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Exploring the Application of Knowledge Graphs in English Reading Comprehension

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ABSTRACT

Against weakened deep reading abilities, English reading instruction must enhance students' higher-order thinking skills. As an efficient knowledge organization technology, knowledge graphs offer new pathways for pedagogical transformation. This paper systematically explores the application value of graphs in reading instruction. By revealing the deep structural connections within texts and linking them to background knowledge, they facilitate the shift from text decoding to profound comprehension. This paper identifies current practical challenges—resource scarcity, superficial teaching, and inaccurate assessment—and proposes targeted solutions: constructing thematic knowledge graph repositories to solidify cognitive foundations, designing inquiry-based classroom activities to deepen critical thinking training, and refining evaluation mechanisms to track comprehension processes. Transforming knowledge graphs into cognitive tools is key to enhancing reading education effectiveness.

KEYWORDS

Knowledge graph; English reading; reading comprehension; Teaching model; Meaning construction

1 Introduction

The core of English reading instruction should focus on cultivating deep comprehension abilities. This requires learners to transcend mechanical processing of vocabulary and syntax, actively engaging in dialectical dialogue between their cognitive experiences and textual content. Current classroom practices often have a misplaced emphasis: teachers excessively focus on isolated linguistic points and fragmented details, making it difficult for students to grasp the macro-structural logic of texts and their cultural contextual connections. This atomized teaching tendency objectively hinders the development of critical thinking. Against this backdrop, knowledge graphs emerge as a valuable semantic relationship-organizing tool. Their strength is integrating discrete textual elements into visual cognitive frameworks, revealing the underlying conceptual networks and semantic connections within linguistic materials. The teaching research community must clarify the following key propositions: How to precisely identify the intersection between graph technology and reading cognition principles, effectively overcome resource and technical bottlenecks in implementation, and thereby construct pedagogically appropriate application pathways. This requires researchers to conduct sustained exploration grounded in authentic classroom contexts.

2 Theoretical logic of knowledge graphs empowering English reading comprehension

2.1 Technical advantages of knowledge graphs in revealing deep discourse structures and background knowledge

The core pedagogical value of knowledge graphs lies in reconstructing knowledge interaction paradigms. Through the visualization of multi-level relational networks, they achieve a structural upgrade in cognitive models for text comprehension. The discourse deconstruction dimension transforms abstract logical relationships into actionable elements within a spatiotemporal coordinate system, dynamically illustrating the evolution of event sequences and the transmission pathways of causal interactions. This presentation method enables students to transcend the limitations of traditional linear comprehension, identify key structural elements within a holistic cognitive framework, and systematically cultivate text architecture analysis capabilities. More fundamentally, it constructs a cultural knowledge linkage system. Learners who focus on specific conceptual nodes simultaneously access associated sociocultural substrates and historical contextual frameworks, forming cross-temporal and spatial pathways of meaning connection [1]. This mechanism effectively bridges conceptual gaps caused by cultural background differences, establishing an empathetic foundation for deep interpretation. In teaching practice, educators can design evidence-driven inquiry chains: learners trace conceptual evolution trajectories, compare functional variations across semantic fields, critically evaluate conflicting information sources, and ultimately develop self-calibrating understanding models.

2.2 Analyzing the inherent limitations of traditional reading instruction in constructing systematic knowledge connections

Traditional English reading instruction often follows a bottom-up, linear approach: implementing predetermined steps to cover language points through mechanical, singular processes. Knowledge points are frequently fragmented into isolated elements, leading students to memorize vocabulary meanings while struggling to grasp their dynamic semantic functions within discourse. Supplementary background knowledge teachers provide is often randomly distributed, failing to establish systematic connections with the text, like scattered markers lacking coordinate guidance. This approach leads learners to accumulate fragmented information without developing a holistic cognitive framework supporting deep comprehension. When encountering complex texts, students often experience cognitive overload and struggle with practical reasoning and critical analysis: they can retell events but explain causal relationships; they recognize rhetorical devices but struggle to evaluate expressive effects.

2.3 Demonstrating knowledge graph technology as an effective tool for advancing English reading from text decoding to meaning construction

The core value of knowledge graphs as cognitive teaching aids lies in reconstructing the interactive pathways between surface-level information processing and deep-level meaning generation within texts. Their fundamental pedagogical function manifests as follows: visually presenting structured cultural background materials and discourse contexts effectively reduces cognitive load associated with linguistic form, helping students transcend literal comprehension limitations. Creating interactive inquiry spaces where learners autonomously adjust conceptual association weights and test semantic logic validity is more educationally significant. This directly emulates mature readers' cognitive patterns—continuously constructing associative networks, establishing textual inferences, and correcting interpretive biases. Deep application of this tool drives pedagogical paradigm shifts: guiding learners beyond factual information reproduction [2]. This facilitates multidimensional reasoning about behavioral motivations, enabling a substantive change from knowledge recipients to meaning creators. At its core, it cultivates critical analysis and textual reconstruction skills. Educators thus shift their focus from authoritative judgment of conclusions to guiding the reasoning process.

3 Current practical challenges in applying knowledge graphs to English reading comprehension

3.1 Insufficient supply of knowledge graph teaching resources tailored for English reading texts

The primary challenge in current practice is the severe shortage of high-quality, highly adaptable teaching resources. General-purpose large-scale knowledge graphs are overly complex and contain redundant information, making them unsuitable for direct instructional use. Conversely, constructing a customized knowledge graph that accurately reflects specific article content while aligning with students' cognitive levels and highlighting key teaching points demands exceptionally high proficiency in textual interpretation and technological application from creators. This requires profound linguistic and literary expertise, substantial information technology skills, and pedagogical design principles. For the vast majority of frontline English teachers burdened with heavy workloads, independently developing such high-quality resources is virtually impossible [3]. This supply-side structural shortage directly limits knowledge graph applications to sporadic experiments by a handful of tech-savvy teachers or superficial demonstrations, hindering systematic, large-scale implementation across broader educational contexts.

3.2 Instructional design fails to leverage knowledge graphs' interactive and inquiry-based capabilities

Even when accessible resources are available, instructional design often underutilizes their core functionalities. Many implementations merely present knowledge graphs as novel visual teaching aids, maintaining teacher-centered, one-way instruction where students remain passive information recipients. Under this model, knowledge graphs' core interactive and exploratory strengths remain untapped. Classroom activities generally lack design elements that genuinely embody modern educational philosophies. For instance, there is little guidance encouraging students to explore different graph nodes in a problem-driven manner, enabling them to uncover the text's underlying logic independently. Even rarer are constructivist learning tasks where students work in groups to supplement, revise, or even construct new knowledge graphs based on their unique text interpretations. This superficial approach to instructional design reduces knowledge maps from cognitive tools that empower students' higher-order thinking to mere teaching gimmicks, failing to achieve a genuine transformation in teaching methodology.

3.3 Traditional assessment systems fail to evaluate students' cognitive construction based on knowledge maps effectively

Assessment serves as the guiding principle for teaching, profoundly influencing instructional practices. Another deep-seated challenge in current knowledge map applications is the severe mismatch of evaluation systems. Traditional English reading comprehension assessments—whether through classroom questioning or standardized tests—primarily rely on multiple-choice questions and short-answer formats to evaluate students' memorization of factual information and partial content comprehension. This approach mainly measures foundational cognitive abilities, fundamentally mismatched with the systemic thinking, associative reasoning, and knowledge construction skills that knowledge graphs aim to cultivate [4]. Higher-order cognitive achievements gained through graph-based exploration—such as profoundly grasping complex motivational conflicts between characters—cannot be effectively reflected on traditional exam papers. The prolonged absence of scientific assessment tools capable of effectively measuring higher-order abilities naturally shifts learning focus back to fragmented knowledge memorization for conventional exams. This fundamentally stifles the intrinsic motivation for deep knowledge graph applications, making integrating them into the core teaching process challenging.

4 Knowledge graph-driven innovation pathways for teaching and learning English reading comprehension

4.1 Building a thematic knowledge graph repository closely integrated with English reading curriculum systems

To fundamentally overcome resource constraints, higher-level institutions such as teaching and research departments or universities must spearhead the systematic construction of a thematic knowledge graph repository closely integrated with mainstream English reading curriculum systems. This repository should prioritize instructional design principles, focusing on core curriculum themes or classic texts to ensure content aligns with explicit learning objectives. Each knowledge graph must be layered and customizable to accommodate diverse student proficiency levels. The repository should function as an open, evolving ecosystem offering user-friendly editing tools. This encourages frontline educators to upload, share, and adapt resources, fostering a virtuous cycle of collaborative creation and sharing. We can only provide robust and sustainable resource support for the routine application of knowledge graphs from the source through this approach.

4.2 Exploring new teaching models to guide students in autonomous inquiry and collaborative knowledge network construction

To truly unlock the potential of knowledge graphs, teaching models must shift from knowledge presentation to inquiry guidance and construction support. First, graph-based inquiry learning should be comprehensively implemented. Teachers transition from lecturers to facilitators, providing an incomplete initial graph and posing driving questions. They guide students to find answers and refine the graph through interaction with the graph and revisiting the original text. In this process, students construct meaning while solving problems. Second, learning can advance to collaborative graph construction. Working in groups, students use specialized tools to map their understanding of the text collaboratively [5]. This process demands deep discussion, negotiation, distillation, summarization, and interconnection of textual content—an intensely deep learning activity. Ultimately, each group presents and explains their diagram, sparking collisions and fusions of ideas, transforming the classroom into a vibrant knowledge-building workshop.

4.3 Designing diversified learning assessment schemes incorporating conceptual association analysis and diagram generation

Traditional assessment mechanisms must be restructured to align teaching evaluation with core competency development goals, shifting from singular knowledge testing to comprehensive evaluation of thought processes and cognitive outputs. The new evaluation system requires diverse assessment tasks, prioritizing in-depth conceptual linkage analysis activities. Students must employ mapping tools to reveal multi-layered interactions among core textual elements and systematically cite original evidence to support their logical reasoning, thereby precisely testing information integration and critical thinking skills. Simultaneously, concept maps should be established as the primary evaluation medium. Portfolio assessment criteria should encompass the following core dimensions: Concept Extraction Completeness: Requires coverage of both primary and subsidiary nodes. Structural Rigour: Emphasizes accurate annotation of causal relationships and contradictions. - Innovative Thinking: Focuses on the quantity of implicit cross-paragraph connections uncovered. Logical Coherence: Verifies the completeness of argument chains. Furthermore, a dynamic tracking mechanism should be established. Teachers periodically collect students' revision node records, quantify the frequency of higher-order thinking questions, and combine metrics such as the density of viewpoint exchanges during group collaboration to form a continuous cognitive development portfolio. This integrated assessment framework, encompassing output, mental behavior, and thinking progression, authentically reflects the evolution of students' comprehension abilities and effectively leverages assessment to enhance learning.

5 Conclusion

The essence of integrating knowledge graphs into English reading instruction lies in facilitating learners' transition from passive reception to active knowledge construction. This technology effectively addresses the challenges of fragmented knowledge and superficial thinking in traditional classrooms by structurally presenting textual network relationships. Current implementation barriers stem from the lack of systematic pedagogical support tailored to the characteristics of knowledge graphs. Breakthrough strategies should focus on the following dimensions: establishing thematic knowledge graph repositories to lay cognitive foundations; designing inquiry-based classroom activities driven by problems to deepen critical thinking training; and developing evaluation schemes that monitor both process and output to gauge comprehension depth. This integrated system transforms graph technology into a genuine tool for cultivating reading literacy, providing a pedagogical fulcrum for nurturing critical readers in the information age.

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