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Research on the Mechanism of Improving English Teachers' Instructional Design Competence with Generative AI Support

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Abstract: With the rapid development of artificial intelligence, generative AI technology has provided a new path for enhancing the teaching design capabilities of English teachers. Instructional design ability encompasses task analysis, learner research, content organization, and resource innovation, and it is an important indicator for measuring teachers' professional growth. At present, English teachers still face many challenges in goal setting, learner analysis, and technology integration. Generative artificial intelligence, with its features such as knowledge generation, semantic analysis, and multimodal expression, can provide task support, resource recommendation, and creative assistance in instructional design, promoting the transformation of instructional design from experience-driven to data-driven. Based on the theory of teachers' professional ability development, this paper constructs an enabling mechanism for instructional design supported by generative artificial intelligence. It explores the mechanism and implementation path of AI promoting the professional development of English teachers from four dimensions: task alignment, learner modeling, teaching structuring, and multimodal content generation.

Keywords: Generative artificial intelligence; Instructional design competence; English teachers

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1. Introduction

Instructional design ability refers to the ability of teachers to integrate subject knowledge, teaching concepts, and learner characteristics to formulate effective teaching plans. In the era of artificial intelligence, the teaching design process of English teachers can no longer rely solely on personal experience, but should leverage intelligent technologies to achieve the precision, innovation, and personalization of teaching plans. Generative artificial intelligence technologies, such as ChatGPT and Copilot, have demonstrated significant advantages in language understanding, text generation, and multimodal interaction, providing teachers with comprehensive support ranging from teaching analysis to content creation. However, how to effectively integrate generative artificial

intelligence technology into the instructional design system and transform it into a driving force for enhancing teachers' professional capabilities is a key research issue that urgently needs to be addressed. This article aims to explore the mechanism of artificial intelligence in enhancing the teaching design ability of English teachers through theoretical analysis and the construction of a practical framework, and to reveal the new model of artificial intelligence assisting teachers' professional development.

2. Theoretical foundations and conceptual framework

2.1. The connotation and evaluation dimensions of instructional design competence

Instructional design ability is a core skill for teachers to achieve teaching objectives, plan content, and arrange processes, involving the effective integration of educational concepts, subject knowledge, and technical tools [1]. This ability focuses on building a purposeful and well-structured learning system based on the characteristics of learners to achieve the best learning outcomes. Its key assessment dimensions cover task decomposition, learner characteristic analysis, content arrangement, strategy integration, and resource innovation. Outstanding teaching design ability is not only reflected in the logical consistency of teaching activities but also in the scientific and reflective nature of the design process [2].

In today's educational environment, the ability to design teaching not only involves teachers' response to the rapid changes in the digital learning environment, but also includes the ability to integrate cutting-edge technologies such as artificial intelligence, big data, and virtual reality into the teaching system [3]. Teachers need to have the ability to interpret learner data analysis, effectively manage multimodal information, and build dynamic feedback mechanisms to ensure the continuous optimization and improvement of the learning process [4]. Therefore, instructional design ability embodies the integration of knowledge, reflection, and innovation, enabling teachers to combine teaching practice with evidence-based learning insights and thus achieve continuous progress in professional development in an intelligent and data-driven educational ecosystem.

2.2. Theoretical perspectives on teacher professional competence development

The improvement of teachers' professional capabilities is a dynamic development process that integrates knowledge, skills, and reflection. Based on constructivist learning theory, a teacher's professional growth stems from continuous practice and the reconstruction of experience. The "Teaching Content Knowledge" framework proposed by Shulman emphasizes the integration of subject-specific knowledge and teaching strategies, which is regarded as the core of teachers' professional development [5]. The theory of agency emphasizes the autonomy and creativity of teachers in instructional design, holding that teachers achieve personal growth through situational awareness and problem-solving. From a social and cultural perspective, the cultivation of teachers' capabilities relies on social support systems and knowledge-sharing environments, emphasizing the importance of collaboration and construction.

The ecosystem theory offers an overall perspective, viewing teachers' professional capabilities as an adaptive process formed through the interaction of individual, institutional, and technological factors. This theory points out that teachers' professional development is achieved through continuous interaction with a dynamic environment, which constantly reshapes their cognitive structure and professional form [6]. With the application of artificial intelligence in the field of education, related theories have been further expanded. Technology is regarded as a collaborative subject for ability construction, and this process has continuously promoted the improvement of educational innovation and reflection capabilities.

2.3. Characteristics of generative AI and its application potential in education

Generative artificial intelligence, relying on deep learning and natural language processing technologies, possesses core capabilities such as semantic parsing, content creation, and multimodal presentation. This technology simulates human cognitive processes and is capable of generating knowledge content and performing complex operations. In the field of education, the application potential of generative artificial intelligence mainly lies in generating teaching resources, assisting in curriculum design, and providing personalized learning support [7]. By analyzing learners' data, this technology can provide real-time feedback and dynamically optimize teaching content and strategies. Its openness and innovation have driven the transformation of teaching models, from the traditional passive knowledge transmission to intelligent collaborative learning.

Generative artificial intelligence transcends the realm of traditional automation and introduces a new paradigm of "human-machine co-intelligence", in which human creativity and machine reasoning capabilities collaborate and evolve together. This technology can simulate the complexity of language, visualize abstract concepts, and create contextualized tasks that adapt to the cognitive level of learners. In addition, by providing scalable adaptive resources and multilingual support, progress in educational equity has been promoted [8]. When AI is scientifically and carefully integrated into the teaching process, a fundamental transformation of educational practice has been achieved in the digital age.

3. Problems in the development of English teachers' instructional design competence

3.1. Vague task awareness and inaccurate goal articulation

Many teachers lack systematic task analysis awareness and often equate instructional tasks with content delivery rather than outcome-based design. This misunderstanding reduces instructional design to mere content sequencing, neglecting the underlying logic of learning progression. Instructional goals are typically broad, vague, and difficult to evaluate, resulting in weak alignment with curriculum standards. The failure to distinguish among the three levels of "knowledge acquisition", "ability formation", and "affective attitude" leads to fragmented instructional intentions and unfocused classroom practices [9]. In addition, teachers often overlook measurable behavioral indicators, causing objectives that are theoretically sound but operationally weak. Consequently, lesson plans lose coherence and alignment between objectives and assessment standards. **Table 1** presents the major issues English teachers face in task analysis and goal setting.

Table 1. Current situation of English teachers' goal articulation in instructional design

Analytical Dimension	Main Performance	Existing Problems	Percentage (%)
Task Analysis	Reliance on personal experience	Lack of systematic task structure	62
Goal Statement	Vague, inoperable expression	Misalignment with curriculum standards	58
Goal Hierarchy	Overly general	Lack of differentiation	54
Outcome Orientation	Low measurability	Difficulty assessing effectiveness	49

The data reveal a structural bias in goal setting during the early design stage. The absence of precise task analysis and measurable objectives constrains instructional quality, leading to inconsistencies between intended outcomes and actual classroom execution.

3.2. Disconnection between learner analysis and content organization

Scientific instructional design relies on accurate learner analysis, yet teachers often neglect systematic evaluation of learners' language proficiency, cognitive styles, and motivational factors. Learner profiling typically depends on intuition or previous experience, lacking the support of data-driven tools or continuous observation. As a result, instructional content remains textbook-centered, with limited adaptation to learners' actual needs or specific contexts. Content organization often fails to reflect the appropriate cognitive load or progression for different learner groups, leading to homogeneous task design that struggles to maintain engagement [10]. The imbalance between factual input and communicative application weakens the development of language competence. Moreover, inadequate feedback mechanisms prevent teachers from adjusting teaching materials in a timely manner, creating a persistent disconnect between instructional content design and learner responsiveness. This gap not only undermines learning effectiveness but also restricts the development of personalized instruction.

3.3. Weak integration of pedagogical strategies and educational technologies

Teachers' understanding of the integration between pedagogical strategies and educational technologies remains limited, constrained by the traditional belief that "technology merely serves as a teaching aid." This perception restricts the transformative potential of educational technology in the teaching process. At present, the application of digital tools is largely confined to basic functions such as slide presentations and video playback, without being deeply integrated into inquiry-based learning, collaborative learning, or formative assessment strategies. Classroom interaction and feedback rely primarily on verbal explanations and manual grading, while the use of intelligent tutoring systems and AI-based analytical tools remains minimal. Insufficient digital literacy among teachers, along with a lack of methodological adaptability, leads to inconsistent outcomes in technology implementation across different classrooms. In the absence of a systematic strategy–technology integration framework, learning experiences tend to be fragmented, and technological resources fail to form meaningful connections with instructional objectives. This weak integration not only hinders instructional innovation but also limits teachers' ability to build sustainable, technology-enhanced teaching models.

3.4. Insufficient innovation in instructional material design and delivery

Teachers have a high degree of reliance on existing teaching materials and standardized teaching platforms, and other resources, but lack initiative and creativity in the design and contextual reconstruction of teaching resources. The current teaching materials are mainly composed of texts and audio-visual materials, lacking interactive or exploratory resources that can stimulate learners' initiative and desire to explore. Teachers' multimodal integration ability is relatively weak, which leads to the teaching content presenting static and non-contextualized characteristics, making it difficult to evoke emotional resonance and genuine communication experiences among learners. In the process of resource development, the problem of insufficient collaboration also leads to content duplication and low development efficiency. **Table 2** summarizes the main problems existing in the design and implementation of English teaching resources.

Table 2. Current situation and problems in English instructional resource design

Resource Type	Usage Characteristics	Existing Problems	Percentage (%)
Textbook-based	Fixed structure	Limited adaptability	67
Online resources	Dispersed sources	Inconsistent quality	59
Multimodal resources	Low application ratio	Poor integration	52
Self-developed resources	Limited quantity	Lack of innovation	61

Overall, English teachers' instructional resource development demonstrates insufficient creativity, poor feedback mechanisms, and inadequate technological integration. This lack of innovation constrains instructional flexibility and prevents the formation of dynamic, data-informed material ecosystems.

4. Construction of an AI-supported empowerment mechanism for instructional design

4.1. Task analysis and alignment with curriculum standards

Task analysis serves as the foundational component of instructional design and a key focus of AI empowerment. Compared with traditional methods that rely on subjective experience, generative artificial intelligence utilizes semantic parsing and curriculum text mining to automatically interpret curriculum standards and achieve intelligent alignment of learning objectives. Through the application of natural language processing (NLP) technology, AI can identify keywords, competence goals, and contextual requirements within instructional tasks, thereby establishing semantic mappings between instructional objectives and curricular expectations. The analytical reports generated by AI clearly display task hierarchies, competence correspondences, and alignment scores, assisting teachers in constructing scientifically sound instructional plans. At the same time, AI provides diagnostic visualization dashboards that intuitively reveal discrepancies between instructional tasks and national curriculum standards, helping teachers adjust task difficulty and cognitive depth. In addition, through predictive analytics, AI systems can leverage historical data and large-scale datasets to estimate the likelihood of task configurations achieving intended learning outcomes. This transforms instructional design into a feedback-driven optimization system that emphasizes goal coherence, task relevance, and assessment validity.

AI technology ensures both vertical and horizontal alignment of instructional objectives, promoting progressive learning development across grade levels while maintaining consistency among curriculum modules. By simulating "what-if" scenarios, teachers can use AI to analyze and refine learning objectives, exploring how adjustments affect the cognitive and linguistic complexity of tasks. **Table 3** provides a detailed overview of AI-supported task analysis and curriculum alignment.

Table 3. AI-supported mechanism for task analysis and curriculum alignment

Stage	AI Support Technology	Core Function	Expected Outcome
Curriculum Standard Parsing	NLP	Extracts key competence indicators	Clarifies instructional orientation
Task Semantic Analysis	LLM	Matches objectives with learning tasks	Enhances goal precision
Structural Reconstruction	Task clustering algorithm	Builds logical task hierarchy	Optimizes instructional pathways
Alignment Feedback	Intelligent calibration model	Provides compliance analysis	Ensures standard consistency

As shown in the table, the semantic parsing and automatic matching capabilities of AI transform task design from subjective inference to intelligent calibration, thereby enhancing the scientific rigor and consistency of goal formulation.

4.2. Learner modeling and intelligent resource recommendation

Artificial intelligence-driven learner modeling technology integrates multi-dimensional data such as learning

logs, assignment performance, and language output to construct models that reflect the dynamic changes and personalized characteristics of learners. By leveraging cluster analysis, emotion recognition, and feature extraction algorithms, AI systems can accurately identify learners' language proficiency, learning motivation, cognitive tendencies, and emotional states, achieving fine stratification of learners. On this basis, the AI system recommends customized teaching resources and adjusts the way tasks are presented based on the specific characteristics of learners to ensure that they are in line with the learners' learning readiness and participation patterns. Meanwhile, teachers can monitor the learning process in real time through the intuitive data panel generated by AI, identify bottlenecks in the learning process, and provide targeted assistance.

The significant advantage of AI lies in its ability to achieve continuous adaptive adjustments through real-time data updates. When learners' performance changes, the system will automatically adjust resource recommendations and learning paths to ensure personalized teaching while maintaining consistency in instruction. This dynamic response mechanism enables teachers to conduct predictive analysis of potential learning difficulties while carrying out large-scale personalized teaching, and to implement early intervention before the learning gap widens. The intelligent recommendation model ensures the suitability of teaching resources by integrating knowledge graph technology with weighted evaluation mechanisms. When choosing teaching materials, these models comprehensively consider the complexity of language, cultural relevance, and multimodal characteristics, thereby supporting the balanced relationship among "content—learner—goal." By integrating AI analysis into instructional design, teachers can transform traditional static teaching plans into an adaptive learning ecosystem that continuously evolves along with the cognitive and emotional development of learners.

4.3. Instructional process structuring with embedded AI toolkits

The embedded artificial intelligence toolkit provides systematic support throughout the entire instructional design process, building a comprehensive platform for teachers that covers teaching planning, execution, and reflection. These toolkits significantly enhance the efficiency of instructional design by automating key steps such as task decomposition, instructional script writing, activity sequencing, and the collection of formative feedback. By using the prompt engineering interface, teachers can generate or optimize teaching scripts to ensure they match the teaching language and cognitive goals. AI can automatically detect logical contradictions in course design and provide real-time optimization suggestions, helping teachers maintain high accuracy and consistency in their designs without the need for extensive manual adjustments. The structured design of the teaching process supported by AI also enables teachers to conduct iterative experiments: teachers can simulate different teaching activity design schemes and view their prediction results in real time. This process combines human professional wisdom with machine intelligence to ensure dynamic consistency and flexible adaptation among teaching objectives, teaching activities, and evaluation standards.

The data-driven structured instructional design model effectively reduces the randomness of teaching, enhances the logical coherence of teaching content, and significantly promotes the improvement of teachers' reflective ability. This model prompts the role of teachers to shift from the traditional "knowledge transmitter" to the "designer of learning systems", leading teaching practice towards a more analytical and evidence-based direction.

4.4. Multimodal content generation and creative expression enhancement

The multimodal capabilities of generative artificial intelligence have opened up unlimited possibilities for

the innovation of teaching content. By integrating text, images, audio, and video elements, AI can construct comprehensive teaching materials, thereby forming immersive language learning tasks and significantly enhancing the interactive experience in the classroom. Teachers can achieve a smooth transition from knowledge imparting to language application by leveraging AI-generated images, short videos, and voice materials. In terms of text creation, speech synthesis, and image construction, the synergy effect of AI technology has transformed teaching content from one-way transmission to two-way interactive experiential learning.

The multimodal generation technology of AI has enriched the forms of teaching expression and promoted teachers' innovative practice and contextualized teaching design in language teaching. **Table 4** shows the application of generative AI in the design of multimodal teaching content.

Table 4. Applications of generative AI in multimodal instructional content design

Modality	Typical Tools	Application Scenarios	Instructional Value
Text Generation	ChatGPT, Claude	Producing scripts and dialogue tasks	Enhances creativity and fluency
Image Generation	Midjourney, DALL·E	Designing visual contexts	Improves engagement and comprehension
Audio Generation	ElevenLabs, VALL-E	Creating listening and speaking tasks	Optimizes auditory learning
Video Generation	Synthesia, Runway	Developing micro-lessons and cultural scenes	Enriches expression and cultural depth

The data in the table indicates that the multi-modal generation capability of AI has effectively enhanced the expressiveness and interactivity of teaching materials, transforming English teaching from a single text to a comprehensive experience that integrates vision and hearing, and promoting the expansion of teachers' creative teaching design capabilities.

5. Conclusion

The integration of generative artificial intelligence provides a systematic and intelligent pathway for enhancing English teachers' instructional design competence. AI technology effectively empowers key stages such as task analysis, learner modeling, instructional process optimization, and multimodal content generation, driving a transformation from experience-based to data-driven instructional design. With AI assistance, teachers can accurately define instructional objectives, flexibly adjust content, and optimize resource allocation, thereby strengthening the scientific rigor and creativity of instructional design. The application of AI not only reshapes the logical framework of instructional design but also supports teachers in establishing a continuous, reflective professional development model. Looking ahead, it is essential to deepen the integration of technology while reinforcing ethical considerations and evaluation mechanisms to ensure the sustainable advancement of instructional design.

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