

# The Synergistic Use of Knowledge Graphs and Generative AI in Smart Course Development: A Case Study of Sociology of Sport

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## Abstract:

Knowledge graphs are well suited to organizing course concepts and their relations, whereas generative AI is strong in dialogic explanation and resource generation. Their division of labor and linkage in smart courses still require course-design constraints. Taking the smart course development of Sociology of Sport as a case, this article introduces the course resources, knowledge base, and question bank, and analyzes the implementation of graph-based organization, course-context retrieval, intelligent question answering, authentic tasks, and diversified assessment. The course has accumulated 35 videos, 49 non-video resources, more than 1,250 knowledge-base entries, and 342 questions, and has collected learning materials through six online offerings. Because the available data do not support strict causal inference, the article focuses on instructional design and assessment evidence. The case shows that the graph defines the knowledge scope and relational basis, generative AI provides explanation and probing, and teachers remain responsible for goals, factual review, and assessment decisions.

## Keywords:

Knowledge Graph, Generative AI, Smart Course, Sociology of Sport

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## 1. Course Problem and Research Logic

Sociology of Sport covers social stratification, sport organizations, urbanization, media, and sport culture. Concepts are closely connected, and social cases change rapidly. Traditional online courses easily become accumulations of resources: after watching videos, students may still find it difficult to understand conceptual relations, and platform recommendations may not necessarily follow course goals. Liu and Wang examine the role of knowledge graphs in structuring course content [1]. Xie et al. extend graphs to the integration of teaching, learning, and assessment [2]. These studies address content organization and process connection respectively.

Generative AI adds dialogic explanation and immediate feedback. Giannakos et al. discuss personalized support together with risks to accuracy and learner agency [3]. Ogunleye et al. show in a systematic review that educational benefits depend on

activity design and teacher guidance [4]. This case therefore does not treat intelligent question answering as an isolated function. Instead, it examines how it is used within the scope of course knowledge, learning tasks, and teacher review.

## 2. Course Foundation and Development Materials

Sociology of Sport is a 32-hour, two-credit course. Since its launch in 2021, it has run for six offerings and accumulated 1,750 enrollments. Existing resources include 35 teaching videos with a total duration of 413 minutes, 49 non-video resources, 1,117 platform resource items, more than 1,250 course-knowledge-base entries, and 342 questions in the question bank. These data reflect the foundation and scale of course development and operation; they do not directly represent learning effects. (Table 1)

*Table 1. Resource foundation of the Sociology of Sport smart course.*

| Resource category     | Quantity or scale                | Main use                                     |
|-----------------------|----------------------------------|----------------------------------------------|
| Course operation      | Six offerings; 1,750 enrollments | Accumulate process data and course feedback  |
| Teaching videos       | 35 videos; 413 minutes           | Support pre-class learning and review        |
| Non-video resources   | 49 items                         | Provide texts, cases, and task materials     |
| Platform resources    | 1,117 items                      | Support online-offline teaching activities   |
| Course knowledge base | More than 1,250 entries          | Organize concepts, cases, and task relations |
| Question bank         | 342 questions                    | Diagnose basic knowledge and weak nodes      |

## 3. Collaborative Design of Knowledge Graphs and Generative AI

### 3.1. The Knowledge Graph Provides Course Structure and Boundaries

The course team constructs nodes around concepts, theories, cases, problems, tasks, and assessment criteria, and establishes prerequisite, explanatory, application, and assessment relations. Taking leisure sport as an example, the graph connects urbanization, event activities, ecological carrying capacity, and green-event criteria, enabling students to trace how theory enters the analysis of social problems. Li et al. also show in a university chemistry course that the value of graphs arises from the joint design of knowledge relations and teaching tasks [5].

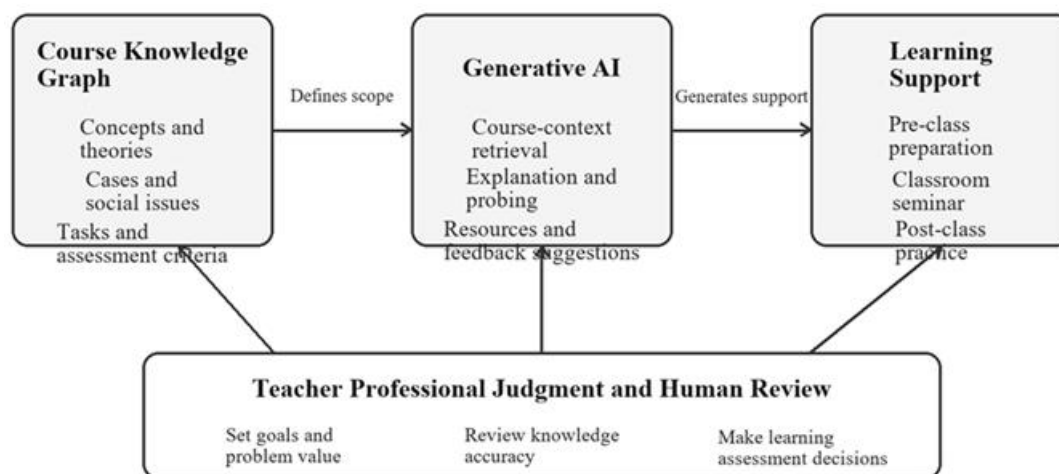
### 3.2. Generative AI Undertakes Explanation, Probing, and Resource Clues

The course team uses the course knowledge base as the main corpus for the intelligent learning companion. When students inquire about concepts, the system provides explanations and related nodes. When students address open-ended problems, the system offers comparative perspectives and resource clues. Students are required to verify facts and sources, and key concepts are finalized by teachers. This description refers to course-use rules and design requirements; it cannot be used to infer that the platform automatically eliminates errors in all responses.

### 3.3. Teachers Control Goals, Problem Value, and Assessment Conclusions

Teachers determine which nodes are core content, select real-world problems suitable for classroom discussion, and review high-risk knowledge. AI may provide preliminary prompts on the structure of a plan, but it does not participate in final

grade decisions. Aytekin and Saygin discuss the efficiency of AI-assisted construction of educational knowledge graphs [6]. Automated construction must still be constrained by course goals and assessment requirements. (Figure 1)



**Figure 1.** Structure of course teaching supported by knowledge graphs and generative AI.

## 4. Teaching Implementation and Assessment-Evidence Design

### 4.1. Online Learning Provides a Shared Foundation for Offline Discussion

The course allocates 16 hours to online learning and 16 hours to offline learning. Students complete micro-videos, graph browsing, and concept quizzes online; classroom time is used for case analysis, debate, and plan design. Question-bank results help identify common weak points in the class, and teachers adjust explanations accordingly. The course emphasizes teachers' rejudgment of recommendation results so that an increase in node quantity does not increase students' cognitive burden.

### 4.2. Authentic Events Transform Conceptual Relations into Analytical Tasks

In the unit on leisure sport and urbanization, the course introduces the Tai'an Marathon and related volunteer-service scenarios. Students analyze event scale, urban space, participant groups, and ecological responsibilities. They form proposals around green-event standards and explain the concepts, evidence, and value judgments used. AI is used for information organization and probing of plans, while teachers review facts and organize comparisons among viewpoints.

### 4.3. Assessment Simultaneously Examines Knowledge, Analysis, and Practice

Course assessment consists of concept quizzes, case analysis, classroom discussion, practical work, and reflective statements. The 342 questions diagnose basic knowledge. Cases and practical tasks assess whether students can select theories to explain phenomena. Reflective statements record how students revise their viewpoints. Platform completion rates indicate participation but are not treated as the main evidence of course effectiveness. (Table 2)

**Table 2.** *Teaching stages, technological support, and assessment evidence.*

| Stage              | Learning task                                | Technological support                    | Assessment evidence                              |
|--------------------|----------------------------------------------|------------------------------------------|--------------------------------------------------|
| Pre-class          | Videos, graph preview, concept tests         | Node relations, intelligent Q&A          | Test results and question lists                  |
| In class           | Case discussion and comparison of viewpoints | Resource clues and instant statistics    | Evidence for statements and analysis records     |
| Post-class         | Event plans and practice reflection          | Structural prompts and simulated probing | Works, revision notes, practice records          |
| Course improvement | Analyze common weak points                   | Node and item statistics                 | Resource updates and teaching-adjustment records |

## 5. Discussion and Limitations

The boundaries between the two technologies are relatively clear in this case. The graph is responsible for stable course structure, generative AI processes dialogue and dynamic materials, and teachers undertake knowledge review and educational judgment. If the graph merely pursues the number of nodes, the course may again fall into resource accumulation. If intelligent question answering is detached from the knowledge scope, the controllability of generated content declines. If teachers treat platform data directly as assessment, students' authentic learning processes may be oversimplified.

The available materials mainly show that course resources and design have been formed. Paired samples, unified scales, and control groups are still lacking. Earlier course materials reporting interaction participation rates or improvements in critical thinking are not used as effectiveness conclusions in this revision because the sample scope and measurement tools were insufficiently specified. Future studies may compare student works across different learning paths, record the acceptance and rejection of AI suggestions, and use pre-post tests or quasi-experimental methods to examine learning changes.

## 6. Conclusions

The development experience of the Sociology of Sport smart course shows that knowledge graphs and generative AI need a division of labor under course goals. The graph organizes concepts, cases, tasks, and assessment relations. Generative AI provides explanations, probing, and resource clues. Teachers determine knowledge boundaries and make assessment decisions. At the current stage, the more adequate evidence comes from course resources, operation records, and teaching tasks; learning effects still require stricter data validation. This evidence boundary helps avoid presenting technological functions directly as teaching outcomes and provides a clear starting point for subsequent empirical research.

## Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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## References

- [1] Liu, X.L.; Wang, W. Curriculum Teaching Reform Based on Knowledge Graph. *China Metallurgical Education*, 2024, 1, 7-11. DOI: 10.3969/j.issn.1007-0958.2024.01.003.
- [2] Xie, Y.R.; Lu, Y.; Peng, Z.Y, etc Exploration of Knowledge Graph Empowering the Integration of “Teaching Learning Evaluation” in University Curriculum. *China Electronic Education*, 2024, 12, 1-7.
- [3] Giannakos, M.; Azevedo, R.; Brusilovsky, P, et al. The promise and challenges of generative AI in education. *Behaviour & Information Technology*, 2025, 44(11), 2518-2544. DOI: 10.1080/0144929X.2024.2394886.
- [4] Ogunleye, B.; Zakariyyah, K.I.; Ajao, O, et al. A systematic review of generative AI for teaching and learning practice. *Education Sciences*, 2024, 14(6), 636. DOI: 10.3390/educsci14060636.
- [5] Li, H.X.; Li, Y.; Xin, J, etc Practice of College Chemistry Curriculum Reform Based on Course Knowledge Graph. *College Chemistry*, 2025, 40(11), 141-149. DOI: 10.12466/PKU.DXHX202504031.
- [6] Aytekin, M.C.; Saygin, Y. ACE: AI-assisted construction of educational knowledge graphs with prerequisite relations. *Journal of Educational Data Mining*, 2024, 16(2), 85-114. DOI: 10.5281/zenodo.14250896.



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