

Research on the Construction and Application of Knowledge Graph of Digital Resources in Vocational Colleges

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Abstract: With the development of digital education, colleges and universities are facing challenges in managing and utilizing digital resources. As an effective way of knowledge organization and representation, Knowledge graph can transform digital resources into structured entities, attributes and relationship forms, and provide personalized learning support and resource recommendation. By analyzing the characteristics, construction status and existing problems of digital resources in vocational colleges, this paper puts forward the overall plan and methods of digital resources knowledge graph construction, including data collection and sorting, knowledge graph construction, verification and optimization, and gives the general process design of knowledge graph construction; Then, this paper discusses the typical application scenarios of digital resources knowledge graph in vocational colleges, such as learning resource recommendation, path planning, teaching assistance and resource sharing; Finally, the challenges in this field, including data quality, knowledge graph updating and maintenance, privacy and security, are discussed, and the future trends and research directions are prospected. The research results are of great significance for promoting the informatization and intelligent development of vocational college education.

Keywords: vocational colleges, digital resources, knowledge graph, construction methods and processes

1 Introduction

Vocational colleges play an important role in cultivating skilled talents from various industries. With the rapid development of information technology and the popularization of the Internet, the position of digital resources in vocational education is becoming increasingly important [1]. Digital resources include various forms of learning materials such as e-books, instructional videos, online courses, and virtual laboratories, providing students with more flexible and diverse learning pathways. However, these large amounts of digital resources are often scattered across different platforms and systems, making it difficult to effectively access and utilize them [2]. In order to better organize, manage and use these digital resources, establishing a Knowledge graph of digital resources in vocational colleges has become an effective solution. This paper aims to explore the construction method and application of digital resources Knowledge graph in vocational colleges, so as to improve the organization and utilization efficiency of digital resources. By constructing the Knowledge graph of digital resources, the scattered digital resources can be integrated into a unified Knowledge graph, enabling students to find, recommend and obtain the required learning resources more conveniently. At the same time, the Knowledge graph of digital resources can also provide students with personalized learning path planning and career guidance, assist teachers in teaching and answering questions, and promote the construction and sharing of resources. By studying the construction of Knowledge graph of digital resources in vocational colleges, it can provide useful reference and guidance, and promote the informatization and intelligent development of vocational college education.

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2 Analysis of the Characteristics and Current Situation of Digital Resources in Vocational Colleges

2.1 Definition and Characteristics of Digital Resources in Vocational Colleges

Vocational college digital resources refer to various digital learning materials and tools provided to vocational college students, including course materials, multimedia teaching resources, online learning platforms, etc [3]. Digital resources in vocational colleges have practicality and career orientation, emphasizing the cultivation and application of practical skills, which are closely related to students' career development. Through analysis, it has the following characteristics:

(1) Diversity: There are various types of digital resources, including textbooks, course materials, experimental data, teaching videos, and other forms of learning and educational resources.

(2) Practicality: Digital resources are oriented towards practice and application, closely related to professional skills and industry needs. These resources focus on practicality and practical operation, helping students acquire vocational skills and professional knowledge.

(3) Frequent updates: Due to the rapid development of the industry and continuous technological updates, the digital resources of vocational colleges need to be updated in a timely manner to keep pace with industry trends and the latest knowledge.

(4) Discipline specialization: Digital resources mainly revolve around specific subject areas, such as computer science, railway engineering, mechanical engineering, marketing, etc. These resources are more specialized and related to the knowledge system and skill requirements of the discipline.

(5) Personalized needs of students: The student population in vocational colleges is diverse, with different learning backgrounds, interests, and goals. Therefore, digital resources need to meet students' personalized learning needs, provide personalized learning support and resource recommendations.

(6) Teacher teaching assistance: Teachers in universities need to utilize digital resources to assist teaching activities, including course design, teaching guidance, evaluation, and feedback. Digital resources need to provide teachers with rich teaching tools and resources.

(7) Management and distribution challenges: The management and distribution of digital resources in vocational colleges is a complex task. Resources need to be classified, stored, and maintained, and efficiently distributed to students and teachers when needed. At the same time, copyright and permission management of resources is also an important consideration.

2.2 The Concept and Application of Digital Resource Knowledge Graph

Digital resource knowledge graph is a method of organizing and representing digital resources by using knowledge graph technology, which is presented in the form of entities, attributes and relationships. Knowledge graphing can help understand and discover the relevance between digital resources, and provide more intelligent and personalized learning and recommendation services. In many fields, such as medicine and finance, the knowledge graph of digital resources has been widely used and has achieved remarkable results.

2.3 Relevant Research Status and Existing Problems

At present, the research on the knowledge graph of digital resources in vocational colleges is relatively small and still in its infancy. Some researches focus on the classification and sorting methods of digital resources, such as entity recognition and attribute extraction based on text mining and natural language processing technology. Other studies explore the application of digital resource knowledge graphs in learning resource recommendation, intelligent question answering, etc., but there are still problems such as inaccurate knowledge representation, imperfect relationship modeling, etc. In addition, the privacy and security issues of the knowledge graph of digital resources in vocational colleges are also worthy of attention to ensure that students' personal information and learning data are properly protected.

To sum up, the current research has not yet fully tapped and applied the potential of the digital resource knowledge graph of vocational colleges, and there are still a series of challenges and problems to be solved [4]. Therefore, this paper aims to explore the construction method and application of the knowledge graph of digital

resources in vocational colleges, so as to improve the organization and utilization efficiency of digital resources, and promote the informatization and intelligent development of vocational college education.

3 The Construction Method and Process Design of Digital Resource Knowledge Graph in Vocational Colleges

3.1 Method of Constructing Knowledge Graph of Digital Resources

According to the analysis of the characteristics of digital resources, the construction scheme of general digital resource knowledge graph includes three parts: digital resource collection and sorting, knowledge graph construction, knowledge graph verification and optimization. The overall scheme of digital resource knowledge graph construction in vocational colleges is shown in Fig. 1.

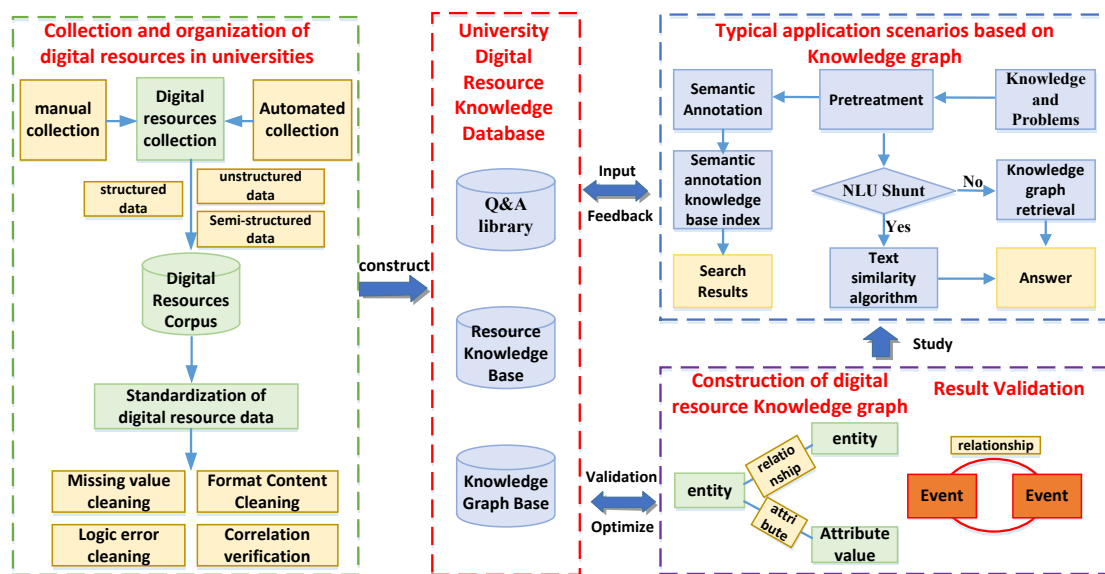


Fig. 1. The overall plan for the construction of digital resource knowledge graph in vocational colleges

(1) Collection and sorting of digital resources. First, carry out the classification and screening of digital resources, clarify that the collection objects of digital resources mainly include curriculum materials, learning materials, practice cases, multimedia teaching resources, online learning platforms and other relevant digital resources, screen according to needs and importance, and label digital resources according to different classifications and themes; Then clean and de duplicate the digital resources according to the demand, delete the redundant content, and complete the incomplete data, so as to realize the cleaning and de duplication of digital resources and provide a good data basis for the construction of knowledge graph.

(2) Construction of digital resource knowledge graph. To establish a corpus of digital resources in vocational colleges and build a knowledge graph based on the collation of digital resources, first of all, entity recognition and attribute extraction should be carried out. Natural language processing and text mining technologies should be used to identify entities in digital resources, such as courses, textbooks, authors, etc., and extract their relevant attribute information; Secondly, modeling and connecting the relationship between entities. Establish a relationship map based on the relationship between analysis entities. For example, the relationship between courses and textbooks can be modeled as “teaching”, “using”, etc., and the connection relationship can be established through the attribute information of associated entities.

(3) Knowledge graph verification and optimization. To ensure the quality and accuracy of the knowledge graph, the knowledge graph should be evaluated and iterated. Evaluate the quality of the knowledge graph, eval-

uate the quality of the constructed knowledge graph, and check the accuracy and integrity of entities, attributes and relationships; The knowledge graph is optimized iteratively. According to the evaluation results and user feedback, the knowledge graph is optimized iteratively, errors and omissions are corrected, and new entities and relationships are added.

Through the construction method of knowledge graph, the knowledge graph of digital resources in vocational colleges can be gradually constructed. The data collection and collation phase ensures the effective acquisition and accuracy of digital resources. The knowledge graph construction phase converts digital resources into entities, attributes and relationships. Finally, the quality and availability of the knowledge graph are ensured through verification and optimization.

3.2 Construction Process of Digital Resource Knowledge Graph

According to the construction method of digital resource knowledge graph, combined with the teaching characteristics of vocational colleges and the needs of digital resource management [5], the general process of knowledge graph construction is given:

(1) Demand analysis: understand the teaching characteristics and digital resource management needs of vocational colleges. Communicate with teachers, students and managers to determine the objectives and application scenarios of knowledge graphing, identify the entities, attributes and relationships that need to be collected and represented, and establish a digital resource corpus.

(2) Data collection and sorting: collect digital resource data related to vocational colleges, including course materials, textbooks, student information, etc. Clean, de duplicate and standardize data to ensure data consistency and quality.

(3) Entity recognition and attribute extraction: use natural language processing technology and domain expertise to identify entities and key attributes in digital resources. For example, identify the course name, student specialty, teacher name and other entities and their corresponding attributes.

(4) Relation extraction and modeling: extract the relations and dependencies between entities through text analysis and semantic reasoning. For example, the relationship between courses and disciplines, the relationship between students and courses, etc. The entities and relationships are represented in the form of graphs to establish the structure of the knowledge graph.

(5) Knowledge graph construction and storage: according to the previous entities, attributes and relationships, build the nodes and edges of the knowledge graph, select the appropriate map database or knowledge graph modeling tool, and store and manage the knowledge graph data. Select appropriate technology and architecture based on the data scale and query performance requirements of vocational colleges.

(6) Verification and optimization of knowledge graph: verify and evaluate the constructed knowledge graph, check the accuracy and integrity of entities, attributes and relationships, conduct expert verification and automated inspection, and optimize and improve according to feedback and actual needs.

(7) Application development and integration: develop application programs or systems based on knowledge graphs to meet the needs of vocational college teaching and learning. For example, build personalized learning recommendation systems, learning path planning tools, etc., and use knowledge graphs to provide intelligent learning support and resource management.

(8) Continuous updating and maintenance: as time goes by, new digital resource data will be collected continuously and added to the knowledge graph. Update and maintain the knowledge graph according to new requirements and feedback, and maintain its timeliness and availability.

In the actual construction process, each vocational college can adjust and expand appropriately according to the specific situation and resource characteristics. The process design provides a basic framework to guide the construction process of the knowledge graph of digital resources of vocational colleges.

4 Application of Digital Resource Knowledge Graph in Vocational Colleges

Knowledge graph is widely used in many fields. This paper gives several typical application scenarios of knowledge graph according to the characteristics of digital resources and teaching scenarios in vocational colleges.

4.1 Recommendation of Learning Resources

Based on the knowledge graph of digital resources in vocational colleges, personalized learning resources can be recommended according to students' interests, learning needs and career goals to provide more accurate learning support and guidance. Using the entity and relationship information in the knowledge graph, we can recommend suitable courses, textbooks, learning tools, etc. according to the current learning status and the knowledge that students have mastered.

4.2 Path Planning and Career Orientation

Based on the knowledge graph of digital resources in vocational colleges, it can provide students with support for learning path planning and career orientation. By analyzing the relationship and attribute information in the knowledge graph, we can provide students with the prerequisite relationship and learning roadmap of relevant courses, and help them better plan their learning process and career development direction.

4.3 Teaching Assistance and Intelligent Question and Answer

The knowledge graph of digital resources in vocational colleges can be used for the development of teaching assistance and intelligent question and answer systems. Based on the knowledge graph, an intelligent question and answer system can be built to help students answer questions and provide learning guidance and feedback. Similarly, teachers can use the resource relationship and attribute information in the knowledge graph to provide more accurate teaching auxiliary materials and cases to enhance the teaching effect.

4.4 Resource Sharing and Cooperation

The knowledge graph of digital resources in vocational colleges can promote the sharing and cooperation of resources. Schools and teachers can add their own digital resources to the knowledge graph, share resources with other schools and teachers, and provide a wider range of learning resources for students to use. At the same time, students and teachers can also cooperate and exchange through the knowledge graph platform to jointly develop, share and improve digital resources. The application of digital resource knowledge graph in vocational colleges can provide personalized learning resource recommendation, help students plan learning paths and career development, assist teaching and intelligent Q&A, promote resource sharing and cooperation, and provide more intelligent and efficient support and services for vocational college education.

5 Challenges and Prospects

5.1 Data Quality and Integrity Issues

The construction of digital resource knowledge graph in vocational colleges requires a large amount of data, but the quality and integrity of data is a key challenge. In the process of data collection, there may be problems such as missing data and wrong labeling, which affect the accuracy and availability of the knowledge graph. To solve this problem, we need to strengthen data quality control and cleaning strategies to ensure the accuracy and consistency of data.

5.2 Updating and Maintenance of Knowledge Graph

Digital resources in vocational colleges are a dynamic field, and learning resources are constantly updated and evolving. Therefore, the knowledge graph needs to be updated and maintained in time to keep pace with the actual resources. Establish an effective updating mechanism and maintenance strategy to ensure the timeliness and sustainability of the knowledge graph.

5.3 Privacy and Security Issues

The construction of digital resource knowledge graph in vocational colleges involves a large number of students' personal information and learning data. Privacy protection and data security have become important issues. Establish a strict data privacy protection mechanism to ensure the security and compliance of students' personal information and prevent data leakage and abuse.

5.4 Future Development Trend and Research Direction

In the future, there is still much room for the research and application of digital resource knowledge graph in vocational colleges. It can further deepen the construction technology of knowledge graph, including entity recognition, relationship extraction, semantic representation and other research, and improve the quality and effect of knowledge graph. Combining artificial intelligence and machine learning technology, develop intelligent learning recommendation systems and teaching aids to provide personalized and intelligent learning support. Explore the integration of knowledge graph and other educational technology means, such as virtual reality, augmented reality, etc., to provide richer and diversified learning experiences and interaction methods.

To sum up, the construction of digital resource knowledge graph in vocational colleges is facing challenges such as data quality, knowledge graph updating and maintenance, privacy and security, but also has broad prospects for development. Future research directions include improving the construction technology of knowledge graphs, developing intelligent learning recommendation systems and teaching aids, and exploring knowledge graphs and other education.

6 Conclusion

At present, the research on the knowledge graph of digital resources in vocational colleges is still in its infancy, and the related research is relatively few. The construction of the knowledge graph of digital resources in vocational colleges is of great significance, which can improve the efficiency of organization and utilization of digital resources and promote the informatization and intelligent development of vocational education. This paper analyzes the characteristics and current situation of digital resources in vocational colleges, analyzes the current situation and existing problems of related research, and on this basis, puts forward the construction method of knowledge graph of digital resources in vocational colleges, including data collection and sorting, knowledge graph construction, knowledge graph verification and optimization, and gives the process design of knowledge graph construction; The typical application scenarios of digital resource knowledge graph in vocational colleges are given, including learning resource recommendation, path planning and career guidance, teaching assistance and intelligent question and answer, resource sharing and cooperation, etc; Finally, it points out that in the process of building the knowledge graph of digital resources in vocational colleges, there are still challenges such as data quality, updating and maintenance of the knowledge graph, privacy and security. It also gives the future development trend of this research field, including deepening the construction technology of the knowledge graph, developing intelligent learning recommendation systems and teaching aids, and exploring the integration of the knowledge graph with other educational technology means, It can provide more intelligent and personalized support and services for vocational college education, and promote the development and progress of vocational education.

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