Knowledge Graph Driven Research on Teaching Practice of Interdisciplinary Curriculum: Taking Meteorological Tourism Course as an Example

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Abstract. To address the issues of fragmented knowledge, disciplinary isolation, and poor teaching effectiveness in traditional meteorological tourism courses, this study explores a curriculum construction and teaching reform path driven by knowledge graphs. The research first analyzes the technical principles of knowledge graphs and constructs a theoretical framework for the course based on the multidimensional associations of experience, selection, and safety between meteorology and tourism. It then designs a knowledge graph with three layers of basic layer, correlation layer, and application layer to integrate core meteorological knowledge, tourism resource classification, and industrial practice content. Finally, relying on the knowledge graph, the study optimizes curriculum modules, introduces diverse resources, and innovates interactive and personalized teaching methods. Practice shows that this design can effectively integrate knowledge, lower the threshold for under-standing, and stimulate students learning initiative, providing theoretical references and practical paradigms for cultivating interdisciplinary talents in meteorological tourism and reforming interdisciplinary courses.

Keywords: Meteorological Tourism; Knowledge Graph; Curriculum Design

1 Introduction

In the era of cultural and tourism consumption upgrading and new liberal arts construction, meteorological tourism as an interdisciplinary course integrating knowledge from meteorology, tourism management, geography, and other fields is becoming an important bridge connecting the application of natural sciences with the development of cultural and tourism industries. Meteorological elements have upgraded from auxiliary influencing factors to core driving factors fully penetrating the entire chain of tourism destination selection, itinerary experience optimization, and safety risk management.

However, universities have long faced three major structural difficulties in the implementation of related courses. Firstly, the problem of fragmented knowledge systems

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is prominent with separate meteorological and tourism modules lacking organic connection. Secondly, the limitation of single teaching methods is obvious with abstract concepts lacking visual presentation. Thirdly, the problem of superficial interdisciplinary integration is significant, making it difficult to support complex problem solving.

Knowledge graphs, as a fundamental technology for knowledge organization and management in the field of artificial intelligence, have demonstrated significant advantages in curriculum reform of science and engineering disciplines through their structured representation in the form of nodes, edges, and attributes as well as their powerful knowledge reasoning capability [1]. However, the application of knowledge graphs shows obvious disciplinary bias and there has not yet been systematic research on applying knowledge graphs to meteorological tourism courses. This research gap has led to the lack of mature theoretical guidance and existing practical paradigms, urgently requiring the construction of a teaching reform plan adapted to the characteristics of interdisciplinary courses.

2 Knowledge Graph Driven Theoretical Framework of Meteorological Tourism Course

2.1 Concepts and Technical Principles of Knowledge Graph

Knowledge graph is a fundamental technology in the field of artificial intelligence for knowledge organization and management. Its essence is to transform scattered knowledge units into a visual and inferable semantic network through the triplet structure of nodes edges and attributes [2]. This structured representation can intuitively present the logical associations between knowledge and solve the problems of fragmentation and isolation in traditional knowledge storage.

The construction of knowledge graph follows three primary steps adapted to the characteristics of meteorological tourism. The first step is data collection and pre-processing which gathers structured and unstructured data from meteorological and tourism fields followed by data cleaning entity recognition and relationship extraction. The second step is graph representation and storage. An ontology model for the meteorological tourism field is constructed to clarify the hierarchical relationships of primary concepts such as meteorological elements tourism resources and disaster risks [3]. Storage is then realized through a graph database to support efficient knowledge query and association analysis. The third step is knowledge reasoning and updating which mines implicit associations using rule reasoning or machine learning algorithms and updates association weights based on tourist behavior data.

At the level of knowledge association between meteorology and tourism the knowledge graph builds a systematic relationship framework through a dual layer structure of concept layer and instance layer. In the concept layer primary association logics such as meteorological elements affecting tourism experience climate types adapting to tourism activities and meteorological disasters threatening tourism safety are clarified. In the instance layer specific entities are linked to form concrete associations. This layered framework helps students master general laws of meteor-ology and tourism and understand their practical applications providing clear theoretical guidance for course design.

2.2 Multidimensional Associations between Meteorology and Tourism

Meteorological conditions run through the whole process of tourism activities and form stable connections with tourism development. These connections can be observed and summarized from three dimensions: tourism experience, destination selection, and tourism safety.

Meteorological elements provide direct support for the comfort of tourism activities. Temperature, humidity, precipitation, wind speed, visibility, and ultraviolet radiation affect physical feelings of tourists, viewing effects of landscapes, and feasibility of outdoor activities. Suitable meteorological conditions help to improve experience quality and satisfaction, while unsuitable conditions will restrict the development of tourism projects and reduce activity comfort.

Meteorological and climatic characteristics provide important references for destination selection and tourism decision-making. Regional differences in climate shape the seasonal attributes of tourist destinations and form unique tourism products. Natural meteorological landscapes such as cloud seas, ice and snow, rime, and mirage have strong periodic distribution characteristics. Cultural resources related to climate and meteorology also enrich the attractiveness of destinations. These factors jointly affect the choice of travel time, destination, and activity mode.

Meteorological conditions are closely related to tourism safety risks. Sudden meteorological disasters may bring threats to scenic spot operation, tourist personal safety, and economic benefits. Different types of disasters have obvious regional and seasonal characteristics, and their impact scope and risk intensity are different (Table 1). Clarifying these connections helps to identify risk points in advance and carry out safety management and emergency response in a targeted manner.

Table 1. Meteorological Disaster Types and Response Measures

Meteorological Disaster Type	Risk Level	Main Impact Scope	Response Measures
Heavy rain	High	Mountain and canyon scenic areas	Advance 24-hour warning, evacuate tourists, close water-related projects, check geological disaster hazards
Thunder and lightning	Medium-high	Plateau and mountain scenic areas	Install lightning monitoring devices, delineate shelter areas, suspend high-altitude projects in the afternoon
Typhoon	High	Coastal and island scenic areas	Close scenic areas above orange warning, transfer coastal tourists, reinforce tourism facilities
High temperature	Medium	Plain and urban scenic areas	Issue high-temperature warnings, adjust scenic opening hours, avoid noon periods, add shading facilities and water points

2.3 Application Value of Knowledge Graph in Meteorological Tourism Course Design

Knowledge graph, with its four primary advantages of structured knowledge organization, personalized knowledge push, cross disciplinary knowledge association, and visual knowledge presentation, can provide breakthrough support for meteorological tourism course design from the three dimensions of teaching content, teaching methods, and ability cultivation[4].

Knowledge graph can integrate fragmented knowledge and build a systematic course knowledge system. Meteorological tourism course knowledge has the characteristics of being cross disciplinary and multi dimensional. Traditional teaching often suffers from the separation of meteorological knowledge and tourism knowledge and the dispersion of knowledge points without association. Knowledge graph can integrate fragmented knowledge from meteorology, tourism, and management into a systematic network through the structure of primary concepts as nodes and logical relationships as edges.

Knowledge graph helps achieve personalized learning and adapts to the learning needs of different students. Learners of meteorological tourism courses may have large differences in disciplinary foundations and different learning goals. Knowledge graph can meet differentiated needs through personalized push driven by learning data.

Knowledge graph can strengthen cross disciplinary integration and cultivate students comprehensive analysis ability. Meteorological tourism as an interdisciplinary course requires students to have the comprehensive ability to analyze tourism problems from a meteorological perspective and apply meteorological knowledge from a tourism perspective.

Knowledge graph also plays an important role in optimizing teaching presentation forms and enhancing course teaching effectiveness [5]. The visualization advantage of knowledge graph can effectively improve this teaching limitation and enhance the overall teaching experience.

3 Knowledge Graph Driven Teaching Reform in Meteorological Tourism Course

3.1 Construction and Design of Meteorological Tourism Knowledge Graph

The construction of the meteorological tourism knowledge graph centers on knowledge association between meteorology and tourism, and follows the three-layer architecture of basic layer, correlation layer, and application layer. It integrates multi-dimensional knowledge content and provides structured knowledge support for course teaching.

The basic layer serves as the underlying support of the knowledge graph, and is used to establish a standardized and complete framework for meteorological and tourism resource knowledge. The meteorological foundation module covers definitions, measurement standards, calculation methods and expression forms of key meteorological elements including temperature, humidity, wind speed, precipitation, visibility, ultraviolet intensity and meteorological comfort index, forming the fundamental knowledge nodes of the course. In the tourism resources module, meteorological tourism resources are divided into natural meteorological tourism resources and humanistic meteorological tourism resources based on resource attributes and formation mechanisms. Each resource node is labeled with attribute information such as regional distribution, suitable seasons and viewing conditions, which supports knowledge association in upper layers.

The correlation layer connects key elements between meteorology and tourism to build a multi-dimensional knowledge mapping system. It sets up mapping between meteorological elements and tourism experience, explains how meteorological conditions influence tourist comfort, landscape appreciation and activity development, matches climate types with tourism destinations, and forms association rules between regional climate features and seasonal tourism products. This layer also analyzes links between meteorological disasters and tourism safety risks, identifies risk levels, impact scopes, early warning indicators and triggering conditions of different disasters, and connects them with scenic types, tourist groups and emergency response measures to present risk knowledge in a structured way.

The application layer extends from the correlation layer to practical operation and industrial development of meteorological tourism, enriching application scenarios of the knowledge graph. It includes modules of meteorological tourism product development, tourism route planning based on meteorological conditions, tourism safety early warning and management, and industrial operation. Practical knowledge including destination planning, product design, risk prevention and control, and operation management is combined with real cases, field survey data and industrial policies. Meanwhile, the application layer supports knowledge reasoning and intelligent recommendation. Based on knowledge and rules from lower layers, it can recommend suitable tourism products, safety tips and planning schemes for specific regions and groups, and provide intelligent support for solving practical problems in meteorological tourism.

In addition, the construction of the meteorological tourism knowledge graph follows a complete technical path: structured and unstructured data in meteorology and tourism are collected and processed through data cleaning, entity extraction and relationship labeling; an ontology model is built to define key entities, relationships and attributes, forming a standardized conceptual system; knowledge triples are stored in a graph database to support efficient query, correlation analysis and visual display; implicit knowledge is mined through rule reasoning and machine learning, and the knowledge graph is updated regularly with industrial data and teaching feedback to maintain timeliness and effectiveness.

3.2 Curriculum Optimization and Teaching Innovation Based on Knowledge Graph

Supported by the three-layer architecture of the meteorological tourism knowledge graph, a teaching system oriented to scenario application and ability development is constructed from four dimensions: content reorganization, resource expansion, method innovation, and assessment optimization.

In curriculum content reorganization, teaching content is restructured into a modular and progressive system. Course knowledge is integrated into modules corresponding to the graph layers, so that learning progresses from basic concepts to relational understanding and then to practical application. The arrangement helps learners establish complete cognitive logic and promotes the connection and integration of interdisciplinary knowledge.

In teaching resource expansion, a diversified resource system is built around the module nodes of the knowledge graph. It includes a case library of typical meteorological tourism destinations, field survey materials for practical observation, and a multimedia resource matrix for auxiliary teaching. Rich real cases and practical materials are provided to support situational teaching and case analysis, so as to narrow the gap between classroom learning and industrial practice.

In teaching method and tool innovation, a teaching platform embedded with knowledge graph is developed, which supports knowledge query, scenario simulation and homework feedback. Hierarchical teaching arrangements are adopted to set differentiated learning tasks for learners. Problem-oriented collaborative learning is carried out through group discussion and presentation, so as to improve classroom interaction and independent inquiry ability.

In assessment and evaluation optimization, a diversified assessment system is established to combine process performance, final learning results and comprehensive application ability. The system focuses on the whole learning process including classroom performance, practical operation and task completion, and combines knowledge mastery inspection with comprehensive ability inspection. It can reflect learning effects comprehensively and guide learners to improve interdisciplinary thinking and problem-solving ability.

4 Conclusions

This study addresses the problems of fragmented knowledge disciplinary isolation and unsatisfactory teaching effectiveness in traditional meteorological tourism courses through systematic exploration of curriculum construction and teaching reform driven by knowledge graph. The research has completed analysis of knowledge graph technical principles construction of course theoretical framework design of three level knowledge graph optimization of curriculum modules and innovation of teaching methods.

This research has constructed a theoretical framework and a three layer knowledge graph of basic layer correlation layer and application layer suitable for meteorological tourism courses. It effectively integrates meteorological knowledge tourism resource classification and industrial practice content. The theoretical framework is based on multidimensional associations of experience selection and safety between meteorology and tourism.

Relying on the knowledge graph a modular curriculum system diversified teaching resources and interactive personalized teaching models have been optimized achieving effective implementation of teaching practice. The knowledge graph driven course design has produced remarkable results. It can effectively reduce the understanding threshold of abstract knowledge stimulate students learning initiative and significantly enhance students cross disciplinary knowledge integration ability and practical application ability. At the same time this research enriches application scenarios of knowledge graph in interdisciplinary courses and forms a reform paradigm of technology empowerment knowledge reconstruction and ability enhancement offering theoretical reference and practical example for teaching re-form of similar courses.

References

1. Chen, P., Lu, Y., Zheng, V. W., Chen, X., & Yang, B. Knowedu: A system to construct knowledge graph for education. Ieee Access, 6, 31553-31563 (2018)
2. Ji, S., Pan, S., Cambria, E., Marttinen, P., & Yu, P. S. A survey on knowledge graphs: Representation, acquisition, and applications. IEEE transactions on neural networks and learning systems, 33(2), 494-514 (2021)
3. Qu, K., Li, K. C., Wong, B. T., Wu, M. M., & Liu, M. A survey of knowledge graph approaches and applications in education. Electronics, 13(13), 2537 (2024)
4. Song, S., Yang, C., Xu, L., Shang, H., Li, Z., & Chang, Y. Travelrag: A tourist attraction retrieval framework based on multi-layer knowledge graph. ISPRS International Journal of Geo-Information, 13(11), 414 (2024)
5. Wu, J., Orlandi, F., O'Sullivan, D., & Dev, S. LinkClimate: An interoperable knowledge graph platform for climate data. Computers & Geosciences, 169, 105215 (2022)