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The Construction of Open Education Teaching Resources Based on the Theory of Educational Knowledge Graph

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Abstract: With the rapid development of information technology and the arrival of the big data era, knowledge graphs, as an important way of knowledge representation and organization, have demonstrated their unique value in multiple fields. Especially in the field of education, the construction and application of educational knowledge graphs are of great significance for improving educational quality, optimizing educational resource allocation, and achieving personalized education. There are a series of inefficiencies in the construction and utilization of open education teaching resources in China. This article analyzes the inherent relationship between educational knowledge graph theory and teaching resource construction, and proposes a new path for the construction of open education teaching resources in China under the guidance of educational knowledge graph theory.

1. Educational Knowledge Graph

Educational knowledge graph is a specialized knowledge graph used in the field of education, which presents knowledge in the form of a graph by structurally representing various entities, concepts, and relationships in the field of education. The conceptual model mainly includes the following core components:

1.1 Entity layer

This is the foundation of the educational knowledge graph, which includes various specific entities in the field of education, such as disciplines, knowledge points, courses, educational institutions, teachers, students, etc. These entities are the fundamental units that make up the knowledge graph, and their relationships constitute the main framework of the graph.

1.2 Relationship layer

The relationship layer defines the relationships between entities, such as the inclusion relationship between disciplines and knowledge points, the association relationship between knowledge points, and the teacher-student relationship between teachers and students. These relationships constitute the main thread of the graph, reflecting the knowledge structure and logical relationships in the field of education.

1.3 Attribute layer

The attribute layer describes the attribute information of the entity, such as the difficulty level of the knowledge points, the learning requirements of the subject, the professional title of the teacher, the age of the students, etc. These attribute information provide a detailed description of entity features, which helps to gain a deeper understanding of the connotation and extension of entities.

2. The Relationship between the Theory of Educational Knowledge Graph and the Construction of Teaching Resources

Knowledge graphs have powerful semantic processing capabilities, providing knowledge services in an intuitive and structured presentation form. They can transform traditional course discourse learning (web interconnection) into learning about knowledge points and their interrelationships (knowledge interconnection), greatly improving learning efficiency and experience. Knowledge graphs can play an important supporting role in the three stages of resource generation, dissemination, and consumption in the construction of lifelong learning resource libraries.

Firstly, in the process of generating teaching resources, knowledge graphs can standardize semantic indexing of teaching resources in the resource library and establish relationships between resources. Resource builders can use this to clarify the current status of teaching resource construction in the resource library, generate teaching resources that are currently lacking in a targeted manner, and improve the completeness of knowledge in the resource library.

Secondly, in the process of resource dissemination, knowledge graphs are expected to break through the bottleneck of traditional resource recommendation and promote personalized supply of resources. The traditional learning resource recommendation methods mainly include content-based recommendation, collaborative filtering recommendation, and hybrid recommendation. However, the above three types of recommendation methods are only suitable for learning platforms with rich learning data, and the lifelong learning resource library often lacks complete user learning records, making it difficult to provide sufficient feature data for algorithm training, making it difficult to achieve personalized recommendation of the lifelong learning resource library. Therefore, the vast majority of lifelong learning resource libraries require manual resource classification and retrieval to obtain learning resources. However, the keywords retrieved by users greatly limit the scope of resource acquisition, and knowledge graph based recommendation technology can better solve the above problems.

Finally, in the resource consumption process, knowledge graphs can help lifelong learners understand the connection between learning resources and knowledge points by providing intelligent visualization of knowledge points, resource association recommendations, and other services, making learning more targeted and systematic.

3. Current Status of Construction and Application of Open Education Teaching Resources in China

The report of the 20th National Congress of the Communist Party of China proposed to promote the digitization of education and build a learning society and a learning country with lifelong learning for all. As of June 2023, the number of Internet users in China is 1.079 billion, and the Internet penetration rate is 76.4%, which makes online learning an important way to help the realization and innovative development of lifelong learning system. Open education, as an important component of China's lifelong education system, has become an important content and carrier of online learning for both academic and non academic education.

At present, China's open education has established a relatively complete learning resource platform and formed a large-scale teaching resource library. However, there are still significant problems in the overall construction and application of teaching resources, which are reflected in: (1) problems in resource construction. In the process of generating teaching resources, whether it is professional course resources or subject resources, the integration system and co construction and sharing mechanism are not sound. All types of teaching resources show characteristics of fragmentation, dispersion, and fragmentation. A large amount of teaching resources have not been timely and efficiently gathered, which to some extent leads to the repeated construction of many low-quality resources; (2) Problems in resource supply services. Firstly,In the process of resource transmission, resource recommendation and push services are not precise enough, making it difficult for learners to quickly, effectively, and conveniently access and obtain relevant teaching resources from a large amount of resources, resulting in the personalized learning needs of students not being met; Secondly, In the resource utilization stage, the types of resource services are single, with the vast majority concentrated and limited to various teaching resources such as text, courseware, audio and video, and cases. Learners obtain corresponding learning resources through course binding or retrieval; There are few diversified learning services such as learning recognition and resource association recommendation in resource utilization; (3) Problems in resource optimization. In the process of resource optimization, the lack of resource feedback services makes it difficult to verify the overall construction and application effectiveness of teaching resources, and make targeted improvements based on this.

There are two main reasons for analyzing these issues: firstly, the construction and application of existing teaching resources in the open education system. Although various links in resource supply services have been explored to a certain extent, a systematic and complete resource supply service system has not yet been formed, making it difficult to systematically integrate each link; Secondly, the construction of existing teaching resources is limited by factors such as technology and cost, and the role of modern educational and teaching technology is not fully utilized, resulting in low quality of resource supply and service in the generation, transmission, utilization, and optimization of resources. Therefore, fully utilizing appropriate modern educational and teaching technologies, integrating various links of teaching resource supply services, providing more comprehensive, intelligent, and convenient resource supply services, and ultimately building an open education teaching resource supply ecosystem, is of great significance for improving the quality of learning for learners.

4. A New Path for the Construction of Open Education Teaching Resources in China under the Background of Digital Education

4.1 Construction of teaching resources for professional courses

The construction of professional or course teaching resources should focus on the following

three aspects:

1. High quality construction of teaching resources for various types of majors and courses.

Create distance education teaching resources that are more suitable for students' self-directed learning, facilitate students' self-directed learning, and meet the learning needs of different students. Strengthen the overall teaching design of professional and course resources, starting from the knowledge level, learning needs, and learning characteristics of students, generate high-quality teaching resources, and integrate various types and diversified teaching resources such as text, pictures, audio and video, animation, textbooks, cases, courseware, exercises, and expansion materials to facilitate students to engage in self-directed and interesting learning, striving to meet the requirements of complete structure, strong practicality, and prominent focus, making it convenient for students to self-study and teachers to teach.

2. Pay attention to the infrastructure construction of related knowledge point resources.

In the process of constructing teaching resources, it is necessary to avoid the dispersion and fragmentation of knowledge points, and establish relationships between knowledge points, such as relationships between knowledge points, chapters, professional courses, and disciplines. For example, when listing a certain knowledge point, associate it with the leading and subsequent knowledge points, explain the relationship between the knowledge point and the leading and subsequent knowledge points, the position and role of the knowledge point in the relevant knowledge system, etc; For example, the correlation between knowledge points in chapters, courses, and disciplines also emphasizes the internal correlation and logical correspondence between this chapter and other chapters, this course and other courses in this major, and this major and other similar majors and disciplines. Through the construction of related knowledge point resources, the teaching resources of professional courses are designed and integrated in a comprehensive and systematic manner, establishing the curriculum foundation for the construction of knowledge graph resources.

3. Avoid redundant construction of various teaching resources.

Under the traditional model, the construction of open education teaching resources presents a decentralized characteristic in terms of knowledge points, chapters, courses, majors, and disciplines. During the construction process, each party acts independently, and teaching resources lack sharing, resulting in the repeated construction of various teaching resources and low utilization efficiency. Therefore, under the guidance of educational knowledge graph theory, various resource construction units participate in the process of resource co construction and sharing, view cross curriculum, cross professional, cross disciplinary knowledge graphs and corresponding resources in the resource library, understand the current situation of resource construction, judge which type of resources are scarce or of low quality, in order to determine the theme of resource development and improve the systematization of high-quality resource development and construction.

4.2 Construction of disciplinary knowledge graph resources

Based on the construction of professional course teaching resources, the construction of subject knowledge graph resources should be carried out from the following perspectives:

1. Taking knowledge interconnection as the leading ideology, focusing on the three elements of knowledge extraction, knowledge fusion, and knowledge reasoning, following cognitive load theory, semiotics theory, schema theory, multimedia learning generation theory, etc., based on the cognitive level of the learning object, developing simplified learning resources around core knowledge points through various representation forms such as images, text, and videos, and promoting the entry of key information into the cognitive system of learners. According to the classification theory of learning outcomes, determine the learning outcome categories of the resources to be developed and

the learning conditions required to achieve the learning outcomes. According to the development process of learning resources, resource construction and development are carried out in five stages: content selection and restructuring, teaching objective analysis, representation method selection and screen design, resource production and application, feedback and modification. Finally, after completing the development of resource content, it is necessary to standardize the resources according to the resource construction standards and specific platform requirements, in order to facilitate aggregation in the resource library.

2. Develop an intelligent question answering and recommendation system to enhance the efficiency of teaching resource transmission. On the one hand, building an intelligent question answering system for interdisciplinary knowledge in open fields can make up for the limitation of current intelligent question answering systems only targeting a certain subject or course, and provide lifelong learners with answers and clarification; On the other hand, developing an intelligent resource recommendation system to innovate and practice resource presentation and recommendation modes, reducing the problems of "information overload" and "knowledge loss" that lifelong learners face in the resource library, fundamentally improving resource utilization and learning efficiency.

3. Enhance the visualization of teaching resource associations, knowledge graphs behind resources, intelligent problems and recommendations, credit banks and other resource utilization and supply services. These intelligent services are free and open to learners, meeting their personalized, diversified, and generative learning needs. In addition, the utilization of teaching resources not only supports individual learning for learners, but also promotes their connection with other learners during the learning process, completing the identity transformation from individual learners to group learners. Therefore, the resource construction subject can use the learning behavior and survey results of learners as the decision-making basis, connecting them into a learning group.

4. The optimization of teaching resources is an important link in ensuring the high-quality development of open education teaching resources. Continuous evaluation of teaching resources is necessary to promote their healthy development. Firstly, collect and analyze diverse feedback information to provide a basis for optimizing and increasing teaching resources, and form positive feedback for teaching resource construction; Secondly, based on the analysis results, targeted optimization strategies for teaching resources should be formulated.

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