A Systematic Review of Generative Artificial Intelligence in Language Education

Zilin WANG[a], Di ZOU[b*], Lap-Kei Keith LEE[a] , Haoran Xie[c] & Fu Lee Wang[a]
[a]*School of Science and Technology, Hong Kong Metropolitan University, Hong Kong SAR*
[b]*School of Graduate Studies, Lingnan University, Hong Kong SAR*
[c]*Department of Computing and Decision Sciences, Lingnan University, Hong Kong SAR*
*dizoudaisy@gmail.com

Abstract: This research paper presents a comprehensive exploration of the application of Generative Artificial Intelligence (GAI) within the realm of language education. Through a systematic review of 20 empirical studies conducted within a structured three-step framework, this study elucidates the multifaceted integration of GAI in language learning. The examination encompasses various dimensions, including target languages, learners' educational levels, GAI applications, language skills, and practical outcomes. Additionally, the study critically assesses the key advantages and challenges inherent in GAI's role in language education. The paper provides valuable insights into human-technology interaction by delving into language learners' attitudes toward GAI. Notably, this research identifies three pivotal roles GAI assumes within the language learning process, and they are co-author, evaluator, and learning materials provider. The study concludes by charting a path toward future research endeavors within the evolving landscape of GAI-based language learning by implicating the future research direction of integrating the GAI into language education, including collaborations between humans and GAI, clarifying the definition of GAI-powered plagiarism, GAI-based language activities design, prompting strategies, and digital literacy.

Keywords: Generative artificial intelligence, language education, technology-enhanced language learning, ChatGPT

1. Introduction

The integration of Artificial Intelligence (AI) in language teaching and learning has become increasingly essential in today's educational landscape. On the one hand, the shift towards online education, particularly in the wake of the COVID-19 pandemic, necessitates the use of AI to provide effective, accessible, and flexible language learning tools that can be utilized anytime, anywhere (Jia et al., 2022). On the other hand, AI technology has found extensive applications in modern language education. These applications encompass automated writing assessments, intelligent tutoring systems for reading, computer-mediated communication, and personalized language learning (Huang et al., 2023; Liang et al., 2021). The latest advancements in GAI technology are poised to continually influence the landscape of language learning in today's digital age.

GAI stands as a groundbreaking stride in the realm of artificial intelligence, characterized by its autonomous capability to craft coherent and contextually pertinent human-like text (Cooper, 2023). The transformative potential of GAI is progressively gaining recognition within the educational sphere, heralding the dawn of a novel epoch replete with dynamic and interactive learning encounters (Rahman & Watanobe, 2023; Wilson & Billam, 2023). In the context of language education, the integration of cutting-edge technological advancements holds a significant sway, and technology-enhanced language learning stands as a burgeoning focal point within this domain. This study embarks on a systematic review to

delve into the realm of GAI deployment in language education, seeking to unearth the present landscape of its integration and chart a course towards future research trajectories.

2. Literature Review

In technology-enhanced language learning (TELL), systematic reviews play a crucial role in advancing the field and informing educational practices. The systematic review is a rigorous and comprehensive approach to synthesizing and analyzing existing research on a specific topic by identifying the research trends and gaps (Zou et al., 2018), organizing diverse findings (Ghanizadeh et al., 2015; Shadiev & Yang, 2020) and providing insights for future research (Su & Zou, 2022). The current systematic review contributes to figuring out the applications of GAI in language learning based on existing empirical studies to investigate further where we start and where we could go.

Few review articles have shared viewpoints on employing ChatGPT in education contexts. Wilson and Billam (2023) reviewed ten interesting articles published between January and May 2023 about using ChatGPT in educational practice, which included radio broadcasts, research articles, and government frameworks. These published articles discussed some cases of students using ChatGPT for academic assignments and academic integrity-related issues. Ethical issues on ChatGPT used in academic language and learning were also a concern (Wilson & Billam, 2023). Similarly, Rahman and Watanabe (2023) expressed the possibility of cheating in exams by using ChatGPT, which diminished students' critical thinking capacity. Meanwhile, human teachers hardly differentiate the ChatGPT and students' work. These threats brought by ChatGPT could transform traditional teaching and learning methods. However, ChatGPT offered opportunities for learners and educators by providing personalized feedback and interactive conversations (Rahman & Watanobe, 2023). Hence, the challenges and opportunities brought by ChatGPT, and more broadly, GAI, are worth further discussion.

In specific subject education, including English language learning (Bin-Hady et al., 2023), academia and libraries (Houston & Corrado, 2023), and medical education (Armitage, 2023), ChatGPT had been first tried and discussed in the review articles. Regarding language education, ChatGPT could serve as a scaffolding to help language learners design learning plans, and ChatGPT's immediate feedback acts as a partner in language practice (Bin-Hady et al., 2023). Regarding academia and libraries, ChatGPT influenced reference practices, collection development, and metadata creation and transformation (Houston & Corrado, 2023). Regarding medical education, the impacts of ChatGPT tend to be harmful as it threatens students' ability to do clinical practice (Armitage, 2023).

The existed literature review about GAI needs to be more systematic than viewpoint reports. At the same time, ChatGPT was the only GAI tool focused on by the previous reviewers, while other diverse GAI tools, such as Bard, POE, and DALL-E2, have been popularized now. Therefore, a systematic review of GAI tools used in the educational field is needed. The current review narrows the scope in the language education fields, which already have abundant empirical studies and lacks a systematic review of current research status, integration of GAI into language education, and future research trends. The research questions for the current review are:

- What is the status of research on GAI-based language learning related to target languages, learners' educational levels, GAI applications, language skills, and practical effects of GAI?
- What are the main benefits and challenges of using GAI in language learning?
- What are the learners' attitudes toward using GAI in language learning?
- What are the roles GAI plays in the language learning process?
- What are the future directions for investigating GAI integration in language learning?

3. Methods

To exam the above five research questions, we conducted a systematic review based on a three-step methodology which is commonly used in technology-enhanced language learning reviews (Ghanizadeh et al., 2015; Shadiev & Yang, 2020; Su & Zou, 2022). The three steps involve article searching, screening, and coding. The first step was identifying topic-related keywords and searching them in the database. Then, the primary search results were screened by specific exclusion and inclusion criteria. Finally, the authors had an intensive reading of the last included articles, had discussions, and labeled the contents together based on the article coding scheme. The details are illustrated in this section.

3.1 Article Search

The databases used in the current review were Web of Science (WoS) and Scopus, which were commonly employed in systematic reviews due to their comprehensive coverage and inclusion of high-quality journals (Celaya et al., 2020). Within these two databases, we enter the keywords related to GAI (“generative artificial intelligence” OR “GAI” OR “ChatGPT” OR “POE” OR “Bing Chat” OR “GPT-4” OR "GPT" OR “Bard” OR “DALL-E2”), language acquisition (language OR second language OR foreign language OR EFL OR ESL OR TESOL OR TEFL) and education (educat* OR acquisit* OR learn* OR teach* OR student* OR class*). We further refined the document type as “Article” and the language as “English”. The search strings in two databases and initial results retrieved in August 2023 were reported in Table 1.

Table 1. *Primary Search in WoS and Scopus*

Database	Search Strings	Search Results
WoS	“Generative artificial intelligence” OR “GAI” OR “ChatGPT” OR “POE” OR “Bing Chat” OR “GPT-4” OR "GPT" OR “Bard” OR “DALL-E2” (Topic) and language OR second language OR foreign language OR EFL OR ESL OR TESOL OR TEFL (Topic) and English (Language) and educat* OR acquisit* OR learn* OR teach* OR student* OR class* (Topic)	231
Scopus	(TITLE-ABS-KEY ("generative artificial intelligence" OR "GAI" OR "ChatGPT" OR "POE" OR "Bing Chat" OR "GPT-4" OR "Bard" OR "DALL-E2") AND TITLE-ABS-KEY (language OR second AND language OR foreign AND language OR efl OR esl OR tesol OR tefl) AND TITLE-ABS-KEY (educat* OR acquisit* OR learn* OR teach* OR student* OR class*)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English"))	197

3.2 Article Selection

Based on the initial results, we still needed to select well-designed empirical studies in the next step systematically. To ensure a focused selection, we established exclusion and

inclusion criteria, which were reported in Table 2. At first, we removed 98 duplications from two databases. Subsequently, 49 articles of literature review, viewpoint, or report were excluded. Then, we carefully examined the remaining items' titles, sources, and abstracts. We further identified and excluded 217 articles that did not investigate language learning, 43 that did not exploit GAI, and 1 that could not find full text. Through the selection process, shown in Figure 1, 20 articles that met the inclusion criteria were kept for further analysis.

Table 1. *Exclusion and Inclusion Criteria*

Exclusion Criteria	Inclusion Criteria
Review, viewpoint, or report	Empirical study
Does not investigate language learning	Investigate language learning
Irrelevant to generative artificial intelligence	Implement generative artificial intelligence tools
Full text unavailable	Full text available

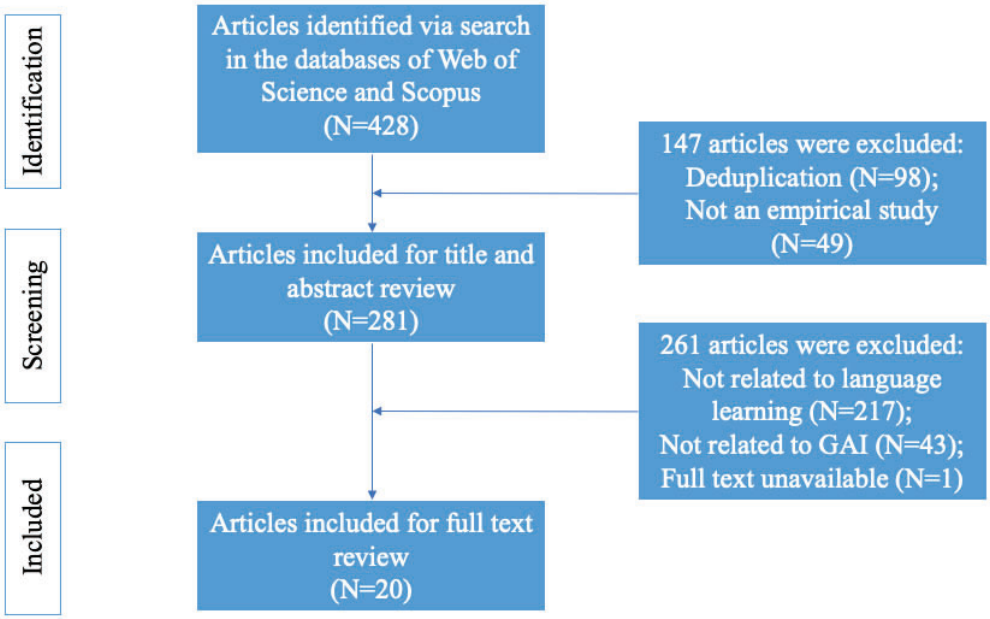

Figure 1. The article selection process.

3.3 Article Coding Scheme

The data extraction and coding procedure was based on previous systematic reviews in computer and education (Crompton & Burke, 2018; Yadegaridehkordi et al., 2019). The authors reviewed 20 articles one by one, assisted by reference management software Mendeley and recorded the necessary data in MS Excel spreadsheets. Regarding five research questions, the 20 articles were coded by the following tags: target language, educational level, GAI Applications, language skills, advantages, challenges, practical effects, learners' attitudes, and the role of GAI in the learning process. Table 3 carefully presents the coding scheme.

Table 3. *Article Coding Scheme*

Tags	Coding Examples	Example References
Target languages	English	(Perkins, 2023)
	Greek	(Ross, 2023)
Educational levels	Higher education	(Macdonald et al., 2023)

	Elementary education	(Lee et al., 2023)
GAI applications	ChatGPT-2	(Bulut & Yildirim-Erbasli, 2022)
	ChatGPT-3.5	(Ahmed, 2023)
Language skills	Reading	(Bulut & Yildirim-Erbasli, 2022)
	Writing	(Y. Su et al., 2023)
Advantages	Students were motivated in GAI-based reading activity	(Lee et al., 2023)
	"ChatGPT could become a great help to researchers worldwide in designing their studies, conducting analyses and drafting their research articles"	(Macdonald et al., 2023)
Challenges	The frequent use of ChatGPT leads to overly similar paragraphs and structure of many papers in the same field, leading to problems with plagiarism check	(Macdonald et al., 2023)
	Lack of human connection and personalization	(Mohamed, 2023)
Practical effects	Major effect	(Macdonald et al., 2023)
	Minor effect	(Ahmed, 2023)
Learners' attitudes	Positive	(Macdonald et al., 2023)
	Negative	(Qasem, 2023)
The role of GAI	Work as a co-author	(Macdonald et al., 2023)
	Learning content provider	(Lee et al., 2023)

4. Results

4.1 Target Languages of GAI-based Language Learning

Out of the total twenty reviewed articles, English emerged as the predominant target learning language, constituting 18 of the articles, whereas Greek and Arabic learning each accounted for a single research article. This distribution can be attributed to the extensive training of the large language model (LLM) on the English language corpus. Notably, one of the prominently used versions of ChatGPT, namely ChatGPT-3, was frequently employed in the research, exclusively generating outputs in English (Ross, 2023). Simultaneously, this linguistic bias resulted in varying output quality when students employed GAI to learn different target languages. Among the findings of this review, it became evident that the quality of English output surpassed that of Greek and Arabic outputs. Rose (2023) observed challenges with ChatGPT-3.5 in handling Ancient Greek, while its performance with classical Latin and Sanskrit was commendable. Conversely, Beheitt and HajHmida (2023) expressed dissatisfaction with the Arabic output.

4.2 Educational Level of GAI-Based Language Learning

GAI found its predominant application in higher education, as indicated by 16 articles that delved into its utilization within this context. Additionally, two articles integrated GAI into elementary education, while another piece of research explored its impact on secondary

education. Furthermore, there was an article that does not specify the educational level under consideration.

4.3 GAI Applications for GAI-Based Language Learning

Figure 2 presents an overview of the GAI applications utilized in the reviewed articles. The most commonly employed platform was ChatGPT, which featured in 16 empirical studies. Within this set of 16 articles, various iterations of ChatGPT, namely ChatGPT-2, ChatGPT-3, ChatGPT-3.5, and ChatGPT-4, were scrutinized for their effectiveness in the language learning process. Notably, ChatGPT-3.5 garnered the highest frequency of adoption, featuring in 10 studies. Versions 3 and 2 were each applied in 4 and 3 articles, respectively, while the most recent iteration, ChatGPT 4, found application in two articles. However, one article did not specify the particular version of ChatGPT employed.

Apart from ChatGPT, the review also examined other GAI applications, including Bard, Bing Chat, CopyAI, and Google T5, with each being the subject of investigation in a separate article.

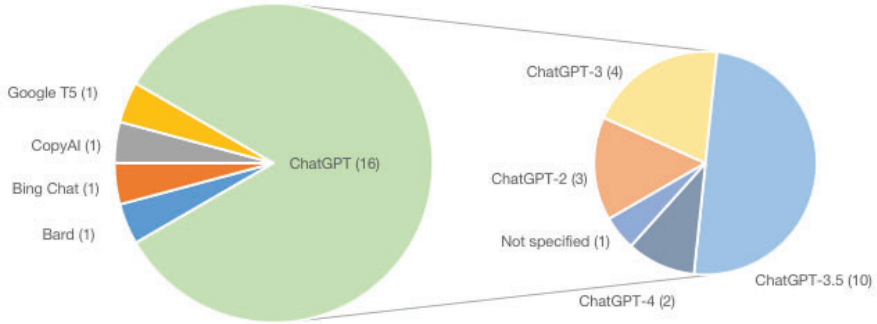

Figure 2. GAI applications used in the reviewed articles.

4.4 Language Skills of GAI-Based Language Learning

In the reviewed articles, GAI proves instrumental in fostering learners' acquisition of writing, reading, communication, and vocabulary skills. Twelve studies have harnessed GAI to facilitate writing practice, encompassing diverse tasks such as digital writing (Perkins, 2023), academic writing (Fyfe, 2022; Macdonald et al., 2023; Yan, 2023), reflective writing (Li et al., 2023), poetry composition (Beheitt & HajHmida, 2023), and argumentative discourse (Hinton & Wagemans, 2023; Y. Su et al., 2023). Additionally, two studies utilized ChatGPT to generate reading materials (Bulut & Yildirim-Erbasli, 2022; Lee et al., 2023), while another pair employed the immediate feedback features of ChatGPT to cultivate learners' communication aptitude ((Mohamed, 2023; Young & Shishido, 2023)). One study recognized ChatGPT as an effective tool for language learners to enhance vocabulary acquisition (Ross, 2023). However, three studies did not specify the particular learning skills that were intended to be enhanced through GAI.

4.5 Advantages of Using GAI in Language Learning

The integration of Generative Artificial Intelligence (GAI) into the language learning process confers significant benefits, leveraging its multifunctional capabilities, provision of immediate and personalized feedback, and user-friendly interface.

Within the scope of the surveyed literature, GAI has showcased remarkable versatility, evidenced by its proficiency in executing diverse tasks. These tasks encompass a spectrum of activities, such as generating essays in numerous languages, crafting speeches

marked by a personalized style (Rudolph et al., 2023), succinctly summarizing complex documents (Yan, 2023), and, intriguingly, producing written content that surpasses the novelty observed in human-authored works. This achievement is attributed to GAI's extensive linguistic foundation (McCoy et al., 2023; Mohamed, 2023) An illustrative manifestation of GAI's efficacy is discerned in the realm of argumentative writing, where the arguments generated by GAI exhibit originality and potency, thereby augmenting the preparatory stages of language learners' writing endeavors (Kohnke et al., 2023; Y. Su et al., 2023). Additionally, GAI emerges as a robust tool for vocabulary and grammar verification, notably aiding in the proofreading phase (Fyfe, 2022; Su et al., 2023). Noteworthy is the discernible enhancement of students' written output through GAI adoption, evidenced by a reduction in grammatical errors and a proliferation of lexical diversity (Yan, 2023).

Concurrently, GAI substantiates its user-friendly disposition, catering to the requisites of both language educators and learners. This adaptability extends to the tailoring of outputs to align with the linguistic proficiency levels of the target audience. The intricate task of curating apt language learning materials, especially pertinent for elementary-level students, encounters a pragmatic solution in GAI's ability to swiftly generate contextually suitable texts. Educators can seamlessly elicit content suited to the cognitive capacity of young learners, enhancing the pedagogical experience (Ahmed, 2023; Bulut & Yildirim-Erbasli, 2022; Lee et al., 2023).

Moreover, empirical investigations underscore GAI's potential to engender heightened learner engagement, a facet facilitated by its interactive attributes. Immediate feedback emerges as a pivotal catalyst, invigorating students' proclivity to engage in meaningful language application, consequently fortifying their communicative self-assurance (Lee et al., 2023; Mohamed, 2023).

4.6 Challenges of Using GAI in Language Learning

The major defects of using GAI in language learning lie in the unstable output quality, ethical and plagiarism issues, the lack of human connection, and learners' over-dependent on it.

The poor quality of GAI output appeared in minority language conversations (Beheitt & HajHmida, 2023; Ross, 2023). On the other hand, the fake information produced by GAI had side effects on scientific research and academic writing (Bulut & Yildirim-Erbasli, 2022; Macdonald et al., 2023). Besides, for different task modalities, such as graphs and figures, GAI performed struggled with them (Li et al., 2023).

In addition, the easy accessibility of GAI to students lead to massive similar work (Macdonald et al., 2023), and human teacher find it hard to differentiate between students' work and GAI's work (Li et al., 2023). It challenged traditional academic policies about ethical and plagiarism issues (Macdonald et al., 2023).

Moreover, the fast generation lessened learners' sense of participation, and compared to the GAI partners, students preferred to interact with teachers and classmates (Ahmed, 2023). Further, learners became lazy and did not check the GAI work because they were over-dependent on GAI. This situation had a high opportunity to appear in the low language proficiency level learners (Ahmed, 2023).

4.7 Practical Effects of Using GAI in Language Learning

In 20 reviewed articles, 15 suggested the practical effects of GAI. 12 studies indicated the GAI had excellent performance in completing the language learning tasks or significantly improved learners' language learning performance. Other three studies indicate GAI had minor effects on promoting students' performance.

4.8 Learners' Attitudes of Using GAI in Language Learning

Nineteen articles investigated language learners' attitudes toward GAI's application. The participants from 13 studies held positive attitudes and highly rated GAI such as "good

learning tools" (Ross, 2023), "in favor of using GAI" (Lee et al., 2023), and "GPT architecture fits best for automatic poem generation" (Beheitt & HajHmida, 2023). Four studies kept neutral attitudes who admitted the advantages of GAI but were still concerned about its threats of plagiarism and ethical issues. Two studies expressed negative attitudes that consider the GAI cannot replace the classroom teaching modes (Ahmed, 2023; Qasem, 2023). On the one hand, students hardly check ChatGPT's output because they did not feel any sense of connect with the output they had, and instead of ChatGPT, the students preferred to cooperate with their classmates (Ahmed, 2023); On the other hand, the fake information produced by GAI made it untrustworthy in the academic writing process (Qasem, 2023).

4.9 The Roles of GAI in GAI-Based Language Learning

We identified GAI's three roles in the language learning process: learning materials provider, co-author, and evaluator. As the learning materials provider, GAI could be an effective tool to gather learning information in vocabulary learning and practice with the definitions, translations, and grammar concepts (Ross, 2023). Meanwhile, GAI could generate reading materials to match different language proficiency levels of learners (Bulut & Yildirim-Erbasli, 2022; Lee et al., 2023). As a co-author, GAI could provide a writing preparation plan and suggestions in completing writing tasks (Kohnke et al., 2023; McCoy et al., 2023; Su et al., 2023), and it also worked as a grammar checker in the proofreading phase (Fyfe, 2022). Being an evaluator, GAI could provide feedback based on the input comment framework. However, the feedback quality depends crucially on the evaluative rubrics (Su et al., 2023).

5. Discussions

Compared with the related review, the present review had consistency in that the plagiarism and ethical issues were urgent to solve (Wilson & Billam, 2023). Meanwhile, within the educational domain, GAI's multifunctions could reduce learners' active learning (Rahman & Watanobe, 2023). Within the language education field, our results also agreed with Bin-Hady et al. (2023) that GAI could be an effective tool during the phase of language learning preparation. However, we also found that GAI could provide strong support for language learning through immediate feedback and a vast knowledge base during the learning process. GAI could be a practical tool for grammar checks and language rectification during the proofreading phase. In addition, the interactive feature of GAI unsatisfied the learners compared with traditional language classrooms, which is different from Rahman and Watanobe (2023), who highly commented on this feature. Furthermore, the current study identified the roles GAI played in the language learning process as an evaluator, co-author, and learning content provider, which extends the recognition to the GAI application in language education.

We also propose future research directions in integrating GAI into language learning from five aspects (see Figure 3):

- The methods of applying GAI in language education, as reviewed in previous studies, are limited and lack systematic approaches. Based on the three roles of GAI in language learning proposed by this study, the form of collaboration between humans and GAI warrants further exploration.
- Redefine the GAI-based plagiarism and adjust academic integrity policy. This study proved that GAI has been a strong writing tool, and this factor challenged traditional academic integrity policy. The discussion of GAI-based plagiarism is necessary.
- Examine the design of GAI-based language activities for learners with varying language proficiency levels. The current study discovered that the effectiveness of GAI-based learning methods is related to the language proficiency level of the learner. Consequently, the design of GAI-based language activities should take this into account and personalize the activities accordingly.

- Identify effective prompting strategies and attempt to incorporate student feedback into these prompts. The language proficiency level of students influences the quality of the prompts and the output quality of GAI. To enhance students' questioning skills and the output quality in GAI applications, further exploration of prompting strategies is required.
- Boost the digital literacy of both language educators and learners by integrating GAI into language teacher education programs. The studies reviewed aim to incorporate GAI into educational practice, even teacher education programs. This requires both language learners and teachers to enhance their digital literacy. The methods to promote digital literacy among participants of different educational levels need further discussion.

Figure 3. Future research directions of GAI in language education.

6. Conclusions and Limitations

With the aim of identifying how GAI could apply to the language education field, the current systematic review analyzed 20 related empirical studies strictly under the three-step framework. We reported the current research status of GAI in language learning related to target languages, learners' educational levels, GAI applications, language skills, and practical effects. Moreover, we combed the main benefits and challenges of using GAI in language learning. In addition, the language learners' attitudes toward GAI were concerned. And three roles of GAI played in the language learning process were identified as co-author, evaluator, and learning materials provider. We implicated future research directions in the GAI-based language learning field, referring to integrating the GAI into language education, including collaborations between humans and GAI, clarifying the definition of GAI-powered plagiarism, GAI-based language activities design, prompting strategies, and digital literacy.

The limitation lies in the limited empirical studies that could be analyzed because GAI was the latest concept, which is still developed in the initial phase.

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