US-China Education Review A, August 2026, Vol. 16, No. 8, 600-608
doi: 10.17265/2161-623X/2026.08.007

Leveraging Knowledge Graphs and AI to Empower Personalized Learning in English Literature Course

ZHANG Ruoxi, LI Hao, HE Guangshuo, WANG Zeyu, WU Dingyutong, ZHANG Wenwen*
Ningbo University, Ningbo, China

Against the backdrop of globalization and global education digitization, traditional English literature instruction for English majors in higher education faces the dual challenges of fragmented knowledge and homogenized learning pathways. Grounded in constructivism and adaptive learning theory, this study leverages a smart teaching platform to construct an English literature knowledge graph model encompassing four major genres—novels, poetry, drama, and prose—thereby establishing semantic connections among multidimensional entities such as authors, works, and themes. Empirical research (N = 40) indicates that this knowledge graph not only significantly enhances students' cognitive completeness regarding the literary genre system with an overall student satisfaction rate reaching 92.5%, but also effectively stimulates their independent learning and critical thinking. Finally, this paper discusses the challenges regarding the graph's semantic recognition accuracy and dynamic update mechanisms, and proposes corresponding strategies for optimizing the integration of technology and teaching.

Keywords: knowledge graph, English literature, personalized learning, ChaoXing platform, digital education

Introduction

Against the backdrop of globalization and the digitization of education, English literature instruction is crucial for fostering cross-cultural awareness and critical thinking. However, traditional English literature instruction is now confronted with two persistent bottlenecks: fragmented presentation of disciplinary knowledge, and one-size-fits-all learning pathways that fail to accommodate diverse learner needs.

As structured semantic networks, knowledge graphs offer new pathways for personalized learning. Most existing relevant research focuses heavily on foundational language knowledge learning, leaving systematic construction of literary text knowledge systems and exploration of dynamic learning feedback loops largely underexplored (Ling, 2025). Accordingly, the core research questions of this study are: How can a knowledge graph model tailored to English literature instruction be constructed? Can this model effectively support personalized learning?

Acknowledgement: This work was funded by the 2025 Zhejiang Provincial College Students' Science and Technology Innovation Program (Planted Talent Program) (Project No.: 2025R405A019).

ZHANG Ruoxi (the 1st author), undergraduate, School of Foreign Languages, Ningbo University, Ningbo, China.
LI Hao (the 2nd author), undergraduate, School of Foreign Languages, Ningbo University, Ningbo, China.
HE Guangshuo (the 3rd author), undergraduate, School of Foreign Languages, Ningbo University, Ningbo, China.
WANG Zeyu (the 4th author), undergraduate, School of Foreign Languages, Ningbo University, Ningbo, China.
WU Dingyutong (the 5th author), undergraduate, School of Foreign Languages, Ningbo University, Ningbo, China.
ZHANG Wenwen* (corresponding author), Ph.D., Lecturer, School of Foreign Languages, Ningbo University, Ningbo, China.

The study follows a "theoretical framework—model development—empirical validation—optimization and refinement" approach. Relying on the ChaoXing platform, a widely used online learning management system in Chinese higher education which is equipped with an integrated knowledge graph construction module and built-in AI (artificial intelligence)-assisted functionalities, this study constructs a knowledge graph covering four major literary genres and evaluates its effectiveness through questionnaires and interviews, aiming to explore pathways for the digital and personalized development of English literature education.

Literature Review and Research Methods

Educational Knowledge Graphs: Technological Evolution, Application Domains, and the Static Nature Bottleneck

Knowledge graphs originated from the Semantic Web's pursuit of computable knowledge, and their application has gradually extended into the humanities and social sciences. As Steenwinkel et al. (2020, p. 344) note, "Within this knowledge graph, all information of the original dataset is linked together, which makes it easier to search for relevant information". Sun et al. (2020, p. 210) observe that "the study of vocabulary learning is limited to the learning of a single vocabulary", and this limitation is highly analogous to the current state of knowledge graph applications in literary studies, which are largely confined to visualizing vocabulary or character relationships, without addressing deeper semantic ambiguity. Constructing a knowledge graph for mathematics or other science subjects is relatively easy, but this task proves far more challenging for language and literature courses. This difficulty likely stems from the complexity of human emotional expression and the inherent ambiguity of literary language, which impose new challenges for both entity extraction and relation identification tasks, as Chen et al. (2018) have similarly noted.

Driven by the national strategy for educational digitization, the focus of related Chinese research is gradually shifting from the development of underlying technologies to top-level pedagogical applications. Yet current practical implementation is still widely trapped in a "static" mindset. As Li Huiqian and Zhong Bochang (2024) point out, educational knowledge graphs face a series of common issues: single data modality, lack of high-quality dedicated datasets, low automation of construction processes, pervasive technical limitations, high difficulty in knowledge modeling, insufficient attention to the development of core pedagogical capabilities, a lack of unified interoperability standards, and low adoption rates in real teaching contexts. They are often reduced to serving merely as "advanced electronic catalogs", lacking deep integration with dynamic teaching processes and learner behavior data, which results in their intelligent potential for adaptive recommendations and personalized diagnostics remaining far from fully realized.

Personalized Learning in English Literature: The Disconnect Between Theoretical Vision and Technological Practice

Richards and Rodgers (2014) point out that although significant progress has been made in understanding language teaching and learning in recent decades, the field continues to explore new instructional designs and pedagogies, and this ongoing exploration has prompted a reassessment of literature instruction's value and a broadening of its pedagogical approaches. The core of English literature instruction lies in cultivating the abilities to interpret texts, make aesthetic judgments, and demonstrate cultural empathy—which fundamentally contradicts traditional standardized teaching models. Although theories such as constructivism and adaptive learning point the way forward, existing technologies struggle to capture the non-deterministic cognitive

processes involved in literary learning, resulting in personalized support that remains superficial.

Knowledge graphs are viewed as a potential solution, but most existing explorations are limited to narrow, single-function applications, and fail to form a complete closed instructional loop that covers the full learning process.

Research Gaps and the Innovative Focus of This Study

The current research consensus holds that knowledge graphs are a key enabling technology for personalized literary education; however, three core gaps remain: a lack of graph-construction models tailored to the characteristics of English literary genres; a lack of dynamic, data-driven learning closed-loop mechanisms centered on knowledge graphs; and a lack of in-depth empirical evidence on blended methods in real teaching contexts.

The innovations of this study are as follows: This study carries out three targeted innovative attempts: First, it proposes a "genre-specific construction and unified integration" strategy to build graph models that adapt to the attributes of different literary genres. Second, it integrates dynamic learner profiling with adaptive recommendation mechanisms to realize a graph-driven dynamic learning loop, thus promoting the evolution of knowledge graphs from static knowledge repositories to active "cognitive engines". Third, it conducts mixed-methods empirical evaluations in real teaching contexts, to provide robust practical evidence for the development of this field.

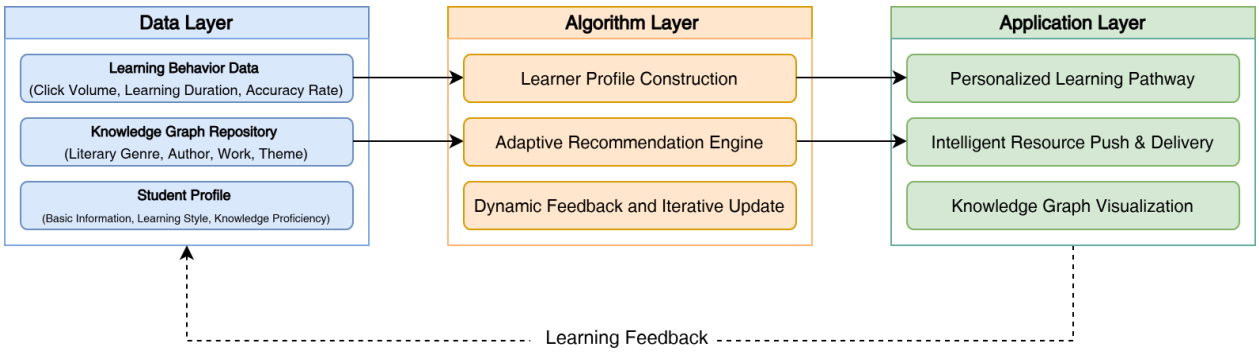

Figure 1. A knowledge graph-based personalized learning model.

Theoretical Foundation and Research Design

Theoretical Foundation

This study draws on constructivism, adaptive learning theory, and cognitive theories of multimedia learning as a framework to support the exploration and application of knowledge graphs in personalized learning in English literature.

The work on knowledge graphs is closely related to scientific advancements in the Semantic Web, databases, knowledge engineering, natural language processing, and machine learning. Over the past few decades, ontology-based approaches have provided many researchers with a roadmap for constructing vocabularies, schemas, and ontologies to meet the needs of various applications (Chen, 2025). Constructivist learning theory emphasizes that learning is an active process of constructing meaning; by visualizing knowledge connections, knowledge graphs serve as "cognitive scaffolding" that facilitates knowledge integration and meaning construction. By reducing learners' external cognitive load, knowledge graphs effectively promote the construction of literary knowledge schemas. Adaptive learning theory advocates providing learners with dynamic, personalized support. Knowledge

graphs can precisely identify knowledge gaps, analyze cognitive tendencies, and track learning trajectories, thereby providing quantitative evidence for learning assessment and path planning. Cognitive theory of multimedia learning suggests that dual-channel information presentation can promote more active knowledge processing. By integrating multimodal resources into graphical structures, knowledge graphs help reduce cognitive load and construct coherent knowledge models.

Research Questions and Scope

In accordance with Zhejiang Province's policies on digital education development, this project explores the innovative application of knowledge graphs in English literature education. By constructing a structured, dynamically updated English literature knowledge graph covering four major literary genres, the project aims to address issues such as fragmented traditional teaching content, difficulties in matching learner interests, and low learning efficiency.

This project focuses on achieving the following objectives:

(1) To examine the current status and challenges of knowledge graph applications in English literature learning.

(2) To construct a high-effect digital and intelligent knowledge graph that can provide reliable support for English literature learning.

(3) To explore pathways for knowledge graphs to enhance the personalization and adaptability of English literature learning.

Research Methods

This study employs a mixed-methods approach. First, a literature review method is used; with the aid of the CiteSpace tool, we examine the progress of knowledge graph applications in the field of English literature learning. By analyzing keyword co-occurrence and co-citation of literature, we identify research trends and provide theoretical support. Second, we employ a model-based research approach to build the dedicated knowledge graph on the ChaoXing platform. This system incorporates multi-level knowledge point design, attribute tag matching, batch initialization of textbooks, and a teaching feedback update mechanism to ensure practicality and timeliness. Third, a mixed-methods approach combining quantitative and qualitative methods was adopted. A questionnaire survey was conducted using Ningbo University as a sample, with plans to expand to other universities in the future; semi-structured interviews were conducted based on the questionnaire results, focusing on practical effectiveness and challenges to provide a basis for user-centered learning models.

Research Implementation Process

The implementation process of this study is divided into the following four phases:

Phase 1: Problem Formulation and Research Scope Definition: Analyze the current situation and background; define the research topic, core questions, and conduct a preliminary literature review; Phase 2: Literature Review and Theoretical Integration: Review the literature and empirical theories; clarify the current state of application, challenges, and research framework; Phase 3: Focus Definition and Knowledge Graph Construction: Using the ChaoXing platform and incorporating textbooks, construct a hierarchical structure of knowledge points, design tags and classifications, create a knowledge map, and apply it to teaching; Phase 4: Empirical Validation and Iterative Optimization: Design an empirical research plan, conduct a semester-long teaching experiment, analyze the data, and optimize the knowledge graph.

Construction and Implementation Pathways for the English Literature Knowledge Graph

The construction of an English literature knowledge graph is grounded in the semantic characteristics of the discipline and guided by instructional needs. Centered on the core concept of "structured knowledge representation—personalized learning adaptation," it addresses pain points in traditional teaching and provides a practical technical pathway for the digital transformation of English literature education.

Core Elements of Knowledge Graph Construction

Knowledge graphs use "entity-relationship-entity" as their basic units to construct semantic networks that reveal knowledge associations (Liang & Liu, 2026). The core elements of the English literature knowledge graph form a three-dimensional architecture comprising entity definition, relationship definition, and data sources, which respectively serve to concretize knowledge units, systematize associative logic, and ensure the authority of content.

Entity definition. Based on the syllabus for the course Selected Readings in English Literature, this study classifies entity types into six major categories, including authors, works, and characters. For each entity category, feature descriptions spanning the dual dimensions of "basic attributes" and "instructional tags" were established, thereby constructing a standardized knowledge entity repository.

Table 1

Standardized Entity System

Entity category	Basic attributes	Teaching tags
Author	Years of birth and death, nationality, literary school, representative works, writing style	Key authors, authors for exam preparation, key teaching focus areas
Works	Period of creation, genre, main characters, summary of themes, text structure	Text difficulty, required reading list, dimensions of text analysis
Characters	Character traits, character relationships, plot function, symbolic significance	Key characters, symbolic characters, priority of analysis
Literary movements	Time of emergence, core tenets, representative authors, stylistic characteristics, evolutionary trajectory	Key movements, easily confused movements, strength of interconnections between movements
Historical context	Time period, historical impact, relevance to literature, ideological trends of the era	Related schools, exam context, dimensions of context analysis
Thematic imagery	Connotations of imagery, distribution in texts, cultural metaphors, intertextual connections	High-frequency imagery, cross-cultural imagery, key points for imagery analysis

Entity definitions adhere to the principles of "instructional orientation" and "semantic integrity"; supplementary instructional tags provide a basis for personalized recommendations, while annotated Chinese definitions lower the comprehension barrier for non-native English speakers.

Relationship definitions. Based on the dual dimensions of cognitive logic domains and learning pathways in literary pedagogy, five major categories of core semantic relationships are defined to form a systematic relationship network.

Data sources. A "three-tier data system" is adopted: the core tier primarily consists of textbooks and course resources to ensure content authority; the expansion tier integrates authoritative literary databases and academic literature to support higher-order learning; the dynamic tier incorporates feedback data from teaching practice to establish a periodic update mechanism. The platform leverages artificial intelligence to compute, process, and analyze these multi-tier data, enabling intelligent knowledge extraction and dynamic adaptation. All data then undergo dual review by professional educators and knowledge graph researchers to ensure reliability.

Table 2

Systematic Relationship Network

Relationship type	Relationship name	Educational value
Creative connection	Created in	Reveals the connection between historical background and literary creation, helping learners understand the influence of the historical context on a work
Subordination Relationship	Belongs to	Builds a classificatory understanding of "work-genre" and "concept-category" relationships, reinforcing the hierarchical structure of the knowledge system
Descriptive relationship	Depicts	Establishes connections between literary texts and external reality, deepening understanding of the work's context
Influential connections	Influenced by...	Traces the lineage of literary traditions and the logic behind the evolution of literary schools, presenting the dynamic process of knowledge development
Comparative connections	Similar imagery/related themes	Supports cross-textual and cross-cultural comparative teaching, fostering learners' comparative thinking and a broader perspective

Construction of a Knowledge Graph Model Based on the Four Major Literary Genres

The knowledge structures and teaching priorities of the four major genres of English literature differ significantly. We adopt a strategy of "genre-specific construction and unified integration" to balance genre-specific characteristics with cross-genre knowledge transfer.

Genre-specific construction strategy. ***Construction of the novel knowledge graph.*** Taking *Sister Carrie* as a typical example, we established a "three-dimensional radiating system" framework using "narrative logic-teaching focus" as dual axes. We constructed a "general-specific-general" framework comprising six core modules, forming a multi-level knowledge point structure annotated with teaching attributes and associations. Knowledge is stored in a "node-edge-attribute" model, supporting the integration of "teaching, learning, and assessment".

Poetry graph construction. Using *Leaves of Grass* as a model, we divide the content into three layers centered on the dual axes of "imagery system—poetic discourse". We construct a three-tiered progressive structure comprising foundational understanding, core analysis, and extended application, establishing a network linking imagery to themes and assigning teaching priority labels. Through visualizations such as imagery-centered diagrams and rhythm curves, we design progressive learning tasks to generate personalized reports and resource recommendations.

Construction of the drama knowledge graph. Taking *Long Day's Journey Into Night* as an example, this framework centers on the playtext itself, with categories extending to dimensions such as dramatic conventions and plot conflicts. The framework comprises three parts: "Knowledge Acquisition—Task Exploration—Supplementary Expansion", with links established between key concepts. It integrates data such as dramatic videos, the author's biography, and academic papers, stores all related content in the back-end database, and presents them visually.

Construction of a prose graph. Taking *Walden* as an example, the system centers on the main thread of "life practice—philosophical expression". It constructs a three-tiered framework in which key concepts are semantically interconnected, and teaching priorities and exam-focused tags are assigned. Using a visualization approach that combines macro-level maps with micro-level analysis, the system designs progressive tasks, provides personalized reports and resource recommendations, and forms a closed-loop learning system.

Technical implementation. Leveraging the ChaoXing platform, we have established a four-tier system

comprising "text category—module—knowledge point—sub-knowledge point". Each tier is assigned instructional attribute tags, and the platform generates teaching aids by associating each knowledge point with multimodal content consisting of "1 core resource + 2-3 supplementary resources", while also labeling resource types and difficulty levels. The platform's visualization features support interactive exploration by both teachers and students, track learning trajectories to optimize instruction, and enable students to independently construct knowledge networks.

Pathways to Personalized Learning

Through a closed-loop design of "Learner Profiling—Adaptive Recommendations—Intelligent Interaction", the knowledge graph delivers personalized learning support tailored to each individual, putting the "teaching based on learning" philosophy into practice.

Learner profiling. Learner profiling serves as the foundation for personalized recommendations. It is constructed based on static and dynamic data, covering cognitive characteristics, learning preferences, and learning objectives, and is dynamically iterated according to the principle of real-time updates.

Table 3

Three-Dimensional Learner Profile

Profile dimensions	Data sources	Core metrics
Cognitive characteristics	Placement tests, platform test scores, knowledge mastery rate	Knowledge mastery rate, cognitive level, knowledge gaps, weaknesses in learning ability
Learning preferences	Platform behavior data	Resource preferences, preferred learning times, interaction preferences
Goals and objectives	Surveys, study plan setup, course selection	Learning goals, learning contexts, career orientation

Adaptive recommendation mechanism. Adaptive recommendations are based on learner profiles and reinforcement learning algorithms to achieve precise customization in "content recommendations", "learning path recommendations", and "difficulty adjustments": For content, resources are recommended at the foundational, intermediate, or advanced levels based on cognitive proficiency; for learning paths, alternative learning paths are generated and their effectiveness is validated through mastery tests; for learning difficulty, a tiered dynamic adjustment approach is adopted, with clear feedback provided to learners to explain the reasons for each adjustment.

Intelligent interaction. The platform regularly generates "weekly/monthly/annual learning reports", providing integrated feedback that combines "quantitative assessment—resource recommendations—pathway adjustment suggestions". It also supports a "teacher intervention" feature, allowing teachers to provide guidance on weak modules while enabling learners to independently adjust their study plans, thus fostering a new collaborative teaching model that combines the respective advantages of human instructors and intelligent systems.

Empirical Research

Research Implementation and Data Collection

This study aims to evaluate the effectiveness of knowledge graphs in a course on selected masterpieces of English literature. It was conducted as a two-phase mixed-methods study: In the first phase, a structured literary knowledge network was constructed using the ChaoXing platform, covering four major genres and comprising 140 core knowledge points, 312 learning paths, 498 knowledge links, and 280 multimodal teaching resources; in the second phase, after the course had been running for one semester, questionnaires were distributed to 40

students, and 10 students were randomly selected for semi-structured interviews; triangulation was employed to ensure reliability and validity.

Effectiveness Analysis

Both quantitative and qualitative data indicate that the application of the knowledge graph has yielded significant results, with particularly outstanding performance in knowledge integration, learning efficiency, and self-directed learning (see Figure 2 for detailed data). The interviews further revealed that the interdisciplinary connections presented by the graph have broadened students' horizons; some students have already been able to proactively conduct comparative analyses and cross-textual explorations, demonstrating the initial development of critical thinking.

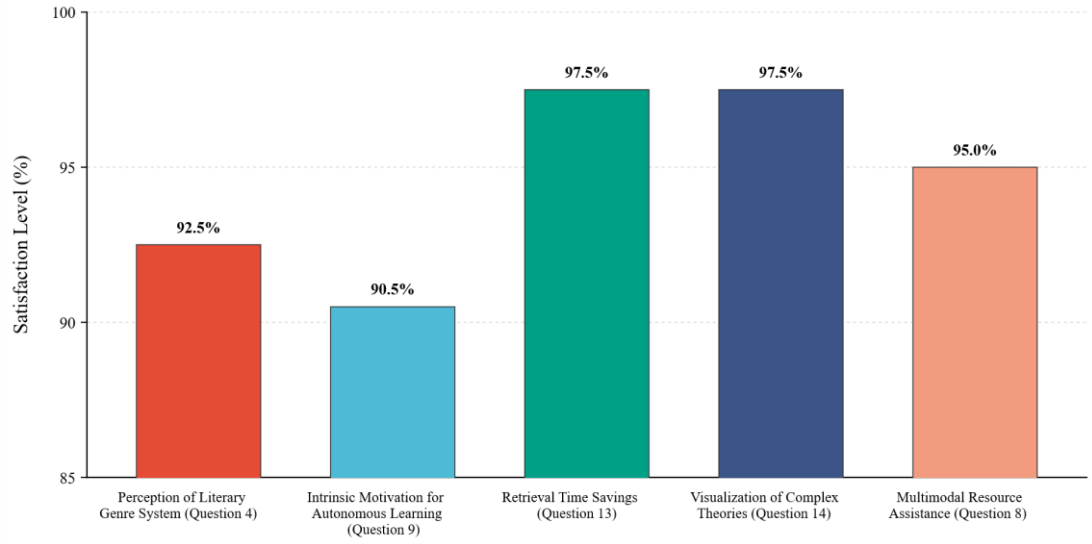

Figure 2. Satisfaction analysis of key dimensions in knowledge graph application.

Challenges and Optimization Strategies

Despite the significant achievements, the study also revealed multiple challenges faced in the implementation of knowledge graphs. On the technical front, this project is currently in an exploratory phase involving small-sample mixed-methods research. Limitations include a reliance on manual processing of unstructured data in the literary field, the lack of an automatic update mechanism for the knowledge graph, and insufficient natural language processing capabilities for understanding literary semantics. On the pedagogical front, student use is primarily concentrated in task-based contexts such as assignments and classroom activities, while the usage rate for spontaneous exploratory learning only stands at 32.5%. Furthermore, the integration of students' non-linear learning paths with traditional coursework places higher demands on instructors.

To address these issues, this study proposes a systematic optimization strategy: Technologically, we will collaborate with the Center for Digital Humanities and academic databases to construct standardized datasets, develop specialized natural language processing algorithms, and achieve dynamic graph updates through a "expert review + community feedback" mechanism; in terms of promotion, we will conduct teacher training workshops and design guided learning tasks; regarding long-term mechanisms, we will establish cross-course pilot programs, build a multidimensional evaluation system, and form interdisciplinary teams to tackle core challenges.

Conclusions and Outlook

By constructing and empirically evaluating a knowledge graph for selected masterpieces of English literature, this study has reached the following core conclusions: At the theoretical level, the graph successfully applies constructivist and connectivist learning theories to the practice of higher education in literature; at the model level, the framework of "genre-based organization and multimodal integration" demonstrates strong systematicity and scalability, providing a paradigm for the digital transformation of liberal arts courses; at the practical level, empirical data indicate that the knowledge graph has achieved significant results in enhancing the systematic nature of knowledge, learning efficiency, and interdisciplinary understanding, effectively stimulating students' motivation for self-directed learning and critical thinking.

Future prospects can be advanced along three dimensions: at the technological level, leveraging RAG (Retrieval-Augmented Generation) technology to promote the deep integration of large language models and generative AI, and developing a digital companion knowledge graph with intelligent reading guidance and multimodal deconstruction capabilities; at the application level, extending these findings to the entire spectrum of teaching processes and proactively constructing a massive-scale digital literary knowledge graph to empower global digital humanities interaction systems; theoretically, we will strengthen interdisciplinary research in areas such as multimodal graph representation, semantic topological structures, and individual cognitive structures, to deeply uncover the "technology-cognition" co-evolutionary mechanisms of knowledge graphs, thereby achieving the reconstruction and iteration of digital humanities education.

References

Chen, P., Lu, Y., Zheng, V. W., Chen, X., & Yang, B. (2018). KnowEdu: A system to construct knowledge graphs for education. *IEEE Access, 6*, 31553-31563. Retrieved from https://doi.org/10.1109/ACCESS.2018.2839607

Chen, Y. (2025). The application of artificial intelligence technology in literary research. *Bulletin of the Dialectics of Nature, 47*(8), 93-99.

Li, H., & Zhong, B. (2024). Educational knowledge graphs: Research progress and future development—An analysis based on articles published in Chinese core journals from 2013 to 2023. *Computer Engineering, 50*(7), 1-12.

Liang, D., & Liu, Y. (2026). Publishing as a catalyst for revitalizing "obscure and forgotten disciplines": Practices in making Cantonese folk songs accessible to the general public and visualizing them. *Publishing Research, 42*(1), 45-52, 66.

Ling, J. (2025). Knowledge graph-empowered foreign language education: Personalized learning and cross-cultural intelligent feedback. In *Foreign language education and application (2025)* (p. 81). Chengdu: Southwestern University of Finance and Economics Press.

Richards, J. C., & Rodgers, T. S. (2014). *Approaches and methods in language teaching* (3rd ed.). Cambridge: Cambridge University Press. Retrieved from https://doi.org/10.1017/CBO9780511667305

Steenwinkel, B., VandeWiele, G., Rausch, I., Heyvaert, P., Taelman, R., Colpaert, P., … Ongenae, F. (2020). Facilitating the analysis of COVID-19 literature through a knowledge graph. In *The Semantic Web—ISWC 2020* (pp. 344-357). London: Springer. Retrieved from https://doi.org/10.1007/978-3-030-62466-8_22

Sun, F., Yu, M., Zhang, X., Zhang, Y., & Wang, J. (2020). A vocabulary recommendation system based on knowledge graph for Chinese language learning. In *2020 IEEE 20th International Conference on Advanced Learning Technologies (ICALT)* (pp. 210-212). IEEE. Retrieved from https://doi.org/10.1109/ICALT49669.2020.00068