

Exploration and Practice of Knowledge Graph Empowering Smart Teaching in Financial Education Courses Taking Wealth Management as an Example

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ABSTRACT

Smart teaching is an important beacon for the digital transformation of financial education. As a core driving force for the development of artificial intelligence, knowledge graph provides new empowerment for innovation in higher education teaching models, and also points out the direction for solving the pain points of classroom teaching in financial education courses. This study is supported by knowledge graph technology and relies on the construction and teaching practice of the Wealth Management AI course. It explores and constructs a feasible curriculum smart teaching model from four dimensions: teaching objectives, teaching design, teaching resources, and teaching evaluation. The research results indicate that this model can effectively stimulate learners' learning interest and classroom participation enthusiasm, which is conducive to promoting the unity of large-scale classroom teaching and personalized student cultivation. The knowledge graph promotes the deep integration of digital education into classroom teaching reform, and provides a path reference for the teaching mode reform of related courses and majors.

Keywords: Knowledge graph, Smart teaching, Financial education.

1. INTRODUCTION

At present, with the increasing maturity of technologies such as 5G, big data, and artificial intelligence, the overlapping and multiplying effect of digital transformation on the high-quality development of higher education is becoming increasingly prominent. The development of knowledge graph and other new generation AI technologies is driving "Internet+education" into a new era of "smart teaching". The State Council pointed out in the "Development Plan for the New Generation of Artificial Intelligence" that it is necessary to focus on breaking through technologies such as knowledge graph construction and learning, knowledge evolution and reasoning, and to achieve intelligent education by establishing a learner centered educational environment. As the core driving force to promote the development of artificial intelligence, knowledge graph provides new empowerment for education and teaching in

the era of educational informatization 2.0. As an important component of quality education in China's colleges and universities, financial education should keep abreast of the times and seize the opportunity of educational environment reform. Therefore, in line with the development trend of higher education digitization, applying knowledge graph technology to the construction of smart teaching models in financial education has rich and profound contemporary connotations and important research significance.

Research on smart teaching can be traced back to the "Smart Classroom" proposed by Ronald Rescigno. Rescigno proposed that a smart classroom is a classroom that embeds information technology such as personal computers and interactive CD video programs into traditional classrooms. On the basis of advocating the concept of a smart earth, IBM applied it to education, thus pioneering the concept of smart education. From the perspective of research content, research on

smart teaching mainly focuses on three aspects: the construction of smart learning environments, smart teaching supported by intelligent technology, and personalized learning supported by machine learning technology. The research on smart teaching in China started relatively late and emerged in the early 21st century, but it has made rapid progress. The research topics comprehensively cover the changes brought to the field of education in different eras and policy contexts: firstly, starting from classroom teaching, understanding the basic connotation of smart teaching, involving feature analysis, teaching design, evaluation mode, smart teaching platform, etc. Secondly, from the practical perspective of technological application, the significance of smart teaching for students' learning and the existing practical challenges is taken as the basis. In addition, from the perspective of research methods, studies on smart teaching mostly adopt the literature analysis method, with a few using case study methods, and empirical research results are relatively scarce.

Since Google introduced the concept of knowledge graph in 2012, a large number of knowledge graph projects have been launched in industry and academia. Education and teaching is an important area of knowledge graph application. In 2021, the Ministry of Education and six other departments issued the "Guiding Opinions on Promoting the Construction of New Education Infrastructure and Building a High quality Education Support System", proposing to accelerate the construction and application of knowledge graphs. Subsequently, many cities such as Shanghai, Guangzhou, and Beijing incorporated knowledge graph construction into the 14th Five Year Plan for education. Integrating knowledge graph technology into the teaching process of universities is widely regarded as an important direction for the development of teaching informatization and intelligence. Regarding the connotation of knowledge graph, scholars have reached a consensus on "the semantic network formed by taking the elements involved in the teaching process as entity nodes and the logical relationships between teaching elements as edges" (Fan and Zhong, 2022). Current research focuses on exploring the construction and application of knowledge graph. Some scholars use specific courses as examples to extract course knowledge points and establish course knowledge graph, such as mobile programming (Hou et al., 2019), calculus (Tu et al., 2020), linear algebra (Yang et al., 2023),

etc. Some researchers have further extended the application of knowledge graph from classroom teaching to extracurricular activities such as science and technology innovation and practice, such as college student innovation practice projects (Zhang et al., 2022) and programming practice (Song et al., 2022).

In summary, there have been many achievements in the research on smart teaching and knowledge graph. The application of knowledge graph technology in the teaching process of universities, and even the teaching activities with knowledge graph as the core, have been recognized by the education and industry sectors, which provides sufficient theoretical and experiential references for this research. However, there is a relative lack of research on the integration of smart teaching and knowledge graph, which provides space for this study. In view of this, this research takes a public finance and economics undergraduate college as an example, relying on finance and intelligence education courses, proposes the exploration and practical research of intelligent teaching based on knowledge graph. Based on the essence of domestic and international research, this study starts from the four dimensions of teaching objectives, teaching design, teaching resources, and teaching evaluation, so as to enrich the depth and breadth of research on the reform of the teaching mode of digital education into financial education courses.

2. ANALYSIS OF THE CURRENT SITUATION OF CLASSROOM TEACHING IN FINANCIAL EDUCATION COURSES

In the undergraduate talent training program of Chinese finance and economics colleges and universities, financial education courses are usually arranged to be studied in the second semester of the sophomore year or the first semester of the junior year. There are differences in the learning subjects, specific courses, and class hours set for financial literacy modules among different universities. Taking a public finance and economics undergraduate university as an example, the financial literacy module is a necessary component of the public foundation courses in the undergraduate talent training program for various majors in the university. The module is set up in a restricted mode, in which students can freely choose courses from the financial education course library according to their personal learning interests,

across disciplines, and majors. At present, financial education courses mainly adopt the traditional teaching mode taught by teachers, where students passively receive knowledge in the classroom. In recent years, teachers have begun to explore and reform the teaching mode of financial education courses, initially attempting diversified teaching methods such as blended learning mode and flipped classroom teaching mode, in order to improve teaching effectiveness and effectively enhance students' learning and research abilities. However, the effect of practice is not satisfactory, and the main reasons can be summarized as follows:

The first is the contradiction between "extensive teaching" and "personalized learning" in classroom teaching. "Extensive teaching" means that teachers need to provide the same teaching content and methods for the whole class, while "personalized learning" requires teachers to make individualized teaching plans according to the different needs and abilities of each student. The contradiction between the two is a persistent problem. For financial education courses, the audience group involves various majors, not only economics and management, but also science and technology. In other words, financial education courses are foundation/core courses with a wide range of learning groups and significant professional differences. Therefore, it is urgent to pay attention to the training objectives of students from different majors in classroom teaching. In addition, even for students in the same major, there are differences in learning styles, motivations, abilities, and mastery of financial knowledge and skills among different learners. Therefore, when learning the same content, learners need different learning support and investment of learning time to achieve the same level of understanding and application. In the context of classroom teaching, when faced with a large number of students (usually over 60 in two administrative classes) and whose learning levels and abilities are not completely consistent, teachers find it difficult to pay enough attention to the personalized characteristics and diverse needs of learners, and they tend to adopt a uniform pedagogical approach. Therefore, it is necessary to provide a supportive environment for personalized learning for students in classroom teaching.

The second is the problem of neglecting innovative teaching modes in classroom teaching. The rapid development of information technology has brought tremendous impact and changes to classroom teaching. The current application of information technology in financial education

courses is mostly characterized by intelligence. In classroom teaching, although the use of information technology has brought much conveniences and efficiency improvements, there is also a neglect of innovative teaching modes. For example, although online interactive teaching (e.g., Rain Classroom, Learning Channel, etc.) has brought great changes to teaching, it does not necessarily represent that the role of teachers has undergone a transformation. The traditional "teacher speaking student listening" model still dominates. From the perspective of course characteristics and student' learning situation, the financial education courses are characterized by both theoretical, practical and comprehensive, which is a typical integration of economics, management, law and other multidisciplinary courses, and the knowledge of the course is numerous and trivial. In traditional offline teaching situations, students generally have problems such as difficulty in absorbing and forgetting during learning. Simply building an online learning platform is not enough to integrate the knowledge points of the whole course, which can easily lead to the fragmentation of knowledge points, the inability to form a knowledge system, and the inability to complement offline teaching well, resulting in double the learning pressure for students. Therefore, it is urgent to pay attention to the logical relationship of course knowledge and students' ability to integrate learning in classroom teaching.

3. THE CONSTRUCTION PATH OF KNOWLEDGE GRAPH EMPOWERING SMART TEACHING IN FINANCIAL EDUCATION COURSES

3.1 Course Selection

Continuing with the example of the public undergraduate finance and economics institution, which covers several courses in financial education, this study chooses a specific course, "Wealth Management," as an example. The reasons are as follows:

- From the perspective of course attributes, Wealth Management is a characteristic course of the financial education module. It is not only a compulsory professional core course for undergraduate students majoring in Investment in the School of Finance, generally set at 48 credit hours; but also a limited elective course for students majoring in other majors in the School of Finance, such as Finance, as well as the

other majors in the School of Statistics, the School of Public Administration, the School of Foreign Languages and the School of Information and Electronic Engineering, generally set at 32 credit hours or 16 credit hours. The learning group has a wide range of people and significant differences in majors. The requirements for mastering basic subject knowledge, analyzing and solving problems, comprehensive abilities, understanding and applying financial knowledge, and analyzing and solving practical problems in life and work are different. Therefore, it is urgent to pay attention to the training objectives of students in different majors in course teaching.

- From the perspective of course characteristics and learning situation, Wealth Management is characterized by both theoretical, practical and comprehensive, and the course is mainly divided into three major parts: foundation of wealth management, business of wealth management, and expansion of wealth management. It is a typical interdisciplinary course that integrates economics, management, law, and other disciplines, with a wide range of knowledge points and trivialities. It is urgent to pay attention to the logical relationship of course knowledge and personalized learning for students in classroom teaching.
- In terms of hardware support conditions, the School of Finance has initiated and completed the construction of the AI course on Wealth Management, which is the first university-wide AI course to initiate construction and is now online and running on the Wisdom Tree platform, providing a natural research foundation and environmental support for teaching reform exploration.

3.2 Construction Path

In view of this, combined with the course attributes and course characteristics of Wealth Management, and on the basis of paying attention to the professional differences of the training students and the requirements of the training program, a practical and feasible intelligent teaching mode in the context of knowledge mapping is designed based on the multi-dimensional aspects of the teaching objectives, teaching subjects, teaching tools, teaching resources,

and teaching evaluation. The key points include: first, building a curriculum knowledge graph to highlight the bidirectional educational value of technology and data; second, integrating intelligent technology to assist in precise classroom teaching and personalized learning for students; third, building teaching resources and achieve digital construction and intelligent application; and fourth, multi-mode fusion empowering the implementation of dynamic and precise evaluation. The construction path of intelligent teaching mode under the knowledge graph of Wealth Management is as follows.

The first is constructing a curriculum teaching objective system based on data and evidence. Different from the traditional chapter study, the teaching objective system of the course is constructed based on the multi-dimensional system of "ability system, problem system and knowledge system", which is in line with the core qualities of students' development and reflecting the needs of the society. It is necessary to use knowledge graphs to decompose the entire course into numerous knowledge points, refine the cognitive objectives of each knowledge point, and visualize the logical relationships of each knowledge point using Bloom's cognitive model. At the same time, with the help of intelligent technology, teachers can accurately grasp the training requirements and learning characteristics of learners from different colleges and majors, and customize differentiated teaching objectives. From the perspective of construction achievements, the teaching objective system of the Wealth Management course extracts a total of 6 abilities from the ability system; Summary of problem system: 29 questions; 86 knowledge points and 120 knowledge relationships were sorted out in the knowledge system. Teachers can selectively select corresponding knowledge points, questions, abilities, and other content in the graph based on the actual teaching needs of the teaching profession class, and set assessment knowledge points for inclusion in the mastery calculation score to achieve personalized teaching objectives.

The second is to design a classroom teaching implementation plan that integrates knowledge graphs. By utilizing the resource center of knowledge graph, teachers can achieve the reconstruction and integration of course content, the summarization of knowledge points and resources, the effective presentation of knowledge point associations, the construction of a mixed domain knowledge graph, and carry out personalized and

customized teaching Based on the pre-course student data portrait, combined with the teaching objectives and content, classroom tasks of different levels of difficulty are provided for different levels of learners to form a progressive task chain, thus realizing data-driven customized teaching. Based on the characteristics of the course, the Wealth Management course externalizes all knowledge points and logical relationships into a currency shape with an outer circle and an inner square. This is suitable for the course's attributes of financial education, and also allows students to see the relationship between each knowledge point at a glance. If students are interested in a certain knowledge point, they can click on it to get a clear picture of the specific content of the knowledge point, the basic knowledge points they need to master in the previous sequence, and the knowledge points derived from the subsequent expansion.

The third is the personalized resource delivery for after-school consolidation according to students' abilities. By utilizing knowledge graphs, teachers can monitor students' classroom performance and learning progress and quality in the after-school period, realizing timely supervision, timely warning and timely intervention. According to the feedback from the knowledge graph, teachers will tailor-make the corresponding after-class consolidation and improvement programs, and push the practice questions to consolidate the weak skills or expand training questions to enhance comprehensive skills, and at the same time, provide diversified ways of completing the course, such as voice, text, picture and video. The Wealth Management course is equipped with a total of 388 teaching resources, including course videos, textbooks, PPT, test questions, and other external resources. These resources are all connected to a specific knowledge point, and can be quickly and conveniently pushed in real-time with a single click for students who have the ability to learn or students who lack mastery of specific knowledge points.

The fourth is the dynamic three-dimensional evaluation of the learning process based on big data. According to the basic requirements of talent cultivation and course teaching, following the principle of focusing on learning process evaluation and objective and fair data, relying on the knowledge graph to intelligently perceive and dynamically store the behavioral data and process data of teaching and learning in the classroom, extracting multi-dimensional feature data of students' course knowledge graph learning path, conducting multi-dimensional subject evaluation

and dynamic evaluation, and visualization in the form of a cobweb diagram, tracking and evaluation of the overall learning status of students. The total score of the Wealth Management course (set at 100 points)=daily score (40 points, including learning progress and habits)+daily test score (20)+final exam score (40). Among them, the learning progress section will clearly show the video learning and testing situation of each knowledge point, while the learning habits section will record the duration of each learning session.

4. IMPLEMENTATION EFFECTIVENESS OF INTELLIGENT FINANCIAL EDUCATION COURSES

Based on the AI course of Wealth Management, and with students from the School of Finance and other colleges studying this course as research subjects, two semesters of teaching quasi experiments have been conducted. Data has been collected through classroom observation, questionnaire surveys, and automatic recording of learning behavior in knowledge graph. The learning effectiveness of students is evaluated through a combination of process and comprehensive methods, and the effectiveness of the intelligent teaching model under knowledge graphs is verified in multiple dimensions.

4.1 Process Evaluation

Process evaluation mainly examines the learning community's classroom performance and classroom interactions, learning progress and study habits, as well as their performance on different levels of difficulty and types of daily tests.

- Classroom performance and classroom interaction: For the first time encountering knowledge graphs and smart courses, the vast majority of students showed high learning interest and strong participation motivation in the classroom. After class interviews found that 73% of students believe that this teaching mode is innovative and allows them to learn theoretical knowledge in a subtle way. Information tools such as computers, mobile phones, and tablets are excellent assistants for learning in this classroom. 15% of students expressed a curiosity and found this teaching mode very novel, with a focus on experiential participation.

- Analysis of learning progress and study habits: The monitoring of students' learning shows that the vast majority of students are able to log on to the system on time during the course teaching period for course learning. As for the learning progress and mastery of specific knowledge points, the results are not consistent.
- Completion and correctness rates of regular tests: The monitoring of students' unit tests shows that more than 95% of the students were able to complete the tests on time and within the specified time. A small number of students took supplementary tests due to special matters. In addition, besides completing the required adaptation tasks, most learners also attempted to complete other difficult tasks.

From the above, it can be seen that the advanced task chain design and personalized resource push promote personalized classroom participation for learners at different levels. These results also provide reference for optimizing the design of multi-level learning tasks for different learning groups and accurately pushing personalized resources in the future.

4.2 Comprehensive Evaluation

Comprehensive evaluation of student learning outcomes based on a competency system constructed from course knowledge graph.

The first is the ability to master the basic knowledge of the subject. Using the knowledge graph review method, it was found that more than 91% of the students were able to sort out the first-level knowledge points in the course, and more than 82% of them were able to extend the knowledge points on the basis and meticulously clarified the logical relationships between the knowledge points, including the inclusion relationship, the sequential relationship, and the correlation relationship.

The second is the analytical, problem-solving and integrative skills. Scenarios are introduced by issuing case-based tasks, such as simulating the specific business of a certain wealth management institution, wealth management product investment planning, wealth management service planning, wealth management risk prevention and control, etc. Students are encouraged to solve real wealth management problems through simulating actual scenarios, open discussions and teamwork. The case review found that more than 80% of the students were able to formulate appropriate wealth

management product and service planning based on specific case scenarios. It shows that their awareness and ability of wealth management are being built up accordingly.

The third is the level of understanding and application of wealth management knowledge, as well as the ability to analyze and solve practical problems in life and work. By allowing students to face actual wealth management issues, such as the mounted relevant news video cases, it is to study and propose solutions in a group discussion. It not only promotes students' mastery of knowledge and skills in the field of wealth management while solving practical problems, but also cultivates their ability to think deeply about wealth management issues and deepen their understanding of China's national conditions.

5. CONCLUSION

Relying on the knowledge graph/AI course construction and teaching practice of the financial education course "Wealth Management", this study explores and constructs a feasible wisdom teaching model for the course under the knowledge map. Its research significance mainly lies in:

Firstly, it is to solve the pain points of "uniform teaching" and "personalized learning" in traditional classroom teaching reform. By constructing an educational knowledge graph, integrating digital education concepts, applying digital teaching technologies, and transforming digital teaching methods, this teaching mode can integrate and enrich educational resources to better meet the needs of individualized teaching, achieve intelligent recommendation of learning resources, and improve personalized learning efficiency for students.

Secondly, taking knowledge graph as an example, this informatization tool provides a path reference for the intelligent reform of classroom teaching mode. The study promotes the deep integration of digital education into classroom teaching reform from the four dimensions of teaching objectives, teaching design, teaching resources, and teaching evaluation, which helps to enhance the teaching effect and improve the teaching quality, and provides path references for the reform of teaching mode in related courses and specialties.

Thirdly, it is to promote teachers' and students' concern and attention to the digitization of education and enhance their digital literacy. This

study highlights the significance of integrating digital education represented by knowledge graphs into teaching reform. Through the application of digital teaching models, it enhances teachers' attention to digital education, promotes students' acceptance of smart education teaching methods in the new era, and strengthens the digital literacy level of teachers and students.

Next, this study will further test the applicability and effectiveness of the smart teaching model of Wealth Management under the knowledge graph in different majors and learning stages, based on increasing the number of audience members.

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