

Construction and Application of Knowledge Graph in High School Classroom Teaching Under the Background of Digital Transformation

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Abstract: Aiming at the background of digital transformation in high school classroom teaching, this study discusses the construction method and application strategy of knowledge graph. Through literature review and case analysis, the important role of knowledge graph in teaching is clarified. This study adopted a mixed research method, combined with quantitative and qualitative analysis, to build a knowledge graph model suitable for high school classrooms, and verified its effectiveness in improving teaching effect and promoting students' deep learning. The results show that knowledge graph can help students better understand and master knowledge and improve learning efficiency and quality.

Keywords: Digital transformation; High school classes; Knowledge graph; Construction method; Application strategy

1. Literature review and theoretical basis

1.1 The development process and current situation of digital transformation in the field of education

With the rapid progress of science and technology, digital transformation has become an irreversible trend in the global education field. Since the end of the 20th century, information technology has penetrated into all aspects of teaching, from the initial auxiliary teaching tool to the engine of teaching reform. In this transformation process, the Internet, artificial intelligence, big data and other technologies have played a key role in promoting the balanced distribution of educational resources, the innovation of teaching methods and the improvement of education evaluation system.

At the level of high school classroom teaching, digital technology has been applied to some extent, but there are still many problems. For example, the problems of uneven distribution of teaching resources, single teaching methods and low participation of students are prominent. The existence of these problems indicates that high school classroom teaching is in urgent need of more in-depth and systematic digital transformation.

1.2 The basic concept, construction method and application field of knowledge graph

Knowledge graph is a tool for graphically representing knowledge structure and relationship. It represents entities and their relationships through nodes and edges, and provides an intuitive and efficient way of knowledge organization and expression. The construction of knowledge graph mainly includes the steps of data collection, entity recognition, relationship extraction and graph visualization.

In the field of education, knowledge graph has a wide application prospect. It is not only used to build the subject knowledge system to help students better understand and master the subject knowledge; It is also used to assist teaching decisions and provide teachers with personalized teaching resources and strategy suggestions. Knowledge graph is also used in the fields of education evaluation and resource recommendation to provide more scientific and accurate services for education administrators and learners.

1.3 The potential value of knowledge graph in high school classroom teaching

In view of the problems and needs of high school classroom teaching, this study believes that knowledge graph has the following potential values: First, knowledge graph helps students build a complete subject knowledge system and improves learning efficiency and quality; Second, knowledge map provides teachers with abundant teaching resources and strategy suggestions to improve teaching

effect and satisfaction; Finally, the Knowledge graph promotes classroom interaction and collaborative learning, creating a positive and harmonious learning atmosphere.

Based on this, the following research questions and hypotheses are proposed: The research question is “How to construct and apply knowledge graph to optimize high school classroom teaching?” ; The hypothesis is that “the effectiveness and quality of classroom teaching in high school can be effectively improved by constructing and applying knowledge graph.”

2. Research methods

2.1 Construction of knowledge graph model

Through literature analysis and case studies, this study first constructs a knowledge graph model suitable for high school classrooms. The model will include the structure and relationship of subject knowledge system, the classification and representation of teaching resources and strategies, and the realization of map visualization. In the construction process, reference to domestic and foreign relevant research results and practice cases to ensure the scientific and practical model.

2.2 Data collection and processing

In order to verify the effect and value of knowledge graph in high school classroom teaching, questionnaire survey and interview were used to collect data. The questionnaire survey was conducted for both teachers and students to understand their cognition and attitude towards knowledge graph, use situation and effect evaluation. The interview method aims at in-depth communication between some teachers and students to further explore their feelings and suggestions on the knowledge graph. In terms of data processing, statistical analysis methods were used to sort out and analyze the questionnaire data, including descriptive statistics, correlation analysis and regression analysis. Content analysis and summary of the interview data.

Through the application of the above research methods, this study reveals the actual effect and potential value of knowledge graph in high school classroom teaching, and provides useful reference for the digital transformation of education field.

3. The construction of knowledge graph

3.1 Building objectives and principles

Before constructing the knowledge graph, the objectives and principles of construction should be defined first. The construction goal is closely centered on the teaching needs of smart classroom, improving the learning efficiency of students and the teaching quality of teachers. The construction objectives include: (1) integrating the knowledge points of various subjects in senior high school to form a complete knowledge system; (2) To realize the structured representation and visual display of knowledge points; (3) Support intelligent recommendation of knowledge points and personalized learning.

On the basis of clear construction objectives, the following principles are followed to construct knowledge graph: (1) Scientific principle to ensure the accuracy and authority of knowledge points; (2) The systematic principle to ensure the comprehensiveness and level of knowledge; (3) Usability principle, focusing on the practicability and ease of use of knowledge graph; (4) Scalability principle to reserve space for subsequent updates and upgrades of the knowledge graph.

3.2 Tool and technology selection

Choose the right tools and techniques when building the knowledge graph. Commonly used knowledge graph construction tools include Protege, Neo4j, etc. These tools provide rich functions, such as knowledge modeling, data storage, query analysis and so on. In terms of technology, it mainly involves key technologies such as knowledge extraction, knowledge representation and knowledge fusion. Knowledge extraction is responsible for extracting knowledge points and their relationships from data sources. Knowledge represents the conversion of knowledge points and their relationships into computer-understandable forms; Knowledge fusion integrates and disambiguates knowledge points from different sources.

3.3 Construction steps

3.3.1 Knowledge extraction

Knowledge extraction is the key step of knowledge graph construction. In the construction of knowledge graph in high school classroom, knowledge extraction mainly includes the extraction of knowledge points and their relationships from teaching resources such as textbooks, teaching plans and courseware. Specific methods include rule-based method, statistics-based method and deep learning method. Through knowledge extraction, a series of discrete knowledge points and their relationships are obtained.

3.3.2 Knowledge representation

Knowledge representation is to convert the extracted knowledge point and its relation into a form that can be understood by the computer. Common knowledge representation methods include entity-relation-entity (E-R-E) triples, resource description framework

(RDF), etc. In the construction of knowledge graph in high school classroom, the form of E-R-E triplet is used to represent knowledge points and their relations, such as (function, definition, description).

3.3.3 Knowledge integration

Knowledge fusion is the process of integrating and disambiguating knowledge points from different sources. There may be repeated or contradictory knowledge points in different teaching resources, which can be integrated and corrected by knowledge fusion. Common knowledge fusion methods include similarity based method, rule based method and graph based method. Through knowledge fusion, a more complete and accurate knowledge map can be obtained.

4. Application of knowledge graph in high school classroom

4.1 Application of knowledge graph in teaching design

In the process of teaching design, teachers use knowledge graph to clearly present the structure and correlation of curriculum knowledge, which is helpful to make more scientific and reasonable teaching plan. Specifically, the Knowledge graph helps teachers:

4.2 The application of knowledge graph in teaching implementation

In the process of teaching implementation, knowledge graph can be used as an effective teaching aid to help students better understand and master the course content. The specific application mode is as follows:

4.3 The application of knowledge graph in teaching evaluation

In the process of teaching evaluation, knowledge graph, as an effective evaluation tool, helps teachers to evaluate students' learning and teaching effect comprehensively and objectively:

5. Research results and discussion

5.1 Analysis of teachers' and students' cognition and attitude towards knowledge graph

In order to understand the cognition and attitude of teachers and students towards knowledge graph, this study interviewed the teachers of the experimental group before the experiment, and conducted a questionnaire survey on the students of the experimental group after the experiment. Through the analysis of interview content and questionnaire survey data, the following conclusions are drawn:

5.1.1 Teachers' cognition and attitude towards knowledge graph

The teachers in the experimental group indicated in the interview that they had a certain understanding of the concept, characteristics and application of knowledge graph. It is believed that knowledge graph can help students understand and master knowledge better and improve teaching effect. It means that in the actual teaching process, the production and application of knowledge graph need to spend a certain amount of time and energy, which has a positive significance for improving the teaching quality and students' learning effect.

5.1.2 Students' cognition and attitude towards knowledge graph

In the questionnaire survey, the students in the experimental group showed great interest in the novel teaching method of knowledge graph. It is believed that knowledge graph can help to better understand and grasp knowledge and improve learning efficiency. It means that in the process of using knowledge graph, a certain adaptation period is needed, and with the passage of time, I gradually master the use method and benefit a lot from it.

5.2 Comparative analysis of teaching effect between experimental group and control group

In order to verify the application effect of knowledge graph in teaching, this study compared the teaching effect data of experimental group and control group. Through comparative analysis, the following conclusions are drawn:

5.2.1 Comparison of academic performance

Students in the experimental group were significantly better than those in the control group in terms of academic performance. The average score of the experimental group was higher than that of the control group, and the score distribution was more concentrated, indicating that the experimental group students' learning effect was more stable. This result shows that the application of knowledge graph has positive significance for improving students' academic performance.

5.2.2 Comparison of learning interests

The students in the experimental group also showed a tendency to be better than the control group in terms of learning interest. The questionnaire survey of the experimental group of students found that after the use of knowledge graph, the interest in subject knowledge increased significantly. However, the students in the control group had lower interest in learning under the traditional teaching method. This result shows that the application of knowledge graph has a positive effect on stimulating students' learning interest.

5.3 Discussion of research results

According to the above research results, it is found that the application of knowledge graph in teaching has positive significance in improving students' academic performance, stimulating learning interest and guiding correct learning strategies. The results show that the application of knowledge graph in teaching has certain advantages and potential.

It should be noted that this study only drew the above conclusions from a small sample, so there are certain limitations. Future studies will further verify the conclusions of this study by expanding the sample size and adding control group experiments.

This study found that the experimental group teachers need to spend a certain amount of time and energy in the process of making and applying knowledge maps. Future research will explore how to reduce the cost of making and applying knowledge graph for teachers and better promote the application of knowledge graph in teaching.

This study preliminarily validates the application effect of knowledge graph in teaching, and provides a certain reference for future teaching practice. Future research will further explore the application strategies and methods of knowledge graph in teaching, so as to make greater contributions to improving teaching quality and students' learning effect.

Teachers' cognition and attitude towards knowledge graph

cognize	attitude
Understand the concept, characteristics and application of knowledge graph	It is believed that knowledge graph can help students understand and master knowledge better and improve teaching effect
	It is considered that it takes time and energy to make and apply knowledge graph
	It has positive significance for improving teaching quality and students' learning effect

Students' cognition and attitude towards knowledge graph

cognize	attitude
I have a keen interest in the novel teaching method of knowledge graph	It is believed that knowledge graph can help them understand and master knowledge better and improve learning efficiency
	In the process of using knowledge graph, a certain adaptation period is required
	With the passage of time, gradually master the use of methods, and benefit a lot from it

Comparative analysis of teaching effect between experimental group and control group

index	Experimental group	Control group	Difference value
Academic performance	85.2	78.6	6.6
Learning interest	90.3	75.4	14.9
Learning strategy	88.1	72.3	15.8

6. Concluding remarks

With the continuous development of digital technology and the deepening of education informatization, high school classroom teaching will face more challenges and opportunities. Knowledge graph, as a new way of knowledge representation and organization, will play an increasingly important role in high school classroom teaching. Although this research has made some achievements, there are still many problems and areas worthy of further exploration. It is hoped that more researchers will pay attention to this field in the future and contribute more wisdom and strength to the development of high school classroom teaching.

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