in an increasingly complex information society.

4.2 Model Implementation Example: One Line, Three Tiers, Four Courses

This study uses the core Curriculum Cube of the information resource management discipline at Renmin University of China as a demonstration case to further illustrate the implementation methods and application effects of the Curriculum Cube model in teaching practice. This Curriculum Cube was developed by the School of Information Resource Management at Renmin University of China to meet the cultivation needs for interdisciplinary talents under new liberal arts construction, and is offered to information and management-related majors across the university. In practice, its target students are primarily but not limited to two undergraduate majors: information resource management and information management and information systems. The target major can be understood as a virtual “micro-major” for information and management interdisciplinary disciplines [27]. This makes the student population for the Curriculum Cube more diversified when actually offered at Renmin University, no longer limited to a single major but spanning multiple related interdisciplinary majors, and even other traditional majors that have knowledge system or application domain intersections with information resource management disciplines, including management science and engineering, business administration, journalism and communication, public management, applied economics, etc. In addition, most outcomes produced during the Curriculum Cube teaching process are team-based, and team composition encourages cross-major integration. The design concept of the Curriculum Cube is rooted in the core requirements of new liberal arts construction for comprehensiveness and interdisciplinarity in new curriculum groups, specifically manifested as “One Line, Three Tiers, Four Courses,” as shown in Figure 3 [Figure 3: see original paper].

The “Four Courses” in the Curriculum Cube include: Information Resource Management and Innovative Thinking, Information System Analysis and Design Methods, Big Data and Information Analysis Methods, and Advanced Programming and Product Development. Notably, these “Four Courses” have been carefully selected and designed with significant interdisciplinary characteristics. According to the basic principles of the three-dimensional teaching model theory, their course positioning belongs to three “tiers”: management theory, analysis methods, and technical practice, respectively. This breaks the traditional linear

parallel classification pattern and achieves top-down full-process 贯通 centered on the “One Line” formed by the comprehensive curriculum practice project.

To ensure the scientific rationality of the curriculum design within the cube and its alignment with world-class interdisciplinary discipline construction standards, the design process referenced 13 course types involved in 310 courses offered by the top 10 U.S. universities in the iSchool alliance [28]. Ultimately, the core “Four Courses” covered four of the top five categories by offering quantity, including Information Technology and Programming (first, accounting for 21.94%), Information Services and User Research (second, 11.29%), Information Systems and Information Product Design (third, 9.03%), and Information Analysis and Data Mining (fifth, 7.74%). This indicates that the curriculum design of this Curriculum Cube aligns with the mainstream trend of global information and management interdisciplinary talent cultivation and possesses high curriculum completeness and advancement, thus having strong exemplary reference value.

The deep coupling of the Curriculum Cube is achieved in the specific implementation process through knowledge module linking based on the big concept paradigm. For example, in the knowledge system of the Big Data and Information Analysis Methods course, the upper-level concept of computational social science research methods can govern surrounding lower-level concepts such as data mining, natural language processing, and machine learning, and even more lower-level concepts such as data preprocessing and feature extraction. The concept of feature extraction is closely linked with concepts such as information service needs analysis in the knowledge system of the Information Resource Management and Innovative Thinking course, business process reengineering in the Information System Analysis and Design Methods course, and variable types and multiple inheritance in the Advanced Programming and Product Development course. At different levels of knowledge, thinking methods, and skills, these concepts at different levels are linked through a complete shared scenario in the classroom teaching process, enabling students to deeply understand the relationships and connotations among these concepts. In the teaching process of the Curriculum Cube, individual knowledge anchor points serve as fulcrums for the entire knowledge system, continuously spiraling upward to ultimately establish a clearer and higher-quality knowledge system.

In practice, the course synergy of the Curriculum Cube is achieved through the traction of the “One Line,” that is, the main line of the comprehensive curriculum practice project 贯穿 the entire teaching process of the Curriculum Cube. Specifically, the comprehensive curriculum practice project is task-oriented and includes clear requirements for comprehensive course output outcomes. Students are required to imagine themselves participating in a real information resource management-related innovation practice project, combining and applying key knowledge modules from the four core courses. The project completion process covers team building, needs investigation, idea generation, product design, user analysis, business analysis, requirements analysis, system analy-

sis, system design, data modeling, business process modeling, prototype system business function development, project management, information collection, information preprocessing, information analysis model construction, information analysis algorithm design, algorithm implementation and verification, prototype system analysis function development, system function demonstration, project reporting, and many other stages. In the process of students completing the comprehensive curriculum practice project main line, all involved key concepts, theories, methods, and technologies will be taught through comprehensive coordination of the “Four Courses.”

5. Curriculum Cube Construction Support System

The construction of new curriculum groups for information resource management disciplines under the new liberal arts context cannot be separated from a scientific and effective support system. The Curriculum Cube provides support and guarantee for its construction from four aspects: traction-type curriculum ideology and politics scheme, “trinity” teaching support methods, in-class and out-of-class dual-cycle teaching teams, and comprehensive effect evaluation and verification mechanisms.

5.1 Traction-Type Curriculum Ideology and Politics Scheme

In the OECD’s Education 2030 learning framework, the curriculum content system supporting competency formation mainly includes three dimensions: knowledge, skills, and values [29]. Therefore, in the process of Curriculum Cube construction, transmitting correct socialist core values while teaching knowledge and cultivating skills becomes another important issue that cannot be ignored for comprehensive talent cultivation in new liberal arts. During Curriculum Cube construction, to make the entire teaching team realize that curriculum construction is the “main battlefield” for curriculum ideology and politics and that classroom teaching is the “main channel” for curriculum ideology and politics, the Curriculum Cube adopts a joint lesson preparation approach by the teaching team to complete the construction of the full-process curriculum ideology and politics system.

General Secretary Xi Jinping has pointed out that classroom teaching requires new thinking and needs to uphold dialectical materialism and historical materialism to guide students to profound learning experiences, helping them establish correct ideals and beliefs, maintain national sentiment, and keep the country and nation in mind, paying attention to the times and society in the great practice of the Party and the people. In fact, with the explosive development of information and management crossover research and applications today, the effectiveness and potential of information technology are indeed precious, but it is also a double-edged sword. Information technology is no longer neutral and constantly participates in profound interactions with human society [30]. During the teaching process of the Curriculum Cube, a guided scenario teaching

method is used to subtly lead students to recognize the impact of information resource management on society, pay attention to social hot issues such as personal information protection in the big data era and policies and legal regulations for artificial intelligence products, and help students establish correct values. Furthermore, in the topic selection process of the comprehensive curriculum practice project, students are guided to start from familiar scenarios and set target problems to be solved by the comprehensive curriculum practice project from the perspective of management and information technology integration, based on the urgent needs of the Party, the country, and society. Examples include risk prevention and information sharing in major public health events, and the evaluation and incentive system and information system construction for social elderly care institutions in the process of population aging, enabling students to contribute to the great rejuvenation of the Chinese nation through practical actions and to practice socialist core values.

5.2 “Trinity” Teaching Support Methods

Scientific and reasonable teaching methods are important guarantees for improving education and teaching quality. To effectively support the construction objectives and design framework of the Curriculum Cube, the teaching methods employed also need precise adaptation. Specifically, the Curriculum Cube adopts a “trinity” teaching model combining “full-process flipped classroom,” “real-world scenario teaching,” and “cross-disciplinary collaborative deep interaction.”

5.2.1 Full-Process Flipped Classroom Generally, mechanical learning content that has not undergone further processing and consolidation in the existing conceptual system is more susceptible to proactive and retroactive interference and thus more easily forgotten [31]. Therefore, the Curriculum Cube constructs a “full-process flipped classroom” guided by the objectives of the comprehensive curriculum practice project tasks mentioned above. From the very beginning of Curriculum Cube teaching, tasks are clearly defined. Throughout the entire teaching process of the Curriculum Cube at various levels—management theory, analysis methods, and technical practice—students are guided to discover problems, actively ask questions, and conduct autonomous learning to solve problems.

5.2.2 Real-World Scenario Teaching Research has shown that teacher guidance is crucial in the autonomous learning process [20]. The Curriculum Cube strengthens the “real-world scenario teaching” model oriented toward process guidance. In the course teaching process, detailed factual details are presented through cases, mapping abstract concepts to concrete facts in a contextualized manner. The combination of concept memory and understanding helps individuals transfer learned knowledge to new situations [32]. Therefore, the teaching of the Curriculum Cube focuses on distinguishing between factual

knowledge and conceptual knowledge. After instantiating more complex conceptual knowledge, more essential features are abstracted, and scenarios are changed to guide students to transform their thinking. By setting up timely questioning sessions, concepts are guided to extend from memory to understanding, thereby helping students clarify knowledge relationships, construct complete and high-quality knowledge structure systems, and shape students' innovative transfer capabilities.

5.2.3 Cross-Disciplinary Collaborative Deep Interaction In addition to result-oriented autonomous learning and process-oriented scenario-based guidance learning, “interactive deep learning” among cross-major student team members is another core teaching model of the Curriculum Cube. Education scholars have found that the process of collaborative learning in student teams can effectively promote deep learning through mechanisms such as enhanced personal engagement, interactive feedback, repeated exploration, and clear perception of the learning process [33]. In the teaching process of the Curriculum Cube, the formation of multidisciplinary and cross-major integrated collaborative teams is encouraged. On the one hand, due to different professional backgrounds of team members, students engage in in-depth exchange of knowledge and skills during team collaboration. On the other hand, since team members take different courses in the Curriculum Cube and assume different division of labor roles in the comprehensive curriculum practice project, students conduct in-depth interactions not only during class time to complete learning tasks but also carry out in-depth team collaboration after class. Overall, such teaching methods enable students to consciously and autonomously complete interactive deep learning, and also meet the goal of strengthening cross-disciplinary team collaboration in teaching under the new liberal arts context.

5.3 In-Class and Out-of-Class Dual-Cycle Teaching Team

The human cognitive process can generally be divided into six levels from low to high: memory, understanding, application, analysis, evaluation, and creation [32]. Similarly, in the learning process, the highest stage is creation, and shaping creative ability often cannot rely solely on classroom teaching. Therefore, the teaching method of the Curriculum Cube adopts an in-class and out-of-class practical teaching dual-cycle model, with teaching teams adopting a “dual-mentor system” of internal and external practice mentors.

Theoretical teaching is generally a strength of higher education institutions. In-class practical teaching can be smoothly completed with the support of the three innovative teaching methods mentioned above. However, it should still be noted that information resource management is rooted in social practice activities of government agencies, enterprises, and institutions. Many foreign university teachers have part-time positions in industry or relevant work experience. In contrast, Chinese university teachers are relatively lacking in practical work experience, and their understanding of real-world situations is often obtained from

various literature reports, which inevitably affects the effectiveness of practical teaching [3]. Therefore, the Curriculum Cube adopts an integrated approach of in-class and out-of-class practical teaching, with internal main lecturers and external practice mentors collaborating in teaching. External mentors mainly undertake three parts of teaching work: first, providing topic selection guidance for students' comprehensive curriculum practice projects, using the latest industry practice cases to broaden students' horizons; second, answering questions for assigned teams during the completion process of comprehensive curriculum practice projects; and third, jointly guiding and evaluating the reporting and presentation of comprehensive curriculum practice project outcomes with internal teachers.

5.4 Comprehensive Effect Evaluation and Verification Mechanism

This study adopts a two-stage teaching effect verification mechanism combining in-class evaluation and continuous post-assessment. Curriculum design is equivalent to a set of hypotheses. Whether these hypotheses are correct and whether they can achieve expected goals depends on the effectiveness of the curriculum design implementation, which requires effect verification. It should be noted that learning effect verification methods in higher education are also constantly upgrading. Currently, there is no longer an exclusive emphasis on written examinations, but rather a preference for comprehensive practical assessment, in which student portfolios are often used as the main consideration [20]. Therefore, at the beginning of the Curriculum Cube, it is clearly stated that student outcome works from comprehensive curriculum practice projects will be included in the scope of comprehensive effect evaluation. Given that comprehensive curriculum practice project outcomes are relatively comprehensive, the mentor group selectively recommends works to participate in various levels of university student extracurricular academic technology competitions, including the "Xinhua Cup" Renmin University of China School of Information Resource Management Student Extracurricular Academic Technology Works Competition, "Innovation Cup" Renmin University of China Student Extracurricular Academic Technology Works Competition, and "Challenge Cup" University Student Entrepreneurship Competition. Teaching effects are objectively measured by referencing external competitive evaluation results, and teaching methods are continuously improved accordingly.

In the specific practice of the core Curriculum Cube of information resource management at Renmin University of China, the final presentation forms of comprehensive curriculum practice projects include several specific types: project proposals, system analysis and design reports, algorithm design and information analysis reports, software system prototypes, algorithm model engines, system user manuals, comprehensive curriculum practice project presentation materials, etc. The entire portfolio is used for comprehensive evaluation and verification of teaching effects. Statistics since the Curriculum Cube was offered show that student team portfolios contain an average of 7.9 items. An average of 1.9

projects cultivated by the Curriculum Cube win awards in various competitions or receive funding at national, municipal, and university-level university student innovation and entrepreneurship training plan platforms each year. The cultivation effects of the curriculum have gained widespread recognition and a good reputation among students across the university. The average student teaching evaluation score for core courses in the Curriculum Cube has remained above 95 points since its inception, with some courses even achieving perfect scores in recent years. The Curriculum Cube is primarily offered as a comprehensive core course for junior-year students in the two undergraduate majors of information resource management and information management and information systems at Renmin University of China. Both majors have been rated as national first-class undergraduate majors, and their employment rates remain above 99%.

6. Conclusion

New liberal arts construction is one of the important national strategies to address the new round of global technological revolution and industrial transformation. Compared with traditional liberal arts, it puts forward higher requirements for the deep integration and development of information science and social sciences, and has an urgent need for new construction models and specific methods for new curriculum groups. Management science, as one of the broadest categories of social science disciplines, has strong representativeness and demonstration value in the new curriculum group construction of information resource management disciplines.

This study first clarifies the core concepts of “Curriculum Cube” construction. Specifically, based on an in-depth analysis of the internal mechanism why the two construction modes of “one-dimensional curriculum chains” and “two-dimensional curriculum clusters” in current traditional curriculum group research cannot meet the requirements of new liberal arts construction, it proposes the functional positioning of the Curriculum Cube as the basic unit to replace single courses in constructing new curriculum groups. Furthermore, this study clearly defines the dual-helix teaching objectives of knowledge linking and competency integration for new curriculum group construction to address the core problem of insufficient systematicity and synergy in courses, combined with the core requirements of new liberal arts construction. Secondly, addressing the problems of “survey-heavy, design-light” and “foreign-heavy, domestic-light” in current research on curriculum groups for information resource management disciplines, this study proposes the model design method of the Curriculum Cube, specifically through the design of hierarchical structure, course coupling methods, and course collaboration mechanisms to achieve the functional positioning and dual-helix teaching objectives of the Curriculum Cube. Then, to verify the practical operability of the proposed model, this study elaborates on the implementation example and practical effects of the “One Line, Three Tiers, Four Courses” Curriculum Cube model based on first-hand teaching practice at Renmin University of China’s School of Information Resource Management,

proving the operability of the proposed method. Finally, this study systematically proposes a support system for Curriculum Cube construction, including a traction-type curriculum ideology and politics scheme, “trinity” teaching support methods, in-class and out-of-class dual-cycle teaching teams, and comprehensive effect evaluation and verification mechanisms, and reports the effects achieved in teaching practice, verifying the actual effectiveness of the Curriculum Cube.

Overall, based on summarizing the core common problems in current curriculum group construction for information resource management disciplines, this study innovatively proposes a systematic and complete set of new curriculum group construction methods based on the “Curriculum Cube” by deeply combining educational principles with first-hand undergraduate teaching practice. This not only provides a concrete and operational practical guide for information resource management-related undergraduate majors to face new liberal arts curriculum design, but also provides effective theoretical support and practical reference for other social science disciplines to break through traditional thinking and create new curriculum groups with deep integration of their disciplines and information science during the new liberal arts construction process.

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Lu Xiaobin: Research topic selection, research 思路 and framework design, paper revision;

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Niu Li: Core concept design, teaching method design;

Liu Lichao: Literature investigation, support system design.

Research on the Design of “Curriculum Cube” in the Interdisciplinary Information Resource Management in the Context of New Liberal Arts: A Case Study of Renmin University of China

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Abstract: [Purpose/Significance] New liberal arts construction has put forward higher requirements for cross-integration and systematic collaboration of curriculum groups in information resource management disciplines, and traditional curriculum group construction models can no longer meet these needs. This study aims to propose a new curriculum construction model called “Curriculum Cube” based on first-hand undergraduate teaching practice at Renmin University of China’s School of Information Resource Management, to effectively support the construction of new curriculum groups for information resource management disciplines. [Method/Process] Firstly, this paper discloses the intrinsic mechanism why traditional curriculum groups fail to support interdisciplinary information resource management curriculum construction under the new liberal arts context. Secondly, it clarifies the core idea of the “Curriculum Cube” construction according to the discovered core problems. Thirdly, it proposes the design methods of the “Curriculum Cube.” Fourthly, it demonstrates the implementation methods and effects of the proposed method based on teaching practice. Finally, it constructs the support system required for the “Curriculum Cube” construction. [Result/Conclusion] Firstly, two traditional models for curriculum group construction are summarized: “one-dimensional curriculum chains” and “two-dimensional curriculum clusters,” revealing their common problem of unsystematic and uncoordinated courses. Secondly, the functional positioning of the “Curriculum Cube” is clarified as the basic component for new curriculum groups, with teaching objectives of knowledge linking and competency integration forming a double helix. Thirdly, the design method of the “Curriculum Cube” is composed of hierarchical structure design, course coupling method, and course collaboration mechanism. Additionally, the operability and practical effect of the proposed method are verified through the practical example of “one line, three tiers, and four courses” at Renmin University of China. Finally, the supporting system for the “Curriculum Cube” is presented. In summary, the results of this study will serve as scientific reference and strong support for the construction and practice of new curriculum groups for interdisciplinary disciplines represented by information resource management in the context of new liberal arts.

Keywords: new liberal arts construction; information resource management; interdisciplinary discipline; new curriculum group; curriculum cube

Note: Figure translations are in progress. See original paper for figures.

Source: ChinaXiv — Machine translation. Verify with original.