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EDITED BY
Simon K. S. Cheung,
Hong Kong Metropolitan University, China

REVIEWED BY
Sezer Kanbul,
Near East University, Cyprus
Ting Yi,
Beijing Language and Culture University, China

*CORRESPONDENCE
Chengche Qiao
chchqiao@bjtu.edu.cn

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Deep learning based AI-driven teaching models in Chinese high school English class: a case study of reading lessons

Yuxin Liu and Chengche Qiao*

School of Languages and Communication Studies, Beijing Jiaotong University, Beijing, China

The traditional English teaching model placed more emphasis on the rote memorization of knowledge, with less focus on encouraging deeper cognitive engagement, which may lead to more fragmented understanding among students. Nowadays, as intelligent technology evolves and educational objectives shift, traditional teaching models face new challenges, suggesting the need for innovative adaptation in high school education. Based on the theory of deep learning, this paper explores an AI-driven instruction model for high school English reading from five dimensions, that is, theoretical foundation, implementation conditions, teaching objectives, operational procedures, and teaching assessment, in an attempt to support deep thinking and core competencies of students, thus providing a possible direction for the sustainable development of high school English education. The practice of AI-driven education based on high school English indicates that the proposed instruction model not only optimizes traditional teaching models but also enhances the deep learning capabilities and higher-order thinking skills of students.

KEYWORDS

artificial intelligence, deep learning, high school English class, reading session, teaching model

1 Introduction

In the context of current educational improvements, the limitations of traditional teaching models have become increasingly apparent. The exam-oriented mode prioritizes the memorization of basic language knowledge, which, while temporarily boosting test scores, often neglects the cultivation of students' critical thinking and creativity. Despite the objectives outlined in the "*General High School English Curriculum Standards (2017 Edition)*" to develop students' core competencies, issues such as fragmentation and superficiality remain prevalent in teaching practice, which accelerate the process of English teaching enhancement and call for the development of students' deep thinking and autonomous learning skills.

Deep learning, as a key concept in contemporary educational improvements, emphasizes the deep understanding, application, as well as innovation of knowledge, and focuses on the cultivation of higher-order thinking ability, offering an effective solution to the learning challenges in Chinese high school English classrooms. Concurrently, advance in artificial intelligence (AI) presents new opportunities for educational transformation, as it not only enables personalized learning and real-time feedback through intelligent platforms, but also supports the restructuring of classroom instruction and the implementation of deep learning. The novel instruction model that combines the two can enhance students' learning experience, improve instructional quality, and address the limitations of traditional Chinese high school English classrooms.

This study examines how technology can overcome traditional teaching barriers, advance deep learning, and improve the value of the discipline as well as students' core competencies by examining the teaching model of Chinese high school English reading classes. It addresses the following questions: First, what is the current state of AI in secondary education? Second, how are the principles and characteristics of deep learning related to English reading instruction? Finally, how to effectively implement an AI-driven deep learning teaching model in Chinese high school English reading class?

2 Analysis of AI in education

2.1 Background overview

After decades of development and improvement since the concept of artificial intelligence was first introduced in 1956 (Zhu, 2024, p. 149), it has been applied to various sectors of society and has become an important force in promoting the transformation and upgrading across industries. During this process, numerous countries and regions around the world have actively promoted the integration of AI and education, making education one of the most significant areas for the application of AI.

In 2018, the Association for the Advancement of Artificial Intelligence (AAAI) and other organizations launched *The Artificial Intelligence for K-12 Initiative* (AI4K12) in the United States (Fang and Huang, 2020), which proposed three key tasks around AI education, providing a framework for the scientific and systematic integration of artificial intelligence into K-12 education. In the same year, China's State Council issued *Opinions on Deepening Reform of the Teaching Workforce in the New Era*, urging teachers to adapt to technological changes like artificial intelligence to improve instructional capacities (Yang et al., 2024, p. 61), which not only reflected the growing importance of AI in education, but also promoted the enhancement of teachers' competencies in applying AI technologies. UNESCO released *The Artificial Intelligence in Education Report* in 2019 (Ren et al., 2019, p. 3), which described the opportunities and challenges of AI in education, showed the huge potential of AI in global education system, and examined the potential negative impacts. In 2024, China's Ministry of Education initiated *The AI Empowerment in Education Action* (Lu, 2024, p. 4), which focused on four areas, including the scope of AI in education, platform construction, application examples and international dissemination.

These developments signal that AI-driven teaching models are becoming an important focus in global educational improvements. However, the successful implementation of this process relies not only on technological breakthroughs but also on policy support, active participation of teachers, and the collective exploration of AI education by the whole society.

2.2 Classification of AI in education

After reviewing relevant literature, it can be found that the tools and functions of AI in the field of education have been gradually diversified, and different scholars have various ways of categorizing. Focusing on specific instructional tools and technologies, Liang and Liu (2018) classified AI educational applications into four major forms, namely, intelligent tutor systems, automated assessment systems, educational games and educational robots with a greater emphasis on specific teaching tools and technology applications, providing a detailed analysis of the structures and principles of each form, respectively. By analyzing and sorting out the current status and development process, Lin and Xie (2019) classified AI educational applications into intelligent teaching systems, intelligent learning platforms, educational robots, and smart campuses, and rationally considered the theoretical and practical issues that might be triggered. Fitria (2021) categorized AI around its functions into eight dimensions, such as Virtual Mentor, Voice Assistant, Intelligent Tutoring System (ITS), and Intelligent Computer-aided Instruction (ICAI), etc. From a pedagogical perspective, Aravantinos et al. (2024) conducted a systematic classification and analysis of the role of AI in primary education across multiple aspects, including research objectives, learning content, learning outcomes, learning activities, activity-based pedagogy and AI tools.

The multi-level application reflects the new experience of smart teaching provided by artificial intelligence for teachers and students. By providing auxiliary support in all aspects of teaching through tutoring systems, assessment systems, and learning platforms, etc., artificial intelligence can help teachers improve the quality and efficiency of the classroom.

2.3 Application of AI in education

While the integration of AI in education faces challenges in implementation (Zheng et al., 2019), potential social issues (Lin and Xie, 2019), and ongoing debates (Zawacki-Richter et al., 2019; Wen, 2024), academic inquiry remains active. Scholars have continued to promote the optimization and implementation of AI in education, exploring its effective application in various educational contexts including personalized learning (Mathews et al., 2012; Xue et al., 2024), intelligent assessment (Bin and Mandal, 2019; Lu, 2021), robotic-teacher relationships (Wang et al., 2019; Mobarak, 2024), and factors affecting the use of AI (Lavidas et al., 2024; Wen et al., 2024), laying a solid foundation for the development of the field.

In terms of personalized learning, Mathews et al. (2012) developed the EER-Tutor intelligent tutoring system with eye-tracking function for analyzing students' learning preferences and personal interests. Through the EEG data, facial expressions, and eye-movements generated during online learning, Xue et al. (2024) analyzed learners' cognitive characteristics as well as learning needs, and constructed an intelligent recognition framework for cognitive styles based on the multi-modal approaches to provide learners with a personalized and intelligent online learning experience.

Artificial intelligence is widely used for the assessment language acquisition. Scholars have conducted research on writing assessment and reading assessment. Bin and Mandal (2019) proposed an AI-based automatic scoring system for English writings. This system reduced subjective bias in human evaluation, enhanced the efficiency and consistency of grading, and provided students with immediate feedback to promptly adjust their learning strategies. Lu (2021) proposed and applied an AI-assisted evaluation design for the evaluation of high school English reading class, and classified AI evaluation into intelligent diagnostic evaluation, intelligent formative evaluation, as well as intelligent summative evaluation according to

the application of AI in different teaching phases in the reading classroom.

Wang et al. (2019) and Mobarak (2024) examined the relationships between AI robots and the teachers. The former developed a "dual-teacher classroom" model supported by educational robots to explore human-artificial intelligence collaborative teaching, while the latter explored the impact of AI on teachers' roles in the classroom and concluded that the relationship between robots and teachers is a cooperative relationship rather than a competitive one. In terms of influencing factors, Lavidas et al. (2024) used the UTAUT2 model to analyze the factors influencing students' use of AI technology and their intentions. Wen et al. (2024) proposed a model to identify factors that influence K-12 teachers' adaptability to AI, and explore pathways to improvement.

The above studies have demonstrated the deep integration of AI technology and teaching practice from different aspects. In the future, AI technology is expected to drive education towards greater intelligence, though this evolution will require long-term exploration.

3 The concept and characteristics of deep learning

3.1 The nature and features of deep learning

Deep learning, in contrast to surface learning, was first introduced by American scholars Marton and Säljö (1976, p. 7). Through experimental studies, they highlighted that surface learning relies on rote memorization and simple repetition, while deep learning focuses on deeper comprehension, knowledge transfer, and application. Subsequently, Australian scholar Biggs (1979) further clarified the differences between surface learning and deep learning from the perspectives of learning motivations and strategies, with a particular emphasis on the impact of cognitive psychology on learning approaches. Biggs (1988, p. 197) also categorized learning approaches into three main types, namely, surface, deep, as well as achievement-oriented, and introduced a composite approach known as the deep-achieving approach. British scholar Entwistle and Ramsden (1983) examined the specific manifestations of deep learning by incorporating students' intrinsic learning perspectives and personality traits, and revealed the impact of teaching and assessment on students' deep learning through phenomenography and the approaches to studying inventory (Entwistle, 2000). In addition, Australian scholar Prosser and Millar (1989, p. 514) proposed that deep learning promotes critical thinking and information integration skills, thereby enriching the theoretical foundation for deep learning in enhancing students' overall competencies.

In China, He and Li (2005, p. 29) first introduced the concept of deep learning, defining it as fundamentally rooted in critical thinking. They identified three core features of deep learning, namely, understanding & critique, connection & construction, and transfer & application. Their work laid the foundation and provided a framework for subsequent research on deep learning.

Building on the research of He and Li, Zhang and Wu (2012) further extended the concept of deep learning by emphasizing that deep learning not only requires learners to reflect critically and engage deeply with the content, but also requires learners to construct a personal knowledge system through in-depth processing of knowledge and understanding of complex concepts, thus promoting higher-order thinking. They outlined six major features of deep learning, including critical understanding, information integration, knowledge construction, transfer and application, problem-solving, and lifelong learning. Through the refinement of these characteristics, they further enriched the theoretical framework of deep learning and clarified the relationship between deep learning and higher-order thinking. Guo (2016) further noted that deep learning involves a comprehensive engagement with challenging topics, encompassing activity and experience, association and structure, essence and variation, transfer and creation, and value and judgment. Drawing upon this, Wang et al. (2021, p. 19) proposed "internalization and communication" as the sixth characteristic, emphasizing the consistency between deep learning and *The New English Curriculum Standards*. These studies not only demonstrate the gradual evolution of the concept of deep learning but also reveal its profound impact on educational practice and student development.

3.2 The relationship between deep learning and English reading instruction

Deep learning emphasizes in-depth understanding, transfer, and application of knowledge, which is closely related to the goal of English reading instruction, namely, fostering students' ability to apply language comprehensively in real-world contexts. The six core characteristics of deep learning, as proposed by Guo and Wang, provide both theoretical support and practical guidance for English reading instruction.

In teaching practice, the role of the teacher extends beyond helping students understand the literal meaning of a text, but involves encouraging them to think critically from multiple perspectives about the author's intent and the underlying cultural significance, which effectively cultivates students' independent thinking and analytical abilities, helping them develop critical thinking skills. At the same time, students should connect the knowledge gained from the text with their own life experiences, cultural backgrounds, or existing English language knowledge. Through this integration of knowledge, reading comprehension shifts from passive reception to active construction, thereby enhancing students' deeper understanding of both language and culture.

Furthermore, teaching requires students to apply their language knowledge flexibly across different contexts. Teachers can design interactive activities in real-world language contexts to guide students in transferring the language knowledge they have learned to new situations, thereby enhancing their practical language application skills, which not only helps students shift from mechanical memorization to knowledge transfer and creative problem-solving, but also encourages them to actively explore and apply their existing knowledge in novel contexts, ultimately improving their adaptability and problem-solving abilities.

Through deep learning, students' language knowledge is internalized, leading to enhanced language expressions and intercultural communication skills. More importantly, the process of deep learning encourages students to demonstrate higher levels of abilities in critical understanding, information integration, knowledge construction, knowledge transfer, and problem-solving,

thereby laying a solid foundation for the development of their higher-order thinking skills. Overall, the integration of deep learning with English reading instruction not only facilitates the improvement of students' language abilities but also provides strong support for the cultivation of their overall competence and lifelong learning abilities.

4 Implementation pathways for AI-driven English reading instruction

4.1 Deep learning theory

Deep learning theory draws from humanistic education, constructivism, and situated cognition. Humanistic education, represented by Rogers and Maslow (Khatib et al., 2013, p. 45), advocates a student-centered approach that fosters autonomy and creativity, promoting equal teacher-student relationships for mutual growth. Constructivism, championed by Piaget (Lisi, 2002, p. 6), views learning as a process of knowledge construction based on prior experiences, where students engage in inquiry and reflection within authentic contexts to achieve deep understanding and knowledge transfer. Situated cognition theory emphasizes enhancing students' higher-order thinking and critical analysis skills through real-world social interactions, practical application, and collaborative learning. A representative example is Dewey's "learning by doing" (Laginder and Stenøien, 2011, p. 158).

Guided by the theory of deep learning, high school English classes conceptualize language acquisition as an integrated process that includes linguistic learning, affective engagement, and cognitive development, characterized by complexity, depth, and creativity. The integration of AI can facilitate the implementation of student-centered education by providing intelligent learning resources and optimizing instructional design, an advancement that not only addresses the challenges faced by traditional English teaching, but also meets the evolving development needs of students, enhancing the humanistic, constructive, and practical dimensions of education.

4.2 Prerequisites for implementation

The implementation of this teaching model hinges on both technological and student-related factors. From a technological standpoint, schools must have access to stable network infrastructure and modern hardware, including computers, smart devices, and projection equipment, to support the smooth operation of artificial intelligence systems. On the students' side, learners should possess foundational English knowledge and comprehension skills. Specifically, they should have an adequate vocabulary, understanding of grammar rules, and basic reading skills to support deep comprehension and knowledge transfer. In addition, students should be able to analyze and synthesize key information, effectively select relevant content, so as to engage in deeper understanding of complex materials and knowledge structures as well as the deeper meaning of texts under teacher's guidance. Furthermore, students should exhibit autonomous learning abilities, utilizing AI-assisted resources and feedback for self-regulation and improvement.

4.3 Potential biases and solutions

The integration of AI into classroom teaching has had a significant impact on educational practices, facilitating teacher's instruction while also posing challenges, including the impact on teachers' autonomy, increased reliance on AI tools by students, and ethical considerations. Specific measures should be taken to ensure the effective use of AI while minimizing negative impacts.

To address the issue of teachers' autonomy, the central role of teachers in instructional design, classroom management and assessment should be strengthened, and AI tools should be positioned as complementary resources, playing a supplementary role rather than a substitute one, so as to enhance teachers' professionalism and avoid excessive reliance on artificial intelligence.

Students' dependence on AI tools should be reduced by designing tasks that foster independent thinking and problem-solving skills. Incorporating more group discussions, inquiry-based learning, and hands-on activities into the curriculum, while encouraging the use of diverse learning resources, can help strike a balance between AI-assisted and traditional teaching methodologies.

In response to ethical concerns associated with the use of AI, awareness of privacy protection should be raised and clear safeguards should be established. Prior to data collection, participants must be fully informed about the purpose and scope of data usage, and their explicit consent must be obtained. Throughout the process of collection, storage, and utilization of students' information, privacy protection standards must be strictly adhered to and certain ways as well as measures must be put in place to prevent the leakage or misuse of information.

4.4 Target participants

The participants in this study were drawn from an 11th-grade class at a foreign language school in Beijing, comprising a total of 16 students. The students were of similar age with a balanced gender distribution, and their average IELTS reading score was 6, indicating a moderate level of reading proficiency. Most students in this class demonstrated a willingness to actively engage in English reading activities, exhibited positive classroom participation, and displayed dynamic thinking.

4.5 Teaching objectives

This study uses Unit 1, "Science Fiction," from the elective compulsory curriculum by the People's Education Press as a case to explore the implementation path of AI-driven English reading teaching model. The unit centers on the relationship between "humans & self" and "humans & the world," prompting students to analyze and reflect on the essence and progress of human society.

Deep learning advocates for unit-based instruction (Wang et al., 2021, p. 20), as it addresses challenges such as fragmented teaching, difficulty in knowledge transfer, and the separation of learning and application, which promotes the development of students' core competencies and long-term growth. Unit-based learning emphasizes integrated and systematic content design. By restructuring the teaching content of the "Science Fiction" unit, a coherent and interconnected

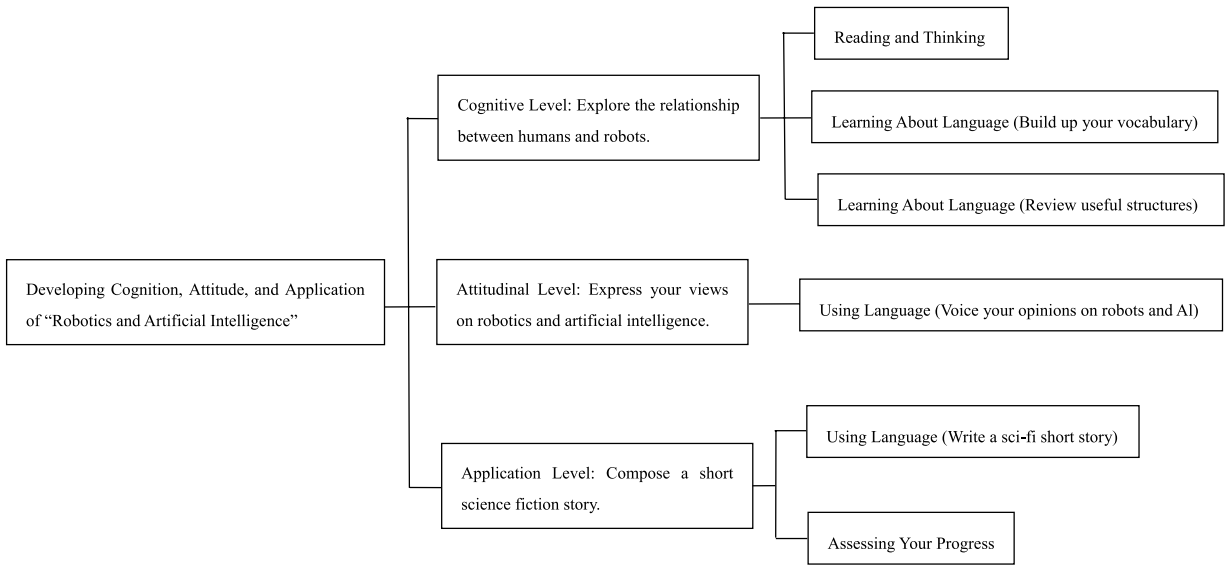

FIGURE 1
Integrated content framework for the "Science Fiction" unit.

knowledge framework is formed, fostering deep learning. The content integration of the "Science Fiction" unit is illustrated in Figure 1.

Defining overall teaching objectives ensures instructional coherence, and provides a solid foundation for organizing teaching activities as well as guiding students to achieve targeted learning outcomes. The overall teaching objectives for the "Science Fiction" unit are outlined in Table 1.

4.6 Operational procedure

Taking the teaching design of the first reading material from the "Science Fiction" unit, "*Satisfaction Guaranteed (Adapted)*," which is a short story consisting of nine paragraphs, as an example, this section explores how to achieve deep learning with the assistance of AI in the teaching of specific texts. In the teaching process, it is essential to construct a series of interconnected and progressively advanced questions to lead students from basic comprehension to deeper analysis, to facilitate the development of a structured knowledge framework and to achieve the objectives of deep learning. The question chain for the reading teaching of "*Satisfaction Guaranteed (Adapted)*" is presented in Figure 2.

4.6.1 Lead-in session

Teacher can use the AI-generated content (AIGC) technology in the Midjourney website[1] to visually present key concepts in reading material so as to enhance the students' learning experience. By transforming textual information into visual representations, AIGC effectively attracts students' attention and fosters deeper engagement. Accompanying these visuals, the teacher can raise guiding questions to introduce the topic, such as:

Q1: What can you see in these pictures or videos?

Q2: What do you think robots are used for in today's world?

Q3: Do you think robots can help with household tasks? Why or why not?

Through these visuals and targeted questions, students are drawn into the theme of "robots and artificial intelligence," activating their prior knowledge and experiences. This process encourages students to make connections between existing knowledge and new concepts, exemplifying the "association & structure" aspect of deep learning in reading instruction.

4.6.2 Knowledge acquisition session

In this session, the teacher should play a crucial role in facilitating students' comprehension of the text and building a coherent knowledge framework. While AI excels at providing access to a wide range of reading materials and data analyses, it cannot replace the teacher's flexibility in instruction, humanistic care, and ability to strengthen foundational skills. The teacher can design targeted questions to guide students to deeper understanding of the text, such as:

Q4: What are the main characters and their relationships in this story?

Q5: What is Claire's feeling towards Tony?

Q6: How did Claire's feelings towards Tony change over time? What caused this shift?

The process begins with a preliminary reading that helps students identify key characters and relationships, establish the basic structure of the story, and grasp the main idea of the text. Building on this foundation, targeted questions guide students in analyzing the characters' motivations and emotional shifts. This progression from Q1 to Q6 promotes a deeper understanding of new knowledge, improves students' ability to connect textual details, analyze cause-and-effect relationships within the plot, and encourages multiple interpretations of the passage.

1 https://www.youchuan.cn/

TABLE 1 Comprehensive teaching objectives for the "Science Fiction" unit.

Class period	Teaching section	Teaching type	Teaching objectives
Period 1–2	Reading and thinking	Reading lesson	First, the teaching aims to cultivate students' understanding of the science fiction genre. Second, it aims to guide students in analyzing character relationships and extending the story based on the text. Third, it aims to improve students' abilities in summarization and reasoning through text analysis, foster creative thinking, and explore the thematic significance of human-robot relationships.
Period 3	Learning about language (build up your vocabulary)	Vocabulary lesson	The teaching aims to improve students' vocabulary acquisition by increasing their ability to interpret vocabulary and sentences in context, encourage students to build a network related to "technology" using word formation skills, and expand their investigation of robots and artificial intelligence.
Period 4	Learning about language (review useful structures)	Grammar lesson	The teaching aims to guide students in analyzing and summarizing the grammatical structures within the text to understand the functions and usage of the passive voice, thereby reviewing and reinforcing the use of passive voice in verbs.
Period 5	Using language (voice your opinions on robots and AI)	Listening and speaking lesson	The teaching aims to use listening materials to guide students in understanding experts' views on robotics development and analyzing the renowned *Three Laws of Robotics*. Students are encouraged to reflect on the development of AI in relation to the text and to express their personal views through discussion.
Period 6	Using language (write a sci-fi short story)	Reading and writing lesson	The teaching aims to guide students in organizing the chronological sequence of the text, and learning rhetorical devices. Students are encouraged to continue or create "time travel" stories, and share with the class. Revision suggestions are provided through collaborative learning.
Period 7	Assessing your progress	Review lesson	The teaching aims to guide students in evaluating the unit content and engaging in self-reflection, including constructing knowledge frameworks and assessing their mastery of specific concepts, as well as gaining deeper insights into the thematic significance. Student performance is assessed, and improvement plans are developed to enhance future learning outcomes.
Period 8	Project: design a robot or an AI device & video time	Extension section	The teaching aims to encourage students to broaden their perspectives, develop the ability to apply knowledge comprehensively, stimulate critical and creative thinking, and deepen their understanding and application of the "robots and artificial intelligence" theme.

Overall Unit Objective: In this unit, students will engage in a dialectical understanding of science fiction and technological development to explore the theme of robots and artificial intelligence. Through this process, students will develop personal insights, apply acquired knowledge to enhance comprehensive application skills, expand interdisciplinary perspectives, and cultivate multi-dimensional thinking abilities.

In addition, teacher can employ AI as an assistant to create visual tools, such as mind maps. With the help of ERNIE Bot, an AI tool that rewrites the structure of the text into Markdown format, using Markmap,[2] the text can be transformed into a mind map, or a generative AI such as Chat-GPT can also be used to directly generate a mind map. This process intuitively organizes the key information and logical relationships in the text, helping students understand the structure of the text more clearly, facilitating in-depth analysis and improving learning efficiency as well as comprehension capability. Figure 3 shows a structured text-based mind map generated by AI.

The integration of teacher-led guidance and AI-assisted visualization ensures students gain a profound understanding of foundational concepts, and efficiently outlines a clear knowledge framework, reflecting the "association & structure" characteristic of deep learning.

4.6.3 Comprehension and internalization session

By guiding students in the transformation of knowledge from "comprehension" to "internalization," the teacher can help students achieve long-term learning outcomes in terms of meaning construction, emotional engagement, and critical analysis. The teacher facilitates re-reading by posing guiding questions such as:

Q7: What are the similarities and differences between Tony and a human being?

Q8: To Claire, was Tony more like a household robot, or a friend or even a lover?

Students are then encouraged to use comparative charts to analyze the differences and similarities between robots and humans in terms of appearance, emotional expression, and social roles, as shown in Figure 4.

This comparative analysis helps students systematically organize textual information, while also prompting deeper reflection on whether AI possesses human-like emotions, social attributes and roles in society. Revisiting the previous questions, the teacher guides students to explore multiple aspects of human-AI dynamics, which not only achieves the teaching objectives of in-depth textual comprehension and affective internalization, but also prompts students to reflect on the broader relationship between human society and technological development. By encouraging students to articulate

2 https://markmap.js.org/repl

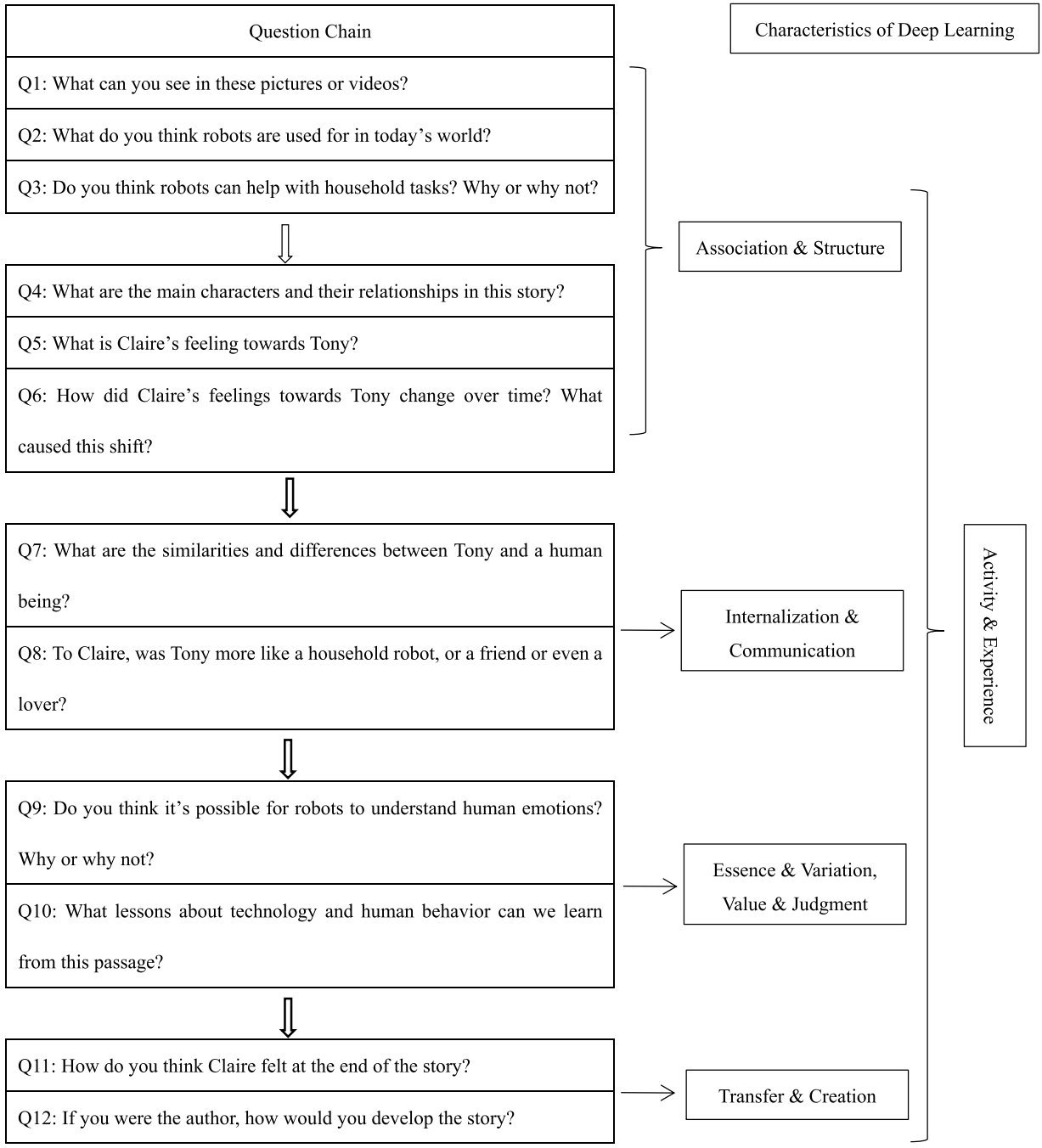

FIGURE 2
Question chain for the reading teaching of *"Satisfaction Guaranteed (Adapted)"*.

personal insights through the learning activities, students can consciously apply the knowledge they have acquired, embodying the "internalization & communication" aspects of deep learning.

4.6.4 Deep learning session

In this session, the teacher facilitates in-depth analysis through exploratory collaboration and group discussion. In collaborative learning, students are divided into groups and are required to take on different roles within the group, such as leader, summarizer, reporter, and timekeeper. The process is initiated through questions such as:

Q9: Do you think it's possible for robots to understand human emotions? Why or why not?

Q10: What lessons about technology and human behavior can we learn from this passage?

It is noteworthy that the innovative approach of integrating text or voice dialogues with generative AIs such as Chat-GPT, Deepseek, Doubao AI, etc., during the teaching process, goes beyond the conventional questioning methods and provides students with unique perspectives, effectively transforming the traditional model of simple

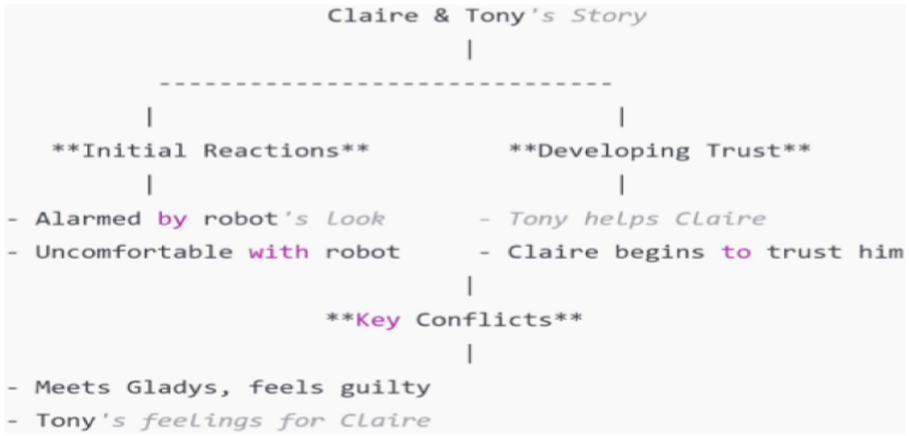

FIGURE 3
AI-generated text structure mind map.

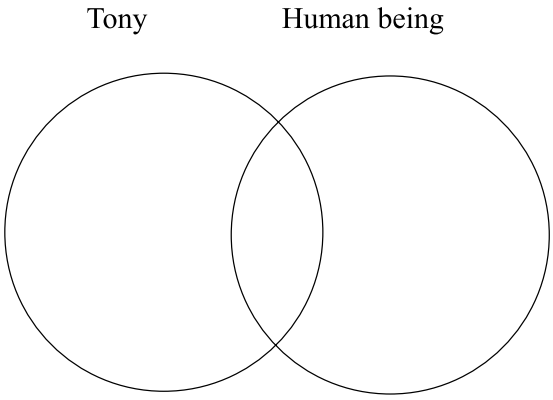

FIGURE 4
Differences and similarities between the robot Tony and humans.

teacher-student interaction. Through this collaborative process, students are inspired to develop a deeper understanding of the text, assess characters' behavior from multiple aspects, and foster the development of sound values. This phase highlights the "essence & variation" and "value & judgment" of deep learning, providing students with a more profound learning experience.

4.6.5 Summary and review session

The students retell the story while the AI group presents versions generated by generative AI such as Chat-GPT, Deepseek, and Doubao AI. This format promotes engagement and interactivity, stimulating competition while encouraging reflection on the strengths and limitations of AI in language processing. The comparison the two versions enables students to identify similarities and differences in language expression and structure, thus enhancing their organization and expression skills.

Following the competition, questions such as, "Q11: How do you think Claire felt at the end of the story?" and "Q12: If you were the author, how would you develop the story?" are used to facilitate discussion and assign follow-up writing assignments to help students further examine the complexities of the AI-human relationship. In addition, AI technologies such as Youdao Writing can further support this process by providing automated grading and personalized feedback on students' assignments to improve efficiency and pinpoint their weaknesses, thus enhancing both language acquisition and instructional effectiveness.

These activities integrate competition and creative tasks, fostering knowledge transfer and innovative application. The retelling competition promotes synthesis and presentation of learned content, while writing assignments encourage narrative expansion and exploration of the development plot. By externalizing learning outcomes, students demonstrate their ability to transfer and apply knowledge, reflecting the "transfer & creation" of deep learning.

4.7 Teaching assessment

This study designed a multidimensional evaluation system covering both formative and summative scores, combining different approaches to comprehensively measure students' performance on multiple dimensions. The effectiveness of this teaching model in improving deep learning outcome is verified by the comparison with non-AI teaching data.

Prior to the experiment, a control data set is established by reviewing students' evaluation in a non-AI-assisted environment. During the experiment, different evaluation approaches and tools are set up according to the teaching session. In terms of self-assessment, students rate and reflect on task completion, collaboration, participation, and motivation through self-assessment scale and post-class questionnaires, enhancing self-directed learning. Peer assessment focuses on the session of classroom discussion and group collaboration, where mutual feedback is given on attitude, clarity, and creativity according to the group mutual assessment scale, promoting teamwork and critical thinking. Teacher assessment consists of classroom observation and following-up quizzes. The former rates students' participation, language use, attitudes, and collaboration, while the latter mainly assess students' mastery of classroom knowledge. AI-assisted evaluation utilizes Youdao Writing to assess language mastery and creativity of students' writing outputs with quantitative feedback, improving assessment efficiency and accuracy while reducing grading biases.

Although different assessment approaches measure different dimensions and have different focuses, thus having different specific

TABLE 2 Quantitative analysis of pre- and post-intervention scores.

Evaluation dimension	Average score (pre)	Average score (post)	Score variation	Significance (p-value)
Language proficiency	6.5	8.0	+1.5	<0.05
Classroom engagement	5.8	7.5	+1.7	<0.01
Teamwork skills	6.0	7.2	+1.2	<0.05
Creativity and expression	6.3	7.8	+1.5	<0.05
Learning motivation and autonomy	5.5	7.0	+1.5	<0.05

evaluation criteria, they follow a uniform rating scale in general. Each dimension is scored out of 10, and the specific scoring intervals as well as the levels are as follows. A score of 9–10 indicates excellency, a score of 7–8 is fairly good, and a score of 5–6 is considered partially mastered. A score of 3–4 is considered weakly mastered and a score of 1–2 means that the student has little or no mastery of the core elements covered by the dimension. All assessment data are processed and statistically analyzed in a uniform quantitative manner and data comparison is made to verify the scientific validity and credibility of the instructional model combined with cross-validation mechanisms. The results are shown in Table 2.

Based on the statistics, the application of AI has significantly contributed to enhancing students' language proficiency, cognitive development, and the transfer as well as creation of knowledge across multiple dimensions, effectively advancing the goals of deep learning. Cross-validation of data reveals consistency among self-assessment, peer assessment, teacher assessment, and AI-assisted evaluation, demonstrating the efficacy of AI in fostering multidimensional skill development. AI tools improved grammatical accuracy, vocabulary usage, and language expression at language proficiency level, and strengthened teamwork skills, fostering collaboration and collective responsibility. Classroom engagement showed a statistically significant increase ($p < 0.01$), supporting language output and cognitive development, and students' language expression demonstrated increased diversity and creativity, contributing to the development of creative thinking. Personalized learning paths and real-time feedback enabled students to take greater control of their learning progress, enhancing intrinsic motivation.

5 Innovations and limitations

Many AI-based educational models remain theoretical, emphasizing holism and systematization but lacking operability, limiting practical applicability. Integration of technology and pedagogy is often insufficient, with AI applications confined to supplementary teaching tasks rather than full involvement in instructional processes. In addition, existing models tend to prioritize data analysis and behavior tracking over the development of students' higher-order thinking competencies.

To address these deficiencies, this study proposes an AI-assisted teaching model grounded in deep learning theory, systematically designed across various dimensions. It integrates AI technology throughout the teaching process, and incorporates unit-based teaching that emphasizes systematic knowledge acquisition and coherence to prevent fragmented learning. A multidimensional evaluation system ensures reliability through cross-validation. The model prioritizes active student engagement through challenging tasks to cultivate higher-order thinking, and by adopting a problem-solving approach, it develops core competencies, encouraging students to transfer disciplinary knowledge to practical applications, and emphasizes cognitive processes and methodologies to foster innovative thinking.

Despite the advantages of the teaching model, there are still limitations. From the perspective of model generalization, limited by the small sample size of this study, its generalizability still needs to be verified through a larger range of practices. The limitations of technical conditions and the dependence of teachers and students on traditional teaching methods may also affect the smooth implementation and widespread popularization of the model. Most importantly, AI technology has raised concerns about data privacy and security, so educational institutions need stricter data protection standards to address potential risks.

In order to address these limitations, it is possible to expand the sample size and conduct controlled trials through diverse pilots in different schools, combining AI-assisted teaching with traditional approaches to improve acceptance, and optimizing the teaching design as well as operation process in a timely manner based on feedback and results, so as to realize the wide application of the model.

6 Conclusion

This study, grounded in deep learning theory, proposes a novel AI-driven model for Chinese high school English reading instruction, offering valuable insights to address the fragmentation and superficiality issues inherent in traditional teaching methods. By constructing a comprehensive framework from theoretical foundation to instructional evaluation, this research emphasizes the potential of AI in holistic unit-based teaching.

The findings highlight that AI technology optimizes instructional models while fostering students' deep learning and higher-order thinking skills. The proposed model demonstrates applicability and transferability, providing a framework for improving education in diverse contexts. However, practical implementation necessitates further large-scale, cross-cultural empirical studies to ensure scientific validity and universal applicability. Challenges include technological dependency, data privacy, and ethical concerns, alongside the need for redefining teachers' roles and enhancing their professional competencies.

Future research should focus on balancing technological innovation with ethical considerations and enhancing the integration of AI and deep learning. Larger-scale empirical studies might

be conducted to support the model's wider application, contributing to improved educational equity and quality.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

YL: Investigation, Writing – original draft. CQ: Conceptualization, Methodology, Project administration, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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