

AI for Enhancing English Lesson Design and Pedagogy in Chinese Middle Schools

Wei Zhang
Daugavpils University
Daugavpils, Latvia
Annazhangwei@outlook.com

Dzintra Ilisko
Daugavpils University
Daugavpils, Latvia
dzintra.ilisko@du.lv

Abstract — AI-empowered English lesson design and pedagogy is potentially reconstructing educational practices in middle schools in China. While AI was previously infrequently used in the field of curriculum design, the introduction of tools like Deep Seek have ignited a wave of major innovation. The literature review distills insights from 70 empirical and theoretical studies to identify trends in AI-driven personalized learning, adaptive assessment, and novel instructional design. English teachers are one of education's greatest change agents for decades who are using Deep Seek in tandem with multimedia authoring tools for creating dynamic and engaging lessons. Many private schools, especially in Sichuan province, have also started to use "AI-assisted learning" models, and educational bureaus and large-scale competitions have further encouraged this new development. However, challenges like misalignment with curriculum, ethical problems, and the need for teacher professional development continue. Policy recommendations include adopting a future orientation and promoting training.

Keywords- AI, Chinese middle school, Deep Seek, personalized education

I. INTRODUCTION

AI has revolutionized many industries and is becoming ever more prevalent in education. Innovative AI tools have been challenging traditional English lesson design methods in Chinese middle schools. While AI application in classrooms had previously been limited, recent developments, such as Deep Seek integrated desktop system have enabled teachers to generate dynamic instructional materials by the use of auto-updated PPT tools, multimedia editors, and audio-visual integration. English as a subject that led the way in educational reform, and now teachers are experimenting with AI-driven instruction that speaks to 21st-century learners in a deep and meaningful way. This review summarizes findings across 70 articles and identifies trends in AI-enabled personalized learning, adaptive assessments, and collaboration between teachers and AI,

emphasizing the trans-formative implications of these technologies for the delivery of English language lessons in China [1],[2].

II. MATERIALS AND METHODS

A systematic literature search was carried out by exploring multiple academic databases (Web of Science, ERIC, and IEEE Explore) for studies published from 2010 to 2024. Inclusion criteria included empirical and theoretical studies addressing the incorporation of artificial intelligence into educational systems, especially within secondary schools teaching the English language. Related studies on AI-supported lesson design, personalized learning, and teacher - AI collaboration were selected (n = 70). Qualitative thematic analysis was used alongside quantitative bibliometric techniques to ascertain key trends and challenges. The main categories drawn from the research include AI-facilitated curriculum design by the use of such tools as Deep Seek applications, instructor readiness and professional training, AI-powered evaluation schemes, and ethical and infrastructural concerns. Data were manually coded, and results were narratively synthesized to reflect the evolving nature of AI-enhanced pedagogy in both Chinese and international contexts.

III. RESULTS AND DISCUSSION

A. Global and Chinese Applications of AI in English Teaching

The use of Artificial Intelligence for English language teaching (ELT) is on the rise globally, with the emergence of intelligent tutoring systems, automated assessment tools, and generative language models [3], [4]. In Western contexts, AI is mostly applied for providing formative feedback, improving writing skills,

Online ISSN 2256-070X

<https://doi.org/10.17770/etr2025vol3.8562>

© 2025 The Author(s). Published by RTU PRESS.

This is an open access article under the [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

and customized grammar practice [5], [6]. In China, the rapid adoption of AI in education has been driven by national policies, especially after the introduction of the “Smart Education of China” initiative in 2021. English teaching has become a testing ground for AI tools such as automated essay scoring systems, speech recognition, and pronunciation correction software [7], [5]. However, uptake at scale remains uneven. AI-augmented programs are more often developed in urban schools as opposed to rural ones, where infrastructure is limited. Government pilot programs tend to start in well-resourced private or model schools, which also have better teacher development support. The recent arrival of Deep Seek has made AI lesson planning more approachable. For example, in provinces such as Sichuan, schools are piloting AI as a “companion teacher” during writing instruction, speaking practice, and feedback on assessments. These trends represent the beginnings of a pedagogical shift but are stymied by issues of access, teacher training, and evaluation infrastructure. These trends are summarized in Table 1 below.

Table 1 provides a broad overview comparing global and Chinese perspectives on AI-supported English teaching. To further illustrate these comparisons in greater detail and highlight specific insights from multiple researchers, Table 2 offers a thematic breakdown emphasizing various authors' viewpoints on key aspects of AI integration.

TABLE 1. COMPARISON OF GLOBAL VS. CHINESE PERSPECTIVES ON AI-SUPPORTED ENGLISH TEACHING

| Aspect | Global Perspective | Chinese Perspective |
|------------------------------------|---|---|
| Focus of AI usage in ELT | Primarily used for enhancing formative learning: providing feedback on writing, grammar practice, and other language skills improvement in classroom or tutoring contexts. | Employed for exam-oriented tasks and language drills: e.g., automated essay scoring, pronunciation correction, and speaking practice, aligning with curriculum goals. |
| Policy and support | No unified national policy exists in many Western countries; instead, integration is often guided by school- or district-level initiatives and international frameworks, such as the UNESCO AI in Education guidelines [8]. | Since 2021, China has demonstrated strong top-down support for AI integration through national initiatives such as the Smart Education strategy, which encourages AI adoption in teaching. Local education bureaus have followed up by actively piloting AI programs [4]. |
| Adoption and infrastructure | Gradual and varied adoption; well-resourced schools and universities often lead, but many institutions still in | Rapid but uneven adoption; urban and private schools implement AI tools more readily, while rural schools lag due |

| Aspect | Global Perspective | Chinese Perspective |
|--------------------------|--|--|
| | exploratory phase. | to limited internet and hardware infrastructure. |
| Examples of tools | Intelligent tutoring systems, writing assistants (e.g., grammar checkers, essay scoring like ETS's e-rater) are used for practice and assessment in some contexts. | Domestic AI tools (e.g., Deep Seek) integrated into lesson planning; Chinese-developed apps for English learning (writing and speaking) are being trialed in classrooms. |

TABLE 2: COMPARISON OF KEY THEMES IN SUPPORTED ENGLISH TEACHING (GLOBAL VS. CHINESE CONTEXTS), HIGHLIGHTING WHAT DIFFERENT RESEARCHERS EMPHASIZE FOR EACH ASPECT OF INTEGRATION

| Aspect | Global Perspectives | Chinese Perspectives |
|---------------------------------------|---|--|
| AI-supported lesson design | AI is used to co-create engaging learning materials and activities. Studies report improved student outcomes (e.g., better writing complexity) when AI tools like chat-bots or intelligent tutors assist in lesson tasks [9], [3]. Researchers emphasize the creative potential of AI to generate diverse language exercises and provide multimedia content, while also noting the need for teachers to vet AI-generated materials for quality and curricular fit [1], [2]. | Teachers are incorporating AI tools such as Deep Seek to design English lesson content, including writing prompts and dialogues, making lessons more interactive. [10], [11]. Preliminary evidence from pilot programs suggests that AI-designed tasks can enhance student engagement and support differentiated instruction [12], [13]. However, Chinese educators emphasize the importance of aligning AI-generated materials with national curriculum standards and maintaining teacher oversight to ensure educational relevance [13]. |
| AI-driven formative assessment | AI tools, such as automated essay scoring systems and speech analyzers, provide instant feedback and frequent practice opportunities, enhancing learning by quickly addressing errors [15]. Studies suggest that such tools improve grammar and pronunciation and ease teachers' workload. However, international organizations and scholars emphasize that human teachers are still essential for evaluating the depth and creativity of student output [16]. | English teachers are increasingly experimenting with AI tools—such as automated writing evaluation systems and speech recognition software—for low-stakes assessments in writing and speaking. Classroom-based studies have shown that AI-generated feedback can raise learners' awareness of language use and foster iterative self-correction [17]. Chinese studies also emphasize the value of a hybrid approach: AI systems are well-suited to handle routine assessments such as identifying grammar or pronunciation errors, while human |

| Aspect | Global Perspectives | Chinese Perspectives |
|--|--|---|
| | | teachers continue to provide feedback on idea development and text organization, ensuring comprehensive evaluation [12], [13]. |
| Teacher professional development | Successful AI integration in education is strongly associated with teacher training and technological confidence. International studies show that while many educators express positive attitudes toward AI, they often lack formal training or established frameworks for implementation [18], [6]. Scholars emphasize the need for robust professional development and the dissemination of best practices to help teachers effectively integrate AI tools into pedagogy and address issues such as techno phobia and digital skill gaps [2], [4]. | Chinese teachers generally view AI as a valuable tool for teaching and are inclined to adopt it. However, many report a lack of clear guidance on how to integrate AI into lesson planning, and there are currently few official pedagogical models to follow. Recent studies indicate a strong need for targeted training programs, updated teacher education curricula, and the development of communities of practice focused on AI-enhanced instruction to build teachers' capacity and technological confidence [19]. |
| Ethical and policy considerations | Scholars worldwide urge careful consideration of data privacy, algorithmic bias, and transparency in AI tools [21], [22]. There is a consensus that clear ethical guidelines and policies must accompany AI deployment in schools, including protecting student data and ensuring AI recommendations do not reinforce biases or inequities [23], [24]. Several countries and international bodies have begun drafting principles for ethical AI in education, though implementation is in early stages. | Chinese research and policy documents echo global ethical concerns, emphasizing data security and culturally appropriate AI use in classrooms [24]. At the same time, China's government has been proactive in issuing directives—such as the Smart Education initiatives—to integrate AI in education [25]. These policies promote innovation while calling for oversight and continuous evaluation of AI's impact on teaching and learning. Recent policy frameworks also acknowledge structural challenges, such as unequal access to technology and infrastructure. In response, national initiatives include increased investment in rural school technology and the development of unified national teacher training standards for AI education [26]. |

B. Teacher Preparedness for AI and Pedagogical Shift

It is widely accepted that teacher readiness is a critical factor in the successful implementation of AI-enhanced

instruction. Recent studies show that many Chinese K – 12 teachers hold positive attitudes toward AI but lack structured pedagogical models or formal training guidelines for effective integration [19], [6], [18]. Additionally, the digital competence divide between urban and rural educators remains significant. Middle school teachers, in particular, face practical challenges in aligning AI-supported activities with national curricular standards [20]. These professional development challenges are summarized in Table 3.

TABLE 3: COMPARISON OF TEACHER PROFESSIONAL DEVELOPMENT CHALLENGES IN AI INTEGRATED ENGLISH TEACHING

| Challenge | Global Context | Chinese Context |
|--|--|--|
| Lack of training and guidelines | Limited formal training programs on educational AI; teachers often must learn on their own or through ad-hoc workshops. | Few official training opportunities on AI pedagogy; educators lack clear models or policies to follow for AI integration. |
| Integrating AI into pedagogy | Uncertainty on how to incorporate AI into existing curricula and teaching methods; need for examples and frameworks. | No established pedagogical frameworks from authorities; teachers are unsure how to align AI tools with mandated curriculum requirements. |
| Digital competency gaps | Varied technical skills among teachers globally; some struggle with new technologies, especially older or under-resourced educators. | Significant urban-rural divide in tech skills; teachers in less developed regions lack confidence and infrastructure to use AI effectively. |
| Attitudes and concerns | Mixed sentiments: some teachers fear AI could replace aspects of their role or feel skeptical of its benefits, while others embrace it cautiously. | Generally positive attitude toward AI's potential, but concerns remain about over-reliance on automation and loss of teacher agency in AI-driven classrooms. |
| Support and workload | Need for administrative and technical support; without support, adding AI tools can increase teacher workload and stress. | Heavy teaching loads and exam pressures leave little time to experiment with AI; lack of support and recognition makes it hard for teachers to innovate with AI. |

One subject area that has stepped boldly into the breach is English, where teachers who are starting to become early adopters of AI in the lesson design process. Given that language instruction is already laden with frequent assessment and feedback cycles, AI fits more naturally into their pedagogy. In several Chinese pilot programs, educators are beginning to explore the use of AI platforms such as Deep Seek to co-design writing tasks, generate oral practice materials, and deliver instant formative feedback. Though largely

concentrated in higher education at present, this trend is gradually expanding into secondary education settings [27], [28]. Yet fears remain about over-dependence on automation, the disenfranchisement of teacher agency, and the ethical ramifications of AI-infused contexts.

C. Lesson Design with AI

One of the areas of the deepest transformative potential of AI is in the design of lessons and tasks. Rather than merely providing static content, AI may co-create materials such as writing prompts, scaffold-ed grammar explanations, or simulated communicative scenarios using tools like Deep Seek or Chat GPT. For instance, recent studies have shown that writing exercises assisted by Chat GPT can support students in producing more complex and accurate written language, including more precise usage of verbs [29].

Aided by AI, modular lesson structures have emerged in Chinese middle school classrooms, where AI-generated input materials are combined with interactive grammar, vocabulary, and fluency activities. Building on principles of collaborative dialogue, recent frameworks have proposed a “blended task cycle” that begins with peer discussion centered on AI-generated stimuli, followed by teacher-led discussion and extension. This design keeps the pedagogy human-centered while enhancing it with AI support. The challenge is to integrate the official curriculum while maintaining creativity, spontaneity, and teacher agency. Table 4 presents an overview of emerging AI-assisted lesson design models [30], [31].

TABLE 4: SUMMARY OF AI-ASSISTED LESSON DESIGN AND TASK CONSTRUCTION MODELS

| Model/Approach | Description & Examples |
|--------------------------------|--|
| AI-assisted content creation | Teachers and AI co-create lesson content. For example, an AI tool generates dialogues or reading passages which the teacher then adapts for the class. This saves time and provides a variety of language inputs. |
| Chat GPT - aided writing tasks | Using large language models like Chat GPT to generate writing prompts or provide students with feedback on drafts is becoming increasingly common in educational settings. Studies show that, when used with proper guidance, these tools can enhance the complexity and accuracy of student writing [29], [32]. |
| Modular AI-driven lessons | Lessons structured in modules, where each module includes AI-generated materials (texts, questions) followed by interactive tasks. This approach is being piloted in some Chinese schools to personalize content and keep students engaged. |
| Blended AI-human task cycle | A mixed approach has been proposed in recent studies, where students first engage with AI-generated stimuli or exercises, then participate in peer discussion, and finally the teacher intervenes to discuss and extend the learning. This ensures that AI use is |

| Model/Approach | Description & Examples |
|----------------|---|
| | balanced with human instruction. For instance, [33] describe a classroom interaction model where large AI models support initial content exploration, followed by teacher scaffolding. Similarly, [34] highlights the effectiveness of combining AI-based digital learning games with human feedback to enhance student understanding and engagement. |

D. Student Engagement and Personalized Learning

Language learning and the personalization of learning paths are also being impacted by AI technologies.

Adaptive learning environments leverage intelligent tutoring systems that can assess student performance in real time, identify a student’s strengths and weaknesses, and customize content accordingly [35], [36]. In English language classrooms, such systems often take the form of pronunciation trainers, grammar corrector, and vocabulary games.

Students in Chinese middle schools respond positively to feedback provided through AI, especially when it is delivered in an interactive or gamified manner. Recent studies have shown that digital game-based AI tools can improve learners motivation, engagement, and academic performance in EFL and information technology classrooms [37], [38]. The personalized task assignment, from an AI generation of activity for the student, allows them to work at their own pace and seek guidance independently when needed. However, some researchers worry that personalization without purposeful scaffold can lead to fragmented learning experiences or superficial engagement. Thus, the teacher’s role remains critical in directing, guiding and contextualizing AI-mediated instruction.

E. AI-Enhanced Assessment and Feedback

As AI is introduced into language education, we are witnessing new ways of implementing formative and summative assessment, which is an essential part of language learning. Tools such as automated essay scoring (AES), speech recognition, and diagnostic feedback enable teachers to rapidly assess students’ grammar, coherence, fluency, and pronunciation. A recent systematic review of AI in English language teaching confirms that these tools can improve both the accuracy and efficiency of language assessment when combined with instructional feedback [39]. These systems also facilitate feedback to students much more frequently and more immediate than in traditional grading systems.

There is some evidence that in Chinese middle schools Deep Seek and similar assistive technologies have been used in low-stakes formative assessments,

especially for writing and oral presentations. According to teachers, AI-generated feedback makes students more conscious of how they are using language, and how this impacts their revision behavior. Researchers caution, however, that AES systems might prioritize superficial correctness over deeper rhetorical or creative qualities. That is why a hybrid model that combines AI-driven remark with teacher commenting was recommended to achieve efficiency and depth in evaluation.

F. Ethical, Infrastructural, and Policy-making Underpinnings

The expanding use of AI in English pedagogy also raises important ethical, infrastructural, and governance concerns. One recurring concern is data privacy — many AI implementations rely on collecting extensive student data, such as performance metrics, which complicates issues of consent, storage, and access [16]. For example, only 16% of countries explicitly guarantee data privacy in education by law, highlighting the global disparity in data protection measures [16]. Additionally, algorithmic bias can exacerbate inequalities when training data fail to adequately represent regional linguistic or cultural contexts. Studies show that biases in educational algorithms can significantly affect students from marginalized communities, reinforcing existing disparities [4].

From an infrastructure standpoint, the divide between urban and rural schools remains. Private and urban schools often have access to faster internet and newer devices, which facilitates the effective deployment of AI systems. In contrast, many public or rural schools lack the necessary hardware and technical support for AI integration. This gap in resources significantly limits the ability of rural schools to benefit from AI technologies [40]. Unless tackled through national and local policy efforts, these digital divides could accelerate achievement gaps.

In response, a few initiatives are getting off the ground. National-level guidelines have been issued by the Chinese Ministry of Education promoting “smart education,” and local governments are spending money to upgrade infrastructure and train teachers. However, there is a need for policy frameworks to develop further so that AI use is pedagogically sound, ethically responsible, and equitably distributed across diverse school settings.

IV. CONCLUSIONS

Integrating artificial intelligence (AI) in Chinese middle school English lesson design has allowed teachers to create interactive instructional materials and encourage students to think critically. But this requires, on one side, the readiness of teachers, and on the other side, addressing the related ethical issues and the challenges of inadequate infrastructure. Going forward, the emphasis needs to be on well-rounded teacher education, the creation of ethical guidelines and equitable distribution of resource allocation to facilitate responsible AI integration into education.

ACKNOWLEDGMENTS

I would like to express my deep gratitude to my supervisor, Dzintra Ilisko for her encouragement, guidance and constant care to me. She is an angle mentor whoever would dream to have.

My sincere thanks also go to my family—especially my husband and my mother and my mother in law, for their unconditional belief in me and great support. This journey would not have been possible without their sacrifices and emotional support.

Lastly, to my beloved daughter, 心心, thank you for coming into my world. Your arrival gifted me the strength to grow beyond myself. I strive to be a role model you can look up to with pride. May my journey one day inspire yours.

REFERENCES

- [1] G. P. Barrera Castro, A. Chiappe, M. S. Ramírez-Montoya, and C. Alcántar Nieblas, “Key barriers to personalized learning in times of artificial intelligence: A literature review,” *Applied Sciences*, vol. 15, no. 6, Art. no. 3103, 2025. [Online]. Available: <https://doi.org/10.3390/app15063103>
- [2] T. K. F. Chiu and C.-S. Chai, “Sustainable curriculum planning for artificial intelligence education: A self-determination theory perspective,” *Sustainability*, vol. 12, no. 14, Art. no. 5568, 2020. [Online]. Available: <https://doi.org/10.3390/su12145568>
- [3] . H. Yeter, W. Yang, and J. B. Sturgess, “Global initiatives and challenges in integrating artificial intelligence literacy in elementary education: Mapping policies and empirical literature,” *Future in Educational Research*, vol. 2, no. 4, pp. 382–402, Dec. 2024. [Online]. Available: <https://doi.org/10.1002/fer3.59>
- [4] R. S. Baker and A. Hawn, “Algorithmic bias in education,” *International Journal of Artificial Intelligence in Education*, vol. 32, pp. 1052–1092, 2022. [Online]. Available: <https://doi.org/10.1007/s40593-021-00285-9>
- [5] H. Waer, “The effect of integrating automated writing evaluation on EFL writing apprehension and grammatical knowledge,” *Innovation in Language Learning and Teaching*, vol. 17, no. 1, pp. 47–71, 2023. [Online]. Available: <https://doi.org/10.1080/17501229.2021.1914062>
- [6] B. Mateos Blanco, R. Cerezo Menéndez, S. Sánchez Somolinos, and M. A. Fernández Cebrián, “Vademecum of artificial intelligence tools applied to the teaching of languages,” *Journal of Technology and Science Education*, vol. 14, no. 1, pp. 77–94, Jan. 2024. [Online]. Available: <https://doi.org/10.3926/jotse.2522>
- [7] M. Rahimi, J. Fathi, and D. Zou, “Exploring the impact of automated written corrective feedback on the academic writing skills of EFL learners: An activity theory perspective,” *Education and Information Technologies*, vol. 30, pp. 2691–2735, 2025. [Online]. Available: <https://doi.org/10.1007/s10639-024-12896-5>
- [8] F. Pedró, M. Subosa, A. Rivas, and P. Valverde, *Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development*. Paris, France: UNESCO, 2019. [Online]. Available: <https://unesdoc.unesco.org/ark:/48223/pf0000366994>
- [9] K. Yang, M. Raković, Z. Liang, L. Yang, Z. Zeng, Y. Fan, D. Gašević, and G. Chen, “Modifying AI, enhancing essays: How active engagement with generative AI boosts writing quality,” *arXiv preprint arXiv:2412.07200*, Dec. 2024. [Online]. Available: <https://doi.org/10.48550/arXiv.2412.07200>

- [10] D. Chen, "How teachers can use DeepSeek: Step-by-step guide," Kangaroos.ai Blog, 2025. [Online]. Available: <https://www.kangaroos.ai/blog/how-teachers-use-deepseek/>
- [11] Z. Guo, Using AI to Teach English Writing in Junior Schools in China, M.S. thesis, Dept. of English Education, Univ. of Wisconsin–Platteville, Platteville, WI, USA, 2024. [Online]. Available: <https://minds.wisconsin.edu/bitstream/handle/1793/85445/Guo%2C%20Zhiyun.pdf>
- [12] S. Xu, Y. Su, and K. Liu, "Investigating student engagement with AI-driven feedback in translation revision: A mixed-methods study," *Education and Information Technologies*, 2025. [Online]. Available: <https://doi.org/10.1007/s10639-025-13457-0>
- [13] X. F. Lin, W. Shen, S. Huang, Y. Wang, W. Zhou, X. Ling, and W. Li, "Exploring Chinese teachers' concerns about teaching artificial intelligence: The role of knowledge and perceived social good," *Asia Pacific Education Review*, 2025. [Online]. Available: <https://doi.org/10.1007/s12564-024-10034-x>
- [14] Y. Zhao, "Artificial intelligence and education: End the grammar of schooling," *ECNU Review of Education*, vol. 7, no. 2, pp. 1–18, 2024. [Online]. Available: <https://doi.org/10.1177/20965311241265124>
- [15] A. Pack, A. Barrett, and J. Escalante, "Large language models and automated essay scoring of English language learner writing: Insights into validity and reliability," *Computers and Education: Artificial Intelligence*, vol. 6, Art. no. 100234, 2024. [Online]. Available: <https://doi.org/10.1016/j.caeai.2024.100234>
- [16] Global Education Monitoring Report Team, *Global Education Monitoring Report, 2023: Technology in Education – A Tool on Whose Terms?* Paris, France: UNESCO, 2023. <https://doi.org/10.54676/UZQV8501>
- [17] F. Yang, K. Li, and R. Li, "AI in language education: Enhancing learners' speaking awareness through AI-supported training," *International Journal of Information and Education Technology*, vol. 14, no. 6, pp. 828–833, Jun. 2024. [Online]. Available: <https://www.ijiet.org/vol14/IJJET-V14N6-2108.pdf>
- [18] O. Filiz, M. H. Kaya, and T. Adiguzel, "Teachers and AI: Understanding the factors influencing AI integration in K-12 education," *Education and Information Technologies*, 2025. [Online]. Available: <https://doi.org/10.1007/s10639-025-13463-2>
- [19] K. Wang, C. S. Chai, J. C. Liang, and G. Sang, "Exploring teachers' behavioural intentions to design artificial intelligence-assisted learning in Chinese K–12 education," *Technology, Pedagogy and Education*, vol. 33, no. 5, pp. 629–645, 2024. [Online]. Available: <https://doi.org/10.1080/1475939X.2024.2369241>
- [20] J. Sun, Z. Yang, S. Chen, and R. Deng, "Exploring the disparity in digital media literacy between urban and rural primary school students: Insights from an empirical study in China," *Frontiers of Digital Education*, vol. 1, pp. 178–197, 2024. [Online]. Available: <https://doi.org/10.1007/s44366-024-0003-1>
- [21] W. Holmes, K. Porayska-Pomsta, K. Holstein, et al., "Ethics of AI in education: Towards a community-wide framework," *International Journal of Artificial Intelligence in Education*, vol. 32, pp. 504–526, 2022. [Online]. Available: <https://doi.org/10.1007/s40593-021-00239-1>
- [22] United Nations Educational, Scientific and Cultural Organization (UNESCO), *Beijing Consensus on Artificial Intelligence and Education. International Conference on Artificial Intelligence and Education: Planning Education in the AI Era*, Beijing, 2019. [Online]. Available: <https://unesdoc.unesco.org/ark:/48223/pf0000368303>
- [23] C.-C. Tsai and C. S. Chai, "The 'third'-order barrier for technology-integration instruction: Implications for teacher education," *Australasian Journal of Educational Technology*, vol. 28, no. 6, pp. 1057–1060, 2012. [Online]. Available: <https://doi.org/10.14742/ajet.810>
- [24] F. Miao and W. Holmes, *Guidance for Generative AI in Education and Research*. Paris, France: UNESCO, 2023. [Online]. Available: <https://doi.org/10.54675/EWZM9535>
- [26] Ministry of Education of the People's Republic of China, *Tech revolution led by AI brings major opportunities: China's education minister*, Mar. 6, 2025. [Online]. Available: http://en.moe.gov.cn/news/media_highlights/202503/t20250307_1181839.html
- [26] Global Smart Education Network, *Global Smart Education Network: 18–20 August, 2024*, Beijing, China, 2024. [Online]. Available: <https://gse.bnu.edu.cn/wp-content/uploads/2024/07/【Concept-Note】Global-Smart-Education-2024.pdf>
- [27] Reuters, "Chinese universities launch DeepSeek courses to capitalise on AI boom," Feb. 21, 2025. [Online]. Available: <https://www.reuters.com/technology/artificial-intelligence/chinese-universities-launch-deepseek-courses-capitalise-ai-boom-2025-02-21/>
- [28] Times Higher Education, "Beyond the black box: How DeepSeek could transform higher education," Mar. 15, 2025. [Online]. Available: <https://www.timeshighereducation.com/campus/beyond-black-box-how-deepseek-could-transform-higher-education>
- [29] A. Lubbe, E. Marais, and D. Kruger, "Cultivating independent thinkers: The triad of artificial intelligence, Bloom's taxonomy and critical thinking in assessment pedagogy," *Education and Information Technologies*, 2025. [Online]. Available: <https://doi.org/10.1007/s10639-025-13476-x>
- [30] M. Guhlin, "The LEARNS cycle: Putting AI in instruction - Part 2," Feb. 6, 2024. [Online]. Available: <https://blog.tcea.org/the-learns-cycle-putting-ai-in-instruction-part-2/>
- [31] The Partners of Collective Shift, "Join the Collective Shift: Human-Centered AI for Learner-Centered Learning," Aug. 14, 2024. [Online]. Available: <https://www.nextgenlearning.org/news/collective-shift-human-centered-ai-for-learner-centered-learning>
- [32] S. Nikolic, S. Daniel, R. Haque, M. Belkina, G. M. Hassan, S. Grundy, et al., "ChatGPT versus engineering education assessment: A multidisciplinary and multi-institutional benchmarking and analysis of this generative artificial intelligence tool to investigate assessment integrity," *European Journal of Engineering Education*, vol. 48, no. 4, pp. 559–614, 2023. [Online]. Available: <https://doi.org/10.1080/03043797.2023.2213169>
- [33] K. Tan, T. Pang, C. Fan, and S. Yu, "Towards applying powerful large AI models in classroom teaching: Opportunities, challenges and prospects," *arXiv preprint arXiv:2305.03433*, 2023. [Online]. Available: <https://arxiv.org/abs/2305.03433>
- [34] B. M. McLaren, "Decimal Point: A decade of learning science findings with a digital learning game," in *Artificial Intelligence in Education: The Intersection of Technology and Pedagogy*, P. Ilic, I. Casebourne, and R. Wegerif, Eds., vol. 261, Intelligent Systems Reference Library. Cham, Switzerland: Springer, 2024. [Online]. Available: https://doi.org/10.1007/978-3-031-71232-6_9
- [35] U. Maier and C. Klotz, "Personalized feedback in digital learning environments: Classification framework and literature review," *Computers and Education: Artificial Intelligence*, vol. 3, 100080, 2022. [Online]. Available: <https://doi.org/10.1016/j.caeai.2022.100080>
- [36] K. VanLehn, "The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems," *Educational Psychologist*, vol. 46, no. 4, pp. 197–221, 2011. [Online]. Available: <https://doi.org/10.1080/00461520.2011.611369>
- [37] S. Zhou, "Gamifying language education: The impact of digital game-based learning on Chinese EFL learners," *Humanities and Social Sciences Communications*, vol. 11, no. 1, Art. no. 1518, 2024. [Online]. Available: <https://doi.org/10.1057/s41599-024-04073-3>
- [38] Y. Xu, J. Zhu, M. Wang, F. Qian, Y. Yang, and J. Zhang, "The impact of a digital game-based AI chatbot on students' academic performance, higher-order thinking, and behavioral patterns in an information technology curriculum," *Applied Sciences*, vol. 14, no. 15, Art. no. 6418, 2024. [Online]. Available: <https://doi.org/10.3390/app14156418>
- [39] T. A. Sharadgah and R. A. Sa'di, "A systematic review of research on the use of artificial intelligence in English language

teaching and learning (2015–2021): What are the current effects?,”
Journal of Information Technology Education: Research, vol. 21, pp.
337, 2022. [Online]. Available: <https://doi.org/10.28945/4999>

[40] W. Zhao, “A study of the impact of the new digital divide on the
ICT competences of rural and urban secondary school teachers in

China,” Heliyon, vol. 10, Art. no. e29186, Apr. 2024. [Online].
Available: <https://doi.org/10.1016/j.heliyon.2024.e29186>