

# Application of generative artificial intelligence (GenAI) in language teaching and learning: A scoping literature review

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## ABSTRACT

This scoping literature review examines the application of Generative Artificial Intelligence (GenAI), a disruptive technology, in language teaching and learning. Since its launch in November 2022, GenAI has captured global attention with OpenAI's ChatGPT, powered by the generative pre-trained transformer-3 (GPT-3) large-language model. The emergence of GenAI holds immense implications across various domains, including language education. This review aims to provide an overview of the current state of research and identify research gaps and future directions in this emerging field. The review follows the PRISMA-ScR guidelines and includes eligible publications published between 2017 and July 2023. Four electronic databases were searched and 41 of the 224 initial papers were eventually selected for review. The findings reveal key terms related to GenAI in language education, the most researched language study and education levels, areas of research, attitudes towards GenAI, and the potential benefits and challenges of GenAI application. The review highlights several research gaps, including the need for more empirical studies to assess the effectiveness and impact of GenAI tools, discussion of ethical considerations, targeted interventions for specific language skills, and stakeholder engagement in responsible integration. Educators are encouraged to incorporate GenAI tools into their teaching practices while remaining vigilant about potential risks. Continuous professional development for educators is crucial to ensure informed decision-making and effective integration of GenAI tools. This scoping review contributes to the existing knowledge on the use of GenAI in language education and informs future research and practice in this disruptive and rapidly evolving field.

## 1. Introductions

Generative artificial intelligence (GenAI), according to [9] definition, is “the use of AI to create new content, like text, images, music, audio, and videos”, utilizing a machine learning (ML) model “to learn the patterns and relationships in a dataset of human-created content” and then “uses the learned patterns to generate new content.” As a subset of artificial intelligence (AI), GenAI differs from past forms of AI technology that employ ML algorithms and predication from data based on past behavior. Instead, according to [49], GenAI focuses on creating new textual and multimodal content using large language models (LLMs), art-based models and video-based models. Examples of well-known GenAI tools include OpenAI's ChatGPT, GPT-4, Playground, DALL · E 3, and Sora, Anthropic's Claude, Google's Gemini (previously Bard), Stability AI's Stable Diffusion 3, and Runaway's Gen-2.

Since the launch of [32] ChatGPT in November 2022, GenAI has attracted global attention. Powered by a LLM known as generative

pre-trained transformer (GPT), ChatGPT has demonstrated the ability to generate coherent and grammatically correct text while continuously improving through machine learning from user inputs. The emergence of GenAI, particularly exemplified by ChatGPT, holds immense implications across various domains, including language teaching and learning.

Language teaching and learning play a vital role in today's globalized world, where effective communication and intercultural understanding are essential for personal, academic, and professional success. Proficiency in a language enables individuals to engage in meaningful interactions, express clear ideas, and navigate diverse cultural contexts. Traditionally in the academic setting, language educators have been the primary facilitators or catalysts for language acquisition and development, where students learn essential language skills from teachers who assess their progress through written and spoken components. However, the advent of the internet and search engines has transformed the language learning landscape, as it drastically reduces the reliance of

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students on teachers, allowing students to access vast amounts of information, language resources, and language learning platforms that cater to their individual learning needs [43]. The introduction of GenAI programs represents the beginning of yet another paradigm shift in language education and acquisition.

At this early stage of GenAI development, conducting a scoping review becomes crucial and highly valuable, as it provides an overview of the current research landscape and holds implications for major stakeholders involved in language education. By examining the existing literature, the review can shed light on the potential impact of GenAI on language teaching and learning, inform future research directions, and guide the actions of language educators, policymakers, developers, and researchers in this evolving field.

### 1.1. Rationale

While there is a substantial body of published studies and literature reviews on artificial intelligence (AI) in recent years (e.g., [6,21,53]), the existing literature specifically focusing on the application of GenAI in language education, as well as GenAI in general, is still very limited. Given that GenAI is a relatively new and rapidly evolving technology, a scoping review presents a suitable methodology for providing a comprehensive overview of the current state of research in this area. The advantage of a scoping review lies in its ability to encompass diverse study designs, methodologies, and types of literature, including empirical studies, technology reviews, and review articles. By undertaking a scoping review that examines the application of GenAI in language teaching and learning, researchers can gain valuable insights into the current research landscape and identify areas that warrant further investigation. This process facilitates the identification of research gaps and emerging trends, thereby guiding future research endeavours in this domain. Furthermore, the findings derived from the scoping review have practical implications as they inform the development of research questions and support evidence-based decision-making in the field of language education with GenAI. Notably, to the best of my knowledge, no scoping literature review has been conducted thus far, specifically focusing on the application of GenAI in language education. Consequently, this research represents a pioneering effort to address this critical gap in the literature.

### 1.2. Objectives

To conduct a scoping review of the literature to determine the current state of research on the use of GenAI (both textual and multimodal) in language teaching and learning, and to identify research gaps and areas for future investigation.

### 1.3. Review questions

This scoping literature review addresses the following review questions:

1. What are the key terms surrounding the use of GenAI in language education?
2. What language studies and education levels are most researched?
3. a) What are the specific areas of research (i.e., language learning/ language skills that have been investigated) in relation to the use of GenAI?
- b) What are the attitudes towards the use of GenAI in language teaching and learning?
1. What are the potential benefits and challenges of using GenAI in language teaching and learning?

## 2. Methods

### 2.1. Exploratory literature review with PRISMA-ScR

Given GenAI has only started gaining traction in the research field near the end of November 2022 despite years of development, there is inadequate literature to support a systematic approach to literature review. This makes a scoping literature review a more suitable approach [45]. Also, compared to systematic reviews, scoping reviews are “useful for answering much broader questions (such as “What is the nature of the evidence for this intervention?” or “What is known about this concept?”)” ([45], p. 467). Because of the difference in the objectives of this study, I adopted the PRISMA statement on scoping review (PRISMA-ScR) by [45].

### 2.2. Eligibility criteria and information sources

The sources of evidence are considered eligible based on years of publication, language and publication type. Publications must be published between 2017 and 2023, from the year the Transformer (the “T” in GPT, generative pre-trained transformer) was first announced [47] up till the time of this writing on July 25, 2023. The idea is to capture the recent development in GenAI in recent years as well as any information related to its build-up a decade prior to this. Also, this study only considered only English papers as it is the only language the author is proficient in. Eligible publication types include published theoretical paper, empirical study, review article, technology review, editorial opinion, and discussion papers. Gray literature is also eligible as it valuable in shaping research direction at the early stage of GenAI technological development. However, book reviews were not included as they are not complete studies on a topic.

Several exclusion criteria were considered in the screening phase. I also exclude publications that do not have a language education focus or GenAI focus because these are not within the scope of this study. Pre-prints of published work which are already in the record were also removed to avoid duplication of content. If for any reasons that the abstract of a publication was not retrievable, the record was also excluded. Finally, this study does not include students’ assignments, commercial websites, blogs, magazine articles, conference abstract as these text types are not intended to be or published by academic journals.

### 2.3. Search and selection of sources of evidence

The search was conducted in four electronic databases: SCOPUS (Elsevier), Science Direct (Elsevier), JSTOR (ITHAKA), ERIC (Institute of Education Sciences), and Google Scholar (Alphabet). Given that GenAI is a relatively new topic in language education, gray literature was considered for screening.

Potential literature was identified using the Boolean conjunction: (“generative artificial intelligence” OR “generative AI” OR “GenAI” OR “ChatGPT” OR “Chat GPT”) AND (“language education” OR “language teaching” OR “language learning”). I included studies that focused on the use of GenAI in language teaching and learning, irrespective of the language or level of proficiency.

The process for selecting sources of evidence included in this scoping review includes identification, and screening and eligibility.

Adapting the design of tables from [21] scoping review paper, new tables were constructed to meet the needs of this study and were filled out carefully after close reading the selected literature several times. I also used AntConc (v 4.2.2) [4] to build a corpus using the selected literature which allowed for the queries of keywords, concordances, and frequency of occurrences, which in turn facilitated the search for important information and confirmation of the accuracy of my data extraction. Re-reading of the papers were performed, and adjustments were made to the cell content when necessary.

### 3. Results

#### 3.1. Selection of sources of evidence

The flow diagram showing the selection of sources of evidence is summarised in Fig. 1. In the identification phase, my search yielded an initial 224 entries (100 %) from selected databases and no additional records were identified through other sources. The citation information of these entries was downloaded from the databases and stored in a Microsoft Excel spreadsheet which was used to remove duplicates. 195 records (87 %) remained after duplicates were removed. These records were screened, and 117 records were excluded, leaving 78 records (35 %) for full-text article retrieval and assessment for eligibility. A total of 37 papers were excluded due to reasons such as failure to retrieve full text, absence of a GenAI focus, and poor quality (e.g., missing major sections, such as methodology). In the end, a total of 41 studies (18 %) that met the inclusion criteria.

#### 3.2. Characteristics of sources of evidence

While the search focused on identifying records published between 2017 and 2023, up till the time of this writing on July 25, 2023, only one

entry was published in 2022 [44], and all others in 2023. This is not surprising because GenAI in language education mostly began to gain attention since the launch of ChatGPT in Nov 2022.

Among the 41 selected papers (100 %), 33 are journal articles (80 %), 7 are gray literature (17 %), and 1 editorial position paper (2 %). Study types consist of 24 empirical studies (59 %) (i.e., 9 qualitative, 8 mixed methods, and 7 quantitative studies), 6 review articles (15 %), 10 technology reviews (24 %), and 1 commentary (2 %) (see Table 1).

Regarding the origins of the papers, I only considered empirical studies because origins of other study types are not as relevant, such as review articles and technology reviews. It is found that East Asia regions (Hong Kong, China, South Korea, Japan) are most productive with ten studies (42 %) [10,14,18,23,40,50–52,55,56], followed by Middle East regions (Iraqi Kurdistan, Saudi Arabia, Turkey) with three (13 %) [2,29,30], two (8 %) from Southeast Asia (Indonesia) ([1]; [46]) and one each from Benin [58], Chile [48], and Czech Republic [17]. However, three empirical studies have not specified the data origins (17 %) [3,27,31], while three others used internet data of which the origins cannot be identified (13 %) [24,25,28].

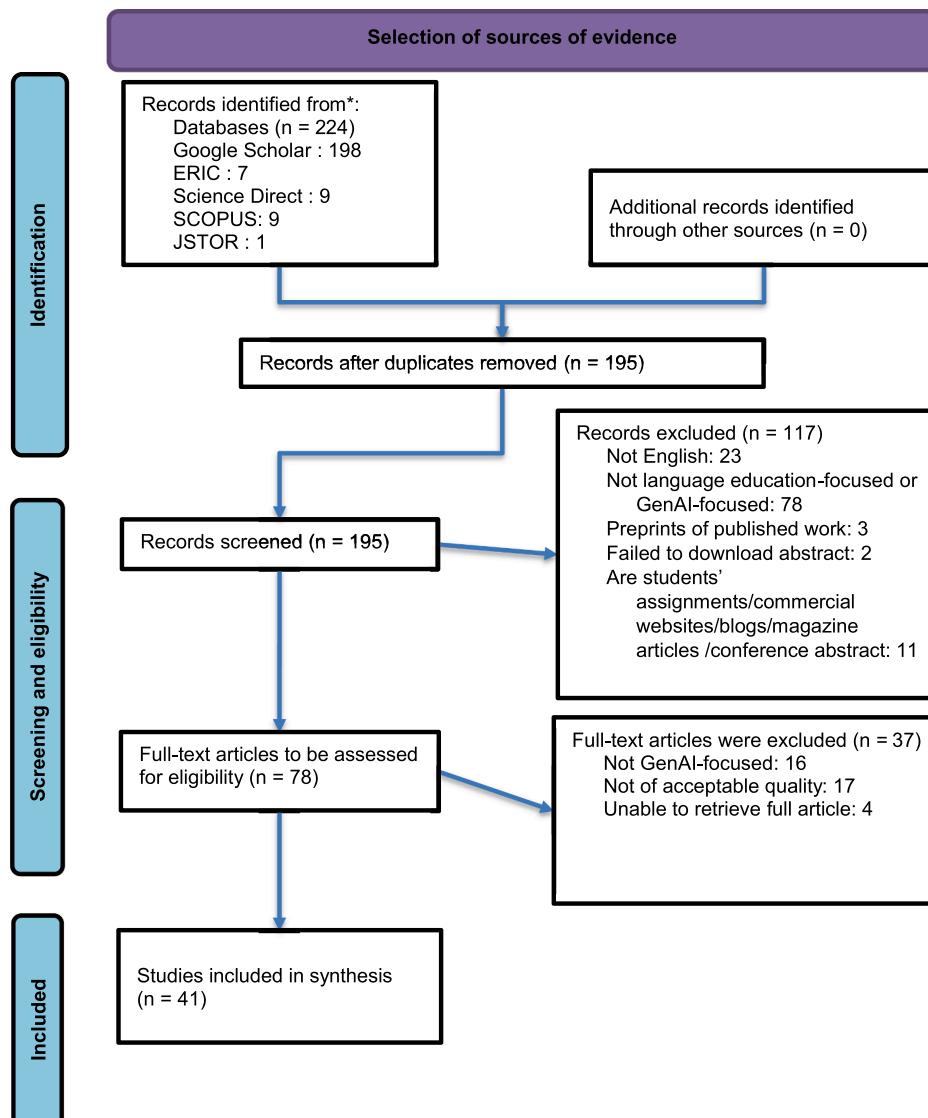


Fig. 1. A flow diagram summary of the selection of sources of evidence.

**Table 1**  
Characteristics of sources of evidence in frequency and percentages.

Characteristics	Frequency	%
<b>Publication year</b>	<b>41</b>	<b>100</b>
2022	1	2
2023	40	98
<b>Publication type</b>	<b>41</b>	<b>100</b>
Journal article	33	80
Gray literature	7	17
Editorial position paper	1	2
<b>Study type</b>	<b>41</b>	<b>100</b>
Empirical study	24	59
Qualitative	9	22
Mixed methods	8	20
Quantitative	7	17
Review article	6	15
Technology review	10	24
Commentary	1	2
<b>Origin of empirical study (by region)</b>	<b>24</b>	<b>100</b>
East Asia	10	42
Hong Kong	4	17
China	3	13
South Korea	2	8
Japan	1	4
Middle East	3	13
Iraqi Kurdistan	1	4
Saudi Arabia	1	4
Turkey	1	4
Southeast Asia	2	8
Indonesia	2	8
Other (Benin, Chile, Czech Republic)	Each 1	13
Unspecified	3	13
Internet data	3	13

3.3. Results of individual sources of evidence

Table 2 and Table 3 provide a summary of information on various aspects related to the use of GenAI programs in language teaching and learning. The concepts and themes that emerged from the analysis include research types and methods, subject locations/origins, education levels, areas of research, attitudes, language skills, testing, assessments, materials development, and policies. These themes encompass a broad range of studies that trial GenAI in language education, highlighting the breadth of research conducted in this area. The results presented in the tables directly address the objective and review questions established for this scoping review.

3.3.1. Review question 1: key terms in genai in education/language learning

In the literature, GenAI is commonly described as a state-of-the-art [11,16,19,25,28,52] AI-powered large language model (LLM) technology [14,35] existing in the form of Natural Language Processing (NLP) software tools [e.g., chatbots [55]]. When discussed under the context of language education, the technology falls under the umbrella terms of AI-based learning tools [46], chatbot-based learning tools [55], AI dialog systems for EFL [54], as well as AI-powered platforms and applications [48]. Intriguingly, within the context of GenAI, the term “AI literacy” does not seem to be vastly salient in the selected literature, appearing only five times in total in only two articles [36,46].

3.3.2. Review question 2: English as a foreign language (EFL) and diverse education levels

Most publications center around English as a Foreign Language (EFL) learners with the exceptions of [46] who looked into Indonesian texts, as well as [2] who also discuss the possibilities of GenAI for teaching social studies, maths, and Turkish.

The application of GenAI is explored across various educational levels and international tests, including preschool [44], primary [2,14,23,44], secondary ([1,46,50,51]), higher education [8,10,18,19,27,29,30,35,40,48,52,55,56,58], CEFR [5,20] and TOEFL [28]. The remaining

publications either have not specified any education levels or that the education level is not applicable in the discussion.

3.3.3. Review question 3: a) areas of research and b) attitudes towards GenAI

Within the scope of language teaching and learning (T&L), there are several major areas of research documented in the forty-one selected literature. The predominant area of investigation pertains to general T&L, which encompasses a significant portion of the literature (22 studies). Following this, T&L policy has garnered substantial attention, with nine studies dedicated to this topic ([1,3,10,18,19,23,27,38,39]). The domains of writing and assessment have also received notable scholarly interest, with five studies focusing on the former [16,25,40,46,56] and two studies investigating the latter [20,28]. The discussion on ethics, which is closely related to T&L policy, also yield two studies [35,36]. However, only a single study has examined a specific topic and it is on fallacy learning [55].

Among the selected papers, the most widely studied application of GenAI in language teaching and learning has been its use for writing instruction. Studies have demonstrated that GenAI systems can, to various extents, assist learners improve their writing skills by providing real-time feedback on grammar, vocabulary, and sentence structure ([1,40,52]). These systems can also help learners expand their vocabulary and improve their sentence structures by providing suggestions for alternative word choices and sentence rephrasings [38]. However, some papers have also pointed out the limitations of GenAI in writing instruction, such as the potential for overreliance on the system’s suggestions, may hinder learners’ critical thinking skills [27,29,30].

Regarding the utilization of GenAI in T&L, thirty-six papers express a clear attitude towards the matter. Among these, twenty-eight papers exhibit a positive attitude towards GenAI implementation, four papers express a mixed attitude [29,30,50,56], three papers strive to present a balanced perspective [12,14,57], while only one paper adopts a negative attitude [52]. In summary, the primary area of application for GenAI tools is language T&L. The studies emphasize the value of incorporating GenAI in language classrooms to support language acquisition, improve language skills, and offer personalized learning experiences. Researchers highlight the potential of GenAI tools, such as ChatGPT, in enhancing various aspects of education, including language skills, content generation, personalized learning, and assessment.

3.3.4. Review question 4: Potential impacts of GenAI (opportunities and challenges)

Researchers have suggested the potential positive impacts of GenAI writing tools such as ChatGPT on L2 writing and on certain psychological aspects such as learning motivations [10,29,31], interest and engagement [31] and students’ writing creativity [27]. In the context of language teaching and learning, many studies have suggested that GenAI (including ChatGPT and other chatbots) and LLMs have the potential to offer advantages such as personalized learning, rapid responses, improved language learning outcomes, and enhanced learning experiences and autonomy. For example, [54] highlights the potential benefits of the use of AI dialog systems for EFL education, which includes customisable input and complexity and instant feedback. [58] argues that AI-powered collaborative and interactive language learning tools can enhance student engagement in EFL teaching, improve student learning outcomes, and increase teacher satisfaction. In addition, [1] argues that ChatGPT has the potential to promote autonomy and personalized learning in language education via its human-like conversation and tailored language learning assistance. Learners can even regulate their learning processes, set objectives, and make decisions about their language acquisition. [57] further argue that ChatGPT can be deployed as a virtual tutor/expert/learning buddy or simply as a reflective learning tool or a stimulus for critical thinking. In terms of materials development and lesson planning, [20] demonstrates how ChatGPT can assist EFL teachers in efficiently generating assignments,

**Table 2**

Selected papers by author, research type, subject location/origin, education level, area of research, and attitude.

Author	Research type	Subject location/ origin	Education level	Area of research	Attitude
[1]	Empirical (mixed methods)	Indonesia	Secondary	T&L policy	Positive
[2]	Empirical (qualitative)	Turkey	Primary	T&L	Positive
[3]	Empirical (quantitative)	Not specified	Unknown	T&L policy	Positive
[5]	Technology review	N.A.	International English tests: CEFR	T&L	Positive
[8]	Technology review	Hong Kong	University	T&L	Positive
[10]	Empirical (quantitative)	China	University	T&L policy	Positive
[11]	Review article	N.A.	Not specified	T&L	Positive
[12]	Technology review	N.A.	N.A.	T&L	Balanced
[13]	Technology review	N.A.	N.A.	T&L	Positive
[15]	Empirical (qualitative)	South Korea	Primary	T&L	Balanced
[14]	Review article	N.A.	Not specified	T&L	Positive
[16]	Review article	N.A.	N.A.	Writing	N.A.
[17]	Empirical (quantitative)	Czech Republic	Not specified	T&L	N.A.
[18]	Empirical (qualitative)	Hong Kong	University	T&L policy	Positive
[19]	Technology review	N.A.	University	T&L policy	Positive
[20]	Technology review	N.A.	International English tests: CEFR	Assessment & Material development	Positive
[23]	Empirical (mixed methods)	South Korea	Primary	T&L policy	Positive
[24]	Empirical (qualitative)	Internet data	N.A.	T&L	Positive
[25]	Empirical (quantitative)	Internet data	N.A.	Writing	Positive
[27]	Empirical (qualitative)	Not specified	University	T&L policy	Positive
[28]	Empirical (quantitative)	Internet data	International English tests: TOEFL	Assessment: Essay grading	Positive
[29]	Empirical (qualitative)	Saudi Arabia	University	T&L	Mixed
[30]	Empirical (mixed methods)	Iraqi Kurdistan	University	T&L	Mixed
[31]	Empirical (quantitative)	Not specified	Unknown	T&L	Positive
[35]	Review article	N.A.	University	Ethics	N.A.
[36]	Commentary	N.A.	N.A.	Ethics	N.A.
[38]	Review article	N.A.	N.A.	T&L policy	N.A.
[39]	Technology review	N.A.	Not specified	T&L policy	Positive
[40]	Empirical (mixed methods)	Japan	University	Writing	Positive
[42]	Technology review	N.A.	Not specified	T&L	Positive
[44]	Technology review	N.A.	Preschool and primary	T&L	Positive
[46]	Empirical (mixed methods)	Indonesia	Secondary	Writing	Positive (but not so good in Indonesian)
[48]	Empirical (mixed methods)	Chile	University	T&L	Positive
Woo et al. (2023)	Empirical (qualitative)	Hong Kong	Secondary	T&L	Mixed
Woo et al. (2023)	Empirical (qualitative)	Hong Kong	Secondary	T&L	Positive
[52]	Empirical (qualitative)	China	University	T&L	Negative
[54]	Review article	N.A.	N.A.	T&L	Positive
[55]	Empirical (mixed methods)	Hong Kong	University	Fallacy learning	Positive
[56]	Empirical (quantitative)	China	University	Writing	Mixed
[57]	Technology review	N.A.	Not specified	T&L	Balanced
[58]	Empirical (mixed methods)	Benin, Africa	University	T&L	Positive

quizzes, learning activities and lesson plans, saving valuable time and effort which could be used on other important aspects of language pedagogy.

A few papers have discussed the potential of GenAI language models in evaluating writing tasks, providing real-time feedback, and revolutionizing writing evaluation methods. For instance, [29] discusses how ChatGPT can enhance conventional pedagogies and improve the efficiency of EFL teachers in grading while providing more accurate and insightful feedback. [20] suggests that using ChatGPT for grading can streamline the assessment process, saving time and effort for teachers. By automating certain aspects of grading, teachers can focus on other critical aspects of language pedagogy. Finally, [28] have studied GenAI-powered TOEFL essay scoring in their research, specifically Automated Essay Scoring (AES) using GPT (Generative Pre-trained Transformer). Results show that AES by GPT can achieve a certain

level of accuracy and reliability of scoring L2 writing and can be enhanced by integrating linguistic features such as lexis, syntax, and cohesion.

However, concerns have been raised regarding the potential challenges, limitations, and pedagogical impact of GenAI in the literature. More than half the selected papers have mentioned the ethical considerations regarding the use of GenAI, with keywords involving plagiarism, and biases. [52] is perhaps the most explicit about the disadvantages of GenAI, arguing that the threats of ChatGPT outweigh its potential benefits. Citing related literature and results from the author's study, [52] lists out several key threats of ChatGPT, including academic dishonesty (i.e., students take credit of AI-generated writing), educational inequality (i.e., the GenAI program may create disparities among students due to unequal accessibility to and proficiency in using the tool), plagiarism detection avoidance (i.e., ChatGPT produces



**Table 3**

Selected papers by author, data/participants, instrument, and summary.

Author	Data/Participants	Instrument	Summary
[1]	6 Indonesian high school students	Semi-structured interview	It highlights the potential of ChatGPT as a learning tool to promote autonomy and personalized learning among English Language Learners (ELLs) in the Kurikulum Merdeka Belajar (KMB) program. The findings suggest that ChatGPT can enhance students' ability to take charge of their learning processes, set objectives, and make decisions about language acquisition. Findings revealed that students found ChatGPT to be engaging, enjoyable, and beneficial for academic achievement. It provided accurate and prompt responses to student queries, offering a greater amount of information compared to traditional resources. The students recommended its use in other subjects such as social studies, mathematics, and Turkish.
[2]	15 4th grade students studying in a public school in Türkiye in the 2022–2023 academic year	Online questionnaire	The findings showed that ChatGPT was able to motivate learners to develop reading and writing skills, while attitudes towards its effect on listening and speaking skills were neutral. The study suggests that ChatGPT-based teaching is motivational and should be used as a learning tool, with further research needed to explore its advantages and address any potential negative effects.
[3]	80 primary school students and instructors of the English language	Questionnaire	LLMs, such as ChatGPT, can assist teachers by reducing their preparation time and providing personalized feedback to students. The article highlights the various tasks that LLMs can perform, such as summarizing texts, correcting grammar, generating writing prompts, and generating lesson ideas. It emphasizes the importance of
[5]	ChatGPT	–	

**Table 3 (continued)**

Author	Data/Participants	Instrument	Summary
[8]	ChatGPT	–	understanding AI and LLMs in order to harness their capabilities effectively for educational purposes. This article highlights the potential of ChatGPT as a personalized language learning partner that provides feedback and practice. However, there is a concern that ChatGPT may lead to limited or zero learning if students rely too heavily on it. It emphasizes the need for finding a balance between assistance and independent learning.
[10]	44 undergraduate students (20 males and 24 females) from a comprehensive university in China	Pretest-posttest quasi-experimental design	The integration of argumentative chatbots into classroom debates can enhance argumentation skills and increase task motivation among students participated in the study.
[11]	ChatGPT	–	ChatGPT presents significant opportunities for improving second/foreign language teaching and assessments. It offers a personalized learning experience and opens up avenues for research. Educators should engage in discussions with students about the ethical and responsible application of chatbots rather than avoiding the topic altogether.
[12]	ChatGPT	Poetry analysis	While AI models like ChatGPT-3 can imitate the style and language of famous poets, they are unable to generate emotions they have not experienced. The article suggests reframing discussions about AI's impact on humanity with a focus on understanding the uniquely human anxiety and the drive to create.
[13]	ChatGPT	–	The authors suggest that GenAI applications can enhance personalized learning, promote creativity, critical thinking, and problem-solving skills. They also emphasize the importance of developing guidelines and templates for GenAI-based learning

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Table 3 (continued)

Author	Data/Participants	Instrument	Summary
[14]	11 English language teachers from ten elementary schools in South Korea	Semi-structured interviews and the teachers' interaction logs with the chatbot	and conducting high-quality studies to further explore its effectiveness and potential in educational settings. The study identifies four roles of ChatGPT (interlocutor, content provider, teaching assistant, and evaluator) and three roles of teachers (orchestrating resources, making students active investigators, and raising AI ethical awareness). It emphasizes the importance of teachers' pedagogical knowledge when using AI tools and provides implications for the future use of LLM-powered chatbots in education.
[15]	32 empirical studies on speech-recognition chatbots for language learning were reviewed	Systematic review	The review suggests the need for further research on speech-recognition chatbots, particularly regarding the use of LLMs.
[16]	Various AI software: Intelligent and Interactive Writing Assistant (In2Writing2)	–	The article discusses the evolution of text revision tools, from rule-based approaches to deep neural-based ones, and acknowledges the existing challenges in terms of accessibility, context consideration, and discursive information.
[17]	109 respondents across the Czech Republic	Questionnaire	The study highlights the importance of simplicity, quick practice opportunities, gamification features, accessibility, and cost-free usage in chatbots for language learning. It also emphasizes the significance of immediate feedback, user-friendly interfaces, and short-term interactions.
[18]	ChatGPT	–	It highlights the benefits of ChatGPT in providing authentic interactions, explaining word meanings, generating texts in various genres, and offering vocabulary support. However, debates and drawbacks surrounding the ethical use of ChatGPT, including concerns about cheating and

Table 3 (continued)

Author	Data/Participants	Instrument	Summary
[19]	ChatGPT; 6 male and 6 female University instructors	Questionnaire; semi-structured interviews	assessment, are also discussed. The study emphasizes that instructors should possess digital competencies and pedagogical knowledge to effectively implement AI-driven teaching tools. It also stresses the importance of providing tailored support and professional development programs to address the challenges and concerns associated with adopting AI in the classroom.
[20]	ChatGPT	–	It emphasizes the benefits of utilizing ChatGPT in material development and assessment, including the generation of tailored text passages and comprehension questions. However, it also acknowledges the need for further empirical research to evaluate the effectiveness and quality of ChatGPT in language education.
[23]	121 Grade five and 6 students (aged 11–12) in elementary schools located in Seoul, Gwangju and Jeollanam-do, South Korea	A pre-post design, including both the experimental and comparison conditions	The researchers examined the impact of using an artificial intelligence-based content generator (AICG) on young English-as-a-foreign-language learners' reading enjoyment and interest. The findings suggest that AICG technology has the potential to improve second-language learning experiences.
[24]	45 YouTube videos		This study identified that ChatGPT is a valuable tool for language teaching but cannot replace teachers completely. The study also highlighted two gaps: the learning optimization gap and the knowledge comprehension gap.
[25]	GPT-3 model (text-davinci-003)		The study found that GPT-3 performed well in GEC tasks, outperforming existing supervised and unsupervised approaches. Additionally, the controllability of GPT-3 in terms of minimal edits, fluency edits, and learner levels was demonstrated.

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Table 3 (continued)

Author	Data/Participants	Instrument	Summary
[27]	4 writing teachers from three different universities; Quillbot, WordTune, Jenni, Chat-GPT, Paperpal, Copy.ai, and Essay Writer	Semi-structured interviews	The article states that integrating AI writing tools in EFL classrooms positively impacts students' writing quality, especially in terms of content and organization.
[28]	12,100 essays contained in the ETS Corpus of Non-Native Written English (TOEFL11)	GPT-3 text-davinci-003 model	The results indicated that AES using GPT-3 demonstrated a certain level of accuracy and reliability, with the potential to enhance scoring accuracy by incorporating linguistic features, suggesting that AI language models such as GPT-3 can drastically change writing evaluation and feedback in both research and practice.
[29]	10 English as a Foreign Language (EFL) faculty members at Northern Border University	Interviews	The faculty members had varying opinions about ChatGPT, with some acknowledging its usefulness in providing immediate responses to questions, while others worried about its impact on critical thinking and research skills.
[30]	67 university teachers (Questionnaire), 23 university teachers (Interview)	Questionnaire & interview	Teachers hold diverse opinions about the advantages of AI technologies for students, expressing both positive and negative views on its impact on academic integrity. The study discusses the importance of providing comprehensive training and support to teachers, enabling them to effectively incorporate AI while upholding academic honesty. Additionally, ethical considerations and guidelines are urged to ensure the responsible implementation of AI in education.
[31]	350 students and teachers	Survey, ANOVA, post hoc multiple comparison tests	The results indicated a significant correlation between teachers' and students' perceptions of using ChatGPT, and it was found that ChatGPT had substantial impact on student motivation and engagement. The research suggests that incorporating ChatGPT into the educational system can improve student learning outcomes.

Table 3 (continued)

Author	Data/Participants	Instrument	Summary
[35]	–	–	The article suggests that whether the use of these tools constitutes plagiarism or a breach of academic integrity depends on how transparent students are about their usage. It highlights the need for Higher Education Institutions to update their academic integrity policies to address the use of LLMs in educational environments.
[36]	ChatGPT	–	The article emphasizes the need for a multidisciplinary and collaborative approach to address the ethical, societal, and practical challenges associated with artificial intelligence (AI). It highlights the importance of robust AI policies, improved AI literacy, sustainable AI practices, and ongoing dialog.
[38]	–	–	It highlights the need for comprehensive pedagogical approaches and academic integrity policies that address the use of AI-powered writing tools beyond large language models (LLMs) like ChatGPT. The study categorizes three types of digital writing tools: machine translators (MTs), digital writing assistants (DWAs), and automated paraphrasing tools (APTs).
[39]	ChatGPT	Case studies, multiple-choice tests, writing tasks, and mathematics queries for standardized tests	The article suggests that while ChatGPT has great potential in enhancing language acquisition, users should exercise critical discernment, and educators need to continually update their understanding of information technology for effective implementation.
[40]	69 Japanese university students	Questionnaire; chatgpt, Grammarly, prowritingaid	The article suggests that ChatGPT is the most helpful grammar-checking tool for Japanese English Language Learners (ELLs) compared to Grammarly and ProWritingAid. The article discusses the potential of ChatGPT in improving students' writing.

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Table 3 (continued)

Author	Data/Participants	Instrument	Summary
[42]	ChatGPT	–	understanding and use of English grammar. The article emphasizes that while AI tools like ChatGPT, Bing AI, and DALL-E have the potential to benefit gifted education programs by providing personalized learning, advanced content, and creative opportunities, teachers need to carefully consider the advantages and disadvantages before incorporating them into the classroom. Despite the limitations of AI, it can be a valuable tool for meeting the needs of gifted and talented students.
[44]	ChatGPT	–	The article proposes a framework for developing a foreign language teaching software tool for children using Augmented Reality (AR), Voicebots, and ChatGPT. It suggests that the framework and design principles presented can serve as a blueprint for highly effective foreign language teaching software.
[46]	58 senior high schools students (25 males and 33 females) in Semarang, Indonesia	Questionnaire; in-depth interviews via mobile instant messaging	This article found that while AI-based learning tools have shown potential in assisting students with academic research and drafting, they have not significantly improved the overall quality of students' academic papers. The study recommends enhancing AI-based tools by adding features for editing Indonesian text and improving AI literacy.
[48]	12 faculty members (9 females and 3 males) from a private university in Chile	–	Positive perceptions towards the use of AI were observed among the teachers, who acknowledged its potential for improving learning and teaching. The study highlights the significance of taking into account students' motivation levels and teachers' technological and pedagogical competence when incorporating AI into the EFL classroom.

Table 3 (continued)

Author	Data/Participants	Instrument	Summary
[50]	67 EFL students from four Hong Kong secondary schools	Open-ended questions; thematic analysis	This article suggests that implementing machine-in-the-loop writing in EFL classrooms has both benefits and challenges. The study highlights the importance of aligning activity goals with students' values, language abilities, and AI capabilities to enhance students' activity systems.
[51]	23 Hong Kong secondary school students	Multiple linear regression, cluster analyses, syntactic complexity of the stories' AI-generated text	This article suggests that the use of AI-generated text can improve the quality of both high-scoring and low-scoring students' writing, providing insights for pedagogical strategies in using AI-generated text for EFL students' writing.
[52]	16 Chinese undergraduate majoring in EFL	Classroom observations, learning log analysis, and interviews	In terms of L2 writing pedagogy, the study's findings indicated that ChatGPT has the potential to bring benefits, such as enhancing writing efficiency. However, participants raised concerns regarding academic integrity and fairness in education. The study emphasized the importance of reassessing plagiarism in the age of AI and establishing guidelines and policies to ensure appropriate use of the tool.
[54]	Google Scholar, ProQuest, IEEE, ScienceDirect, and Web of Science.	–	The findings revealed gaps in the design of AI dialog systems, such as the neglect of debate and problem-solving skills and the absence of cultural, humorous, and empathetic functions. The study suggests focusing on meaning-based communication, intelligibility in language competency, and problem-solving skills in future research.
[55]	30 Chinese English students (25 females and 5 males) at a university in Hong Kong	Semi-structured interviews, pre-post tests of fallacy knowledge, and pre-post motivation questionnaires	This study found that although the chatbot was considered to be somewhat less effective in enhancing target knowledge, it demonstrated greater effectiveness in enhancing learner motivation. The study emphasized the benefits of chatbots in

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Table 3 (continued)

Author	Data/Participants	Instrument	Summary
			terms of their interactions between humans and computers, the ability to create study plans, and their accessibility.
[56]	40 sophomores majoring in English (10 males and 30 females) (native Chinese speakers) in a top-20 university in China	Coh-Metrix: A tool for analysing language discourses, used to measure the data in terms of five discourse components.	This study suggests that while ChatGPT outperformed human writers in certain aspects of writing, such as narrativity, word concreteness, and referential cohesion, it fell behind Chinese intermediate English (CIE) learners in terms of syntactic simplicity and deep cohesion.
[57]	ChatGPT	SWOT analysis	The authors put forward the idea of conducting a SWOT analysis on ChatGPT and provide recommendations on effectively incorporating it into educational settings. The research underscores the importance of acknowledging ChatGPT's limitations while capitalizing on its strengths to improve the field of education.
[58]	30 EFL teachers and 431 students from the English Department and the Beninese Center for Foreign Languages of the University of Abomey-Calavi	Questionnaire surveys, semi-structured interviews, observation of online language learning sessions	The findings demonstrated that the implementation of AI-powered collaborative and interactive language learning has the ability to enhance EFL teaching in the post-pandemic online setting. It was shown that incorporating AI-assisted collaborative online learning leads to improved engagement in EFL instruction, enhanced learning outcomes for EFL students, and higher levels of teacher satisfaction.

writing that is undetectable by existing plagiarism detection software), and learner motivation impairment (i.e., ChatGPT produces writing without students putting in significant effort). Studies conducted on university teachers' perception of GenAI programs reveal teachers' concern about academic integrity [29,30], reinforcement of biases or misinformation, as well as hindrance of students' development of critical thinking and research skills [29].

Another important aspect of ethical concern is data privacy and security. However, this topic has only been discussed at length by [29] and [31] and [57]. The major argument is that as AI-powered chatbots collect and analyze user data to provide personalized learning experiences, there is a need to ensure that students' personal information is protected and handled in a secure manner.

4. Discussion

4.1. Summary of evidence

From an initial 224 entries from the selected databases, 41 studies have met the inclusion criteria and were investigated in this scoping review. The objective is to determine the current state of research on the use of GenAI in language teaching and learning, and to identify research gaps and areas for future investigation. Four review questions were conceptualised to meet the objective and were successfully answered.

As far as key terms surrounding the use of GenAI in language education is concerned (see Section 3.3.1 Review question 1), there is a variety of synonyms and acronyms used by the authors. To a certain extent, this can lower the chances of their papers appearing on online databases and may even cause confusion to readers. Therefore, there is a need for a more unified term to maximize the exposure of studies, and a simpler term such as generative artificial intelligence (GenAI) programs may be more practical.

Studies included in this current review have demonstrated the versatility of GenAI tools at different education levels and languages (see Section 3.3.2 Review question 2). However, many papers have emphasised on EFL and in university settings. To broaden the reader base, it can be beneficial to add more research on GenAI for teaching other purposes of English or other languages at different education levels.

Given the time of publication of the selected papers (i.e., almost all in the first half of 2023), it is not surprising that researchers have focused on T&L and related policies, writing, and assessments (see Section 3.3.3 Review question 3a). Indeed, these are the areas which are impacted by the launch of the freely available OpenAI's ChatGPT (GPT-3), a then-text-based chatbot [7]. Since multimodal GenAI programs are now available [e.g., GPT-4 [33], DALL-E 2 [34]], it is expected that the areas of research and disciplines to be significantly broader than it currently is within a very short period of time. Generally, researchers are positive towards the use of GenAI in language education (see Section 3.3.3 Review question 3b), but educators should be aware of the environmental impacts of GenAI, and that some potential effects of this technology race in GenAI development is yet to surface (see [22,41]).

This review encompasses a range of studies examining the potential advantages and challenges associated with the implementation of GenAI in language teaching and learning (see Section 3.3.4 Review question 4). These impacts can be classified into two main categories: psychological aspects and productivity considerations. From a psychological perspective, several studies have indicated that students may derive various benefits from utilizing GenAI programs. These programs can adapt to learners' proficiency levels, learning pace, and cognitive abilities, and thus may function as virtual private tutors, offering tailored language learning suggestions and personalized feedback on-demand (e.g., [57]), thereby enhancing students' motivation, creativity, interest, learning experience, and autonomy (e.g., [48,55,58]). These advantages surpass the capabilities of human class teachers. However, more research is needed to investigate their effectiveness in different educational settings. From a perspective of productivity gains, GenAI programs can swiftly generate drafts, compose short essays, correct grammatical errors, and refine sentences and paragraphs, effectively saving valuable time. Consequently, teachers also stand to benefit from GenAI programs. In terms of productivity, these programs can facilitate idea generation, provide examples, aid in grading, and offer feedback to students. Psychologically, the increased productivity resulting from GenAI utilization may alleviate stress among teachers and afford them additional time and resources to enhance the quality of their instruction.

However, it is worth noting that contrasting viewpoints have emerged from certain papers, positing that the same psychological aspects (once again referring to students' motivation, creativity, interest, learning experience, and autonomy) may potentially be compromised by the integration of GenAI programs. These papers argue that these

programs may be perceived as shortcuts for writing [30,52], and concerns have been raised about the potential lack of contextual understanding and the inability to assess higher-order cognitive skills in generative AI systems [29], thereby increasing the risk of plagiarism and contributing to academic dishonesty [52]. Interestingly, however, that when examining the issue through the lens of productivity, the potential advantages offered by GenAI programs remain uncontested.

Although ethical concerns (e.g., algorithmic bias, plagiarism, dishonesty, inequality) have been discussed by a few researchers in their papers, there is a clear lack of attention given to an important aspect of ethical consideration: data privacy and security. Only six papers [19,20,29,31,48,57] briefly mention this topic within the selected literature. Among them, [57] provide the only substantial discussion, addressing potential risk factors such as security breaches or hacking that could lead to illegal access to student data. They also raise concerns about the misuse of student data by third parties and emphasize the role of teachers in safeguarding the data and obtaining informed consent from students before using GenAI programs.

In addition, the lack of AI literacy discussion in the selected papers could potentially suggest the lack of awareness among language researchers/educators. One highly possible scenario, but has not been discussed in the selected literature, is that teachers may unknowingly introduce seemingly beneficial GenAI programs to students without fully understanding how the first-party data, rather than third-party data, is collected and utilized. As discussed in a recent publication by [7], it is crucial that all educators should have a satisfactory level of teacher AI literacy.

Logically then, a teacher's knowledge in data privacy and security within 'GenAI literacy' (which is emphasised here not as a different type of AI literacy, but a subset of it) is of utmost importance, since a teacher should be able to educate students that any user data – be it text, image, sound, or video – once uploaded, has the potential to be used by the programs for training and replication (see [26] for a video with AI-generated voice-over of US Presidents playing a Nintendo game, and see [37] for a demonstration video of how GenAI generates voices). In short, every teacher should serve as the first line of defense to ensure that students understand the concept of 'what they pay' before 'what they get'.

#### 4.2. Significance of findings

This scoping review provides insights into the research types and methods used, the positive attitudes towards GenAI tools in language teaching and learning, the focus on various language skills, the assessment and material development aspects, and the policies related to their implementation. These findings help shed light on the current state of research, identify gaps, and offer implications for future investigations.

The findings have relevance to key groups involved in language education. Language learners and teachers can take into account the positive attitudes reported towards the use of GenAI programs such as ChatGPT and other GenAI tools and consider incorporating these programs into their lessons. The identification of language skills and areas of language learning that have been investigated may guide curriculum development and instructional practices. Additionally, developers of GenAI technologies may use the review findings to inform the design and improvement of GenAI tools for language teaching and learning.

Furthermore, the findings of this scoping review hold significance for researchers in the field of language education. The identified research gaps, such as the need for more studies on GenAI for purposes other than English language teaching, provide valuable directions for future investigations. Researchers may also draw insights from the various research types and methods employed in the reviewed studies, allowing for the advancement of research methodologies in the domain of GenAI in language teaching and learning.

Moreover, the implications of this scoping review extend beyond language education. The positive attitudes towards GenAI programs and

their potential benefits in terms of enhancing productivity and psychological aspects may be of relevance to other disciplines that incorporate GenAI technologies. The findings highlight the broader implications of GenAI tools in education and emphasize the need for a comprehensive understanding of their impact on learners and educators.

The ethical considerations raised in this scoping review, particularly regarding data privacy and security, also hold significance for policy-makers and educators alike. The limited attention given to this aspect in the reviewed literature underlines the importance of raising awareness and ensuring adequate teacher 'GenAI literacy' to address potential risks and safeguard student data. Policymakers can utilize these findings to develop guidelines and policies that promote ethical practices and protect the privacy of individuals involved in GenAI-based language education.

#### 4.3. Limitations

One apparent limitation is the year span of publication of this study. While publications spanning across 6 years can be considered a reasonable length (i.e., they must be published between 2017 and 2023, up till the time of this writing on July 25, 2023), studies on GenAI are expected to surge after the cut-off date. This means many potentially useful articles have not been considered in the current study. Considering the rapid development of GenAI, I posit that it is worth performing a similar literature review to this current study on a yearly basis in order to keep up with the latest trend in the related scholarship.

Another important limitation to note is that the literature lacks empirical evidence on the effectiveness and quality of students' work after incorporating GenAI tools. This means that there may still be unexpected issues or uncertainties regarding the pedagogical impact of GenAI in educational contexts.

#### 5. Conclusion

The application of GenAI in language teaching and learning is a promising area of research with the potential to transform language education. This scoping literature review has achieved its objective by answering several review questions with respect to the literature, revealing key terms related to GenAI in language education, most researched language studies and education levels, areas of research, attitude towards the use of GenAI, and potential benefits and challenges of GenAI application in the context.

The results of this scoping review highlight several implications and future directions for research and practice. Firstly, there is a clear need for more empirical studies to provide a comprehensive understanding of the short and long-term effectiveness and impact of GenAI tools. This includes exploring both text-based and multimodal-based tools and their specific applications in language education. Secondly, continuous and regular investigations are required to explore the ethical considerations and potential limitations of these fast-changing technologies. As GenAI tools continue to advance, there is a need to address concerns related to data privacy, security, and the responsible use of these technologies in educational settings. Thirdly, future research should focus on specific language skills, such as writing or speaking in different languages, to provide targeted interventions using GenAI tools. By understanding how these tools can support and enhance specific language skills, educators can develop more effective instructional strategies. Lastly, stakeholder engagement is crucial in shaping the implementation and use of GenAI programs [19]. Students, language educators, researchers, policy-makers, and developers should collaborate to ensure that these tools are integrated into language teaching and learning contexts in a meaningful and responsible manner. Moreover, the implications of GenAI programs extend beyond language education, making it important to consider their integration in other subjects as well. Since GenAI is here to stay, educators should consider incorporating GenAI tools into their teaching practices. However, it is important to remain vigilant and mindful of the

potential risks involved. Continuous professional development for educators on GenAI-related subjects is paramount to ensure that they are equipped with the necessary knowledge and skills to make informed decisions and effectively integrate these tools into their teaching practices [7].

In conclusion, the findings from this scoping review contribute to the existing knowledge on the use of GenAI tools in language education. The identified concepts, themes, and types of evidence provide an overview of the current research landscape, and have implications for major stakeholders involved in language education. Future research should build upon these findings to further explore the potential of GenAI tools in enhancing language teaching and learning experiences.

### Declaration of Generative Ai and AI-assisted technologies in the writing process

During the preparation of this work the author used ChatGPT in order to improve readability and language. After using this tool/service, the author reviewed and edited the content as needed and take full responsibility for the content of the publication.

### CRedit authorship contribution statement

**Locky Law:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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