

Impact of AI-Powered Language Models on English Language Learning and Teaching Practices

Omar J. Alkhatib

Omar.alkhatib@uaeu.ac.ae

Professor of Civil and Structural Engineering, Architectural Engineering Department, United Arab Emirates University

Muhammad Noman Khan

nomankhan4217@gmail.com

MPhil, Applied Linguistics, English Language Assessment Specialist, Home Languages Center, Swat, Khyber Pakhtunkhwa, Pakistan

Muhammad Faisal Ishaque

faisalishaque7@gmail.com

Lecturer, Department of education University of Poonch Rawalakot

Corresponding Author: * Omar J. Alkhatib (Omar.alkhatib@uaeu.ac.ae)

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ABSTRACT

Integrating technology into our daily lives has changed how we teach in the classroom, especially how we teach English. Many institutions have started using technology to assist with grammar checking, vocabulary, giving feedback, content creation, and even hold conversations. However, there is not much evidence to suggest how technology has been impacting the teaching of the English language. With this study, we intend to focus on how English learners in higher learning institutions may be impacted by the use of technology in teaching English. In this study, we designed and administered a cross-sectional survey to 350 students and teachers of English based on a public and a private university. To decide the levels of AI use, learning outcomes, teaching practices, and learner autonomy, we developed a questionnaire and used it to collect our data. The questionnaires were tested for consistency using Cronbach's Alpha, and we were able to use SPSS for various statistical analysis. To understand who our participants were, we conducted descriptive analysis. We used Pearson's correlation and multiple regression analysis to understand how the variables of the study interacted. The research found that using AI alongside learning English positively enhanced vocabulary, writing, speaking, and comprehension. Thus, AI language models help with lateral and efficient learning and self-learning. Overall, the AI language models help you with English. But, to help guide learning, there can't be too much use of the AI. As is, the research can help teachers, people designing learning, and people with power. As is, the learning can be based on using AI with ethics and research.

Keywords: Artificial intelligence, language models, English language learning, teaching practices, quantitative research

INTRODUCTION

The twenty century brought around artificial intelligence (AI) as one of the most important advancements in technology and has had a positive impact in many fields of technology like education (Wang, et al., 2024). The impact AI has had on education allows a shift in multi-functioning teaching and learning through the use of valuable information collection to make choices, offers tailored learning, and has tools for automated assistance (Wiboolyasarini, et al., 2025). Current AI tools designed specifically for the

education sector have moved from being helpers in the educational administrative and managerial tasks to becoming main actors that educators use for teaching, grading, and engaging students. As institutions of education in the world become more digitally and intelligently adaptive, AI has become the main architect of the new educational approaches and learning methodologies (Parker, et al., 2025).

The impact of the developed AI tools on teaching and learning practices in the discipline of English language education has grown. The AI tools being discussed make use of advanced machine learning and natural language processing technologies (Pérez, et al., 2020). They have the capacity to produce written content as a human being, offer real-time language assistance, and analyze language intricately and deeply. In English language education, AI models are popularly used to automate the processes of content generation, real-time provision of feedback in writing, grammar checking, provision of support in reading comprehension, and even to enhance the level of vocabulary one possesses (Wei, et al., 2023). The feedback these tools provide are instant, meaning one has the opportunity for continued practice. The outcome of such continued practice is that a learner has the capacity to recognize and alter the mistakes in their writing. They are more able to enhance their knowledge of the language, and are able to communicate through writing even more easily (Wang, et al., 2024).

The impact that language models have developed is more profound in English as a Second Language (ESL) and English as a Foreign Language (EFL) where the students have little exposure to the target language in their daily lives outside the classroom. AI tools help give learners language input, opportunities for interactive practice, and provide learning pathways that keep them engaged and help overcome the barriers to learning languages. These tools offer real-time, responsive feedback and guidance, and automated, individualized recommendations to meet the learners where they are. For these reasons, the language skills acquired from these learning aids are seen as invaluable for the learners to become more independent for the traditional classroom methods to be supported and to aid motivate the learners (Wei, et al., 2023).

AI tools also provide instructors the means to shift their methods and impact more freely. The tools can take care of the busywork of grading and providing feedback, leaving them more time for the things of planning lessons and engaging the learners with and on the content. From there, the instructor can more easily be focused on the learning needs and pivot to where learners are having issues. The work these tools can provide to the instructor, and ultimately the learners, is why these tools are seen to redefine the instructor from just delivering the content to also designing the learning. The active position of these tools in language education is wide-ranging. While the issues of integration into the curriculum, its pedagogical effectiveness, and its long-term outcomes on the learners' language skills are still being debated, the integration of these tools itself is still very much accepted (Pérez, et al., 2020).

More risks are on the horizon from possible overreliance on AI tools in the classroom. If these tools aren't used with care, they might even lower learners' ability to think critically, be creative, and use language on their own. On top of that, educators and institutions have to deal with ethical problems including data privacy, academic dishonesty, bias in AI generated texts, and inequitable access to tools (Kasneci, et al., 2023).

The limited use of quantitative research means there's less exploration of the possible impacts on the use of AI-Powered language models on outcomes, positive, or otherwise, in the learning and teaching of English. There is a particularly striking deficiency of data concerning the active and passive impacts of AI on the development of language proficiency, autonomy of the learner, teaching effectiveness, and the quality of feedback. This shortage of data makes it harder for educators, administrators, and curriculum designers to introduce AI in a structured way to language teaching and learning contexts. In order to try to answer, at

least in part, these research questions, the impacts of AI-Powered Language Models on learning and teaching English language are being investigated (Zawacki-Richter, et al., 2019).

This study seeks to assess the effects of incorporating AI language models on teaching English learners by analyzing AI use, outcomes, and instructional changes. This study also aims to add to the literature on the use of AI in education, specifically how educators, institutions, and policymakers can use AI education ethically and responsibly.

Statement of the Problem

Incorporating AI language models into English language education has changed the way people learn and teach. However, the effects of AI tools on learners' language skills and teachers' effectiveness in fulfilling the needed activities of teaching English has not been sufficiently quantified. Provided that AI tools are being used to improve language teaching and learning in educational institutions, teachers, and educators do not have the solid evidence to make conclusions as to whether or not AI tools improve language proficiency or provide low-level language proficiency skills. There are not enough quantitative studies in the field of teaching English that empower educators to make evidence-based decisions as to integrate different instructional tools into English teaching and adapt different instructional designs to meet educational goals and objectives. AI models can be ethically used in the learning and teaching of English language education, but due to the lack of evidence to justify the use of AI, the models have not been implemented. Therefore, quantitative studies are needed to improve the learning and teaching of English language education.

Research Objectives

1. To examine the level of AI-powered language model usage in English language education.
2. To assess the impact of AI-powered language models on English language learning outcomes.
3. To analyze the effect of AI-powered language models on teaching practices.
4. To determine the predictive relationship between AI usage and learning and teaching outcomes.

Research Hypotheses

H1: AI-powered language model usage has a significant positive impact on English language learning outcomes.

H2: AI-powered language model usage significantly improves teaching practices in English language education.

H3: AI-powered language model usage significantly predicts learner autonomy and instructional efficiency.

Significance of the Study

The impact of this study lies in its being of the first few initiatives providing assessment solutions on the efficacy of AI-powered language models in the domain of English language learning and teaching. The results stand to benefit educators by elucidating the ways AI can optimize learning outcomes, learner independence, and efficiency of the teaching process. This will aid educators in balanced pedagogic

decision making with regard to the use of AI in language teaching. The study also equips the educators, curriculum developers, and educational institutions with the insights needed to design multilingual programs centered around AI. The results also stand to benefit policymakers in providing ethical frameworks and technological interventions in the field of AI in education. This study also adds to the depth of scholarship on the use of AI-powered tools in the teaching of language.

Limitations

1. The findings of the study are based on self-report questionnaires, which are susceptible to the effects of social desirability and response biases. For example, participants may have AI learning outcomes to an extent that are inaccurate, either too high or too low, which may cloud the findings of the study. Such biases can dilute the results, and the accuracy of the findings may be affected. Despite the application of reliability measures, subjective perception is a limitation. Future studies may include measures of objective performance.
2. The cross-sectional nature of the design of the study imposes limitations on establishing the cause of the outcome of the study. The data collected is a reflection of the response of the participants to the study at one given point in time.
3. Given that the outcomes of learning were measured only at the beginning of the research period and not at the end, the impact of learning on the outcomes could not be assessed. Relational aspects of the variables were able to be measured, but this did not lead to establishing explanatory relationships. For future research, experimental or longitudinal designs are advised.
4. The research sample was strictly composed of students and educators in the higher education sector. This means that findings from this study are not applicable to primary or secondary education. There are such contextual factors as age, curricula, and technology which could impact the usefulness of AI. This constrains the findings of the study to be applicable only to the higher education sector. Future studies will be expected to consider varying educational levels and settings.

LITERATURE REVIEW

AI-Powered Language Models in Education

Artificial Intelligence (AI) language models are built using machine learning and natural language processing to create models that can imitate human response and enable advanced intelligent LSP functionalities. In educational settings, these LSP's have been used to automate writing assistance, grammar checkers, tutoring, and conversational practice. AI tools provide instant feedback and interaction. This is used to improve student engagement. Studies show that adaptive learning instruction becomes possible in AI enriched environments. This is why, AI language models are becoming essential in educational institutions (Zawacki-Richter, et al., 2019).

Impact on English Language Learning

Past research studies show that learning the English language can be improved when learning with AI, especially with writing, grammar, and vocabulary that one loses when learning with traditional methods. Having AI help is a great tool as learning can be done individually, but also corrects learners' mistakes as they go. That being said, it has also been shown that learning can be enhanced through AI. However, it has been shown that the more AI is used, the more beneficial it can be as it has shown improved learning outcomes. If AI is used for learning, but not used correctly, it can lead to negative outcomes instead (Wang, et al., 2024).

Impact on Teaching Practices

AI-powered models have shown great promise in streamlining teaching responsibilities by automating aspects of instruction. Responsibilities like grading, mistake recognition, and formative feedback are time-consuming and can lead to burnout, but using automated grading and feedback tools can relieve some of that strain. This opens the teacher's time to think more about the higher level skills of teaching. They can engage in more creative lesson planning, and have more direct and impactful facilitation of class time. Research shows, and analytics can confirm, time efficiency in teaching a subject and the quality of instructional feedback can improve through the effective use of AI tools. From this, the use of AI has created a necessity for more facilitatory and learner-centered instruction (Chiu, et al., 2024).

Research Gap

People really like learning about different forms of A.I. However, most research focuses on ill-defined records of what people 'think' rather than what people have. This creates research gaps on the correlation between A.I. in the classroom, learning, and teaching styles. Very few research attempts to analyze such gaps. This creates an absence of data that educators and those in charge need when trying to make a decision. Thus, a more in-depth analysis of research gaps may lead to more A.I. integration styles in the classroom (Li, et al., 2024).

RESEARCH METHODOLOGY

Research Design

This research utilized a quantitative cross-sectional survey design to analyze the potential connections between the use of AI-powered language models, the learning outcomes in the English language, and the related teaching practices (Karatay, & Karatay, 2024). This design allowed for gathering numerical data from a large a population of the sample in a given period of time. It helped in understanding the data effectively and helped in finding and determining patterns and relationships among the variables. This method made sure the data interpretation was objective and statistically sound. Moreover, the design allowed the findings to be generalized within the specified population. This method fits the study's empirical and hypothesis testing characteristics.

Population and Sample

The study involved the English language learners and the instructors from both the public and private universities. For sufficient statistical analysis, a total of 350 individuals were chosen as a sample. To gain equal representation of both students and instructors, strata random sampling was utilized. This method of sampling increased the sample representativeness and decreased selection bias. The participants have different ages, degrees, and years of teaching. The findings were more reliable and applicable due to an even greater range.

Research Instruments

This study employed a pre-structured questionnaire to gather information. The questionnaire had four proportions designed to capture the different levels of AI usage, the outcomes of learning (Huang, et al., 2022) the levels of teaching practices and learner autonomy. The items were formulated from existing literature and validated through appropriate scales. All the variables were assessed using a five-point Likert scale. Based on the study, the five-point Likert scale was from strongly disagree to strongly agree. The

reliability analysis returned more than sufficient internal consistency, evaluated from the standpoint of the Cronbach's alpha which scored more than 0.75. The results of the analysis were thus dependable and could be relied on the instruments that were used.

Data Collection Procedure

To get the most survey responses, Researcher distributed the questionnaires, both online and in print. Researcher made sure to tell the participants what the study was about, then collected the data, and finally collected informed consent from all the participants, but this was voluntary (Ding, et al., 2025). Researcher informed the participants that their responses would be kept confidential and that their identities would be protected. Researcher did not share the data for any purpose other than for research. Throughout the research process, Researcher maintained the standards of ethical research and conduct.

Data Analysis Techniques

Using SPSS, the data set was analyzed. Summaries of the demographic characteristics and the distribution of variables were summarized using descriptive statistics. The strength and the direction of relationship were assessed by the Pearson correlation analysis. The effect of using AI-powered language models on learning outcomes and teaching practices was assessed using multiple regression analysis. Statistical significance was set at the .05 level. These methods provided thorough and sound quantitative analysis.

DATA ANALYSIS AND RESULTS

Table 1: Demographic Characteristics of Respondents (N = 350)

Demographic Variable	Category	Frequency (f)	Percentage (%)
Gender	Male	182	52.0
	Female	168	48.0
Role	Students	270	77.1
	Teachers	80	22.9
Age Group	18–22 years	145	41.4
	23–26 years	118	33.7
	27–30 years	87	24.9
Institution Type	Public University	210	60.0
	Private University	140	40.0
Experience (Teachers)	1–5 years	34	42.5
	6–10 years	28	35.0
	Above 10 years	18	22.5

Table 1 presents the demographic distribution of respondents. The sample consisted of both students and teachers from public and private universities, ensuring representativeness. A balanced gender distribution was observed, and most respondents belonged to the 18–26 age group, which is highly relevant for AI-assisted language learning. The inclusion of experienced teachers strengthens the validity of findings related to teaching practices.

Table 2: Descriptive Statistics

Variable	Mean	Std. Deviation	Minimum	Maximum
AI Usage Intensity	3.82	0.71	1.60	5.00
Learning Outcomes	3.91	0.68	1.80	5.00
Teaching Practices	3.88	0.73	1.70	5.00
Learner Autonomy	3.97	0.66	2.00	5.00

The descriptive statistics indicate moderate to high levels across all study variables. AI usage intensity shows a high mean score, reflecting frequent use of AI-powered language models. Learning outcomes and teaching practices also demonstrate positive trends, suggesting favorable perceptions and effectiveness of AI integration. Low standard deviation values indicate consistency in responses.

Table 3: Reliability Statistics (Cronbach's Alpha)

Variable	No. of Items	Cronbach's Alpha
AI Usage Intensity	6	0.81
Learning Outcomes	10	0.84
Teaching Practices	8	0.79
Learner Autonomy	6	0.83
Overall Scale	30	0.87

Table 3 demonstrates strong internal consistency for all measurement scales. Cronbach's alpha values exceed the acceptable threshold of 0.70, indicating that the questionnaire items reliably measure their respective constructs. The overall scale reliability further confirms the instrument's suitability for quantitative analysis.

Table 4: Pearson Correlation Matrix

Variables	AI Usage	Learning Outcomes	Teaching Practices	Learner Autonomy
AI Usage	1			
Learning Outcomes	0.58**	1		
Teaching Practices	0.55**	0.61**	1	
Learner Autonomy	0.63**	0.66**	0.59**	1

The correlation results show significant positive relationships among all variables. AI usage has a strong positive correlation with learning outcomes, teaching practices, and learner autonomy. This indicates that increased use of AI-powered language models is associated with improved English learning and instructional effectiveness.

Table 5: Multiple Regression Analysis

Predictor	β	t-value	p-value
AI Usage Intensity	0.47	9.21	0.000
Learner Autonomy	0.39	7.88	0.000
R²			
F-value	187.6		0.000

Regression results reveal that AI usage intensity significantly predicts English language learning outcomes. Learner autonomy also contributes significantly, indicating a partial mediating role. The model explains 52% of the variance in learning outcomes, confirming the strong explanatory power of AI-powered language models.

Table 6: Regression Results for Teaching Practices

Predictor	β	t-value	p-value
AI Usage Intensity	0.42	8.13	0.000
Learning Outcomes	0.36	6.91	0.000
R²	0.48		
F-value	161.4		0.000

The regression model indicates that AI-powered language model usage significantly enhances teaching practices. Improved learning outcomes also positively influence instructional efficiency and feedback quality. The model explains 48% of variance in teaching practices, highlighting AI's instructional value.

Table 7: Summary of Hypotheses Testing

Hypothesis	Statement	Result
H1	AI usage positively impacts learning outcomes	Accepted
H2	AI usage positively impacts teaching practices	Accepted
H3	Learner autonomy mediates AI usage and learning outcomes	Accepted

All proposed hypotheses were supported by statistical evidence. The findings confirm that AI-powered language models significantly enhance English language learning and teaching practices, with learner autonomy playing a crucial role.

FINDINGS

It was found from the research that the use of AI language models in teaching and learning English language is improving and the activities in learning and teaching the English language is becoming more effective. The research stated that there is more use of AI technology in learning and as a result there are improvements in the learning outcomes of vocabulary knowledge, more accurate writing, confident speaking and improvements in comprehension. Other outcomes were that the more AI tools the learners used the more autonomous and self-directed the learners become (Chen, et al., 2020). AI technology was found to translate in how efficiently the teachers were teaching, the quality of feedback they were providing and how flexible the teachers were in their teaching. Both correlation and regression analyses acknowledge that there were strong relationships in the use of AI technology, learning outcomes and teaching practices. It was reported that learner autonomy was a partial mediator between the AI use and learning outcomes in education (Chen, et al., 2020). The results of the study confirm that the AI models in the language have a

positive impact in the teaching of English Language. The evidence also confirms that most of the hypotheses were indeed true. The results also confirm the need for structured AI use in teaching and learning to improve outcomes in education. Strength of the findings was based on the validity of the findings.

DISCUSSION

This study's findings correspond with current literature affirming the benefits of Artificial Intelligence on the teaching of language. The positive correlation between the employment of AI-based language models and educational benefits reinforces previous studies that highlighted the role of feedback and individualized instruction (Chen, et al., 2020). The increased autonomy of learners that was observed during the study supports the theories of self-regulated learning which posit that AI learning technologies motivate learners to embrace self-responsibility in their learning (Albadarin, et al., 2024). The finding that teaching changes for the better because of the presence of AI shows that it lightens the burden of teaching and increases efficiency of providing feedback. Though the findings also suggest that the effectiveness of AI tools is conditional on the presence of sound pedagogical directions and their appropriate levels of usage (Baig, & Yadegaridehkordi, (2024). It is argued that over-dependence of AI tools can impede critical thinking and language production. The findings reconcile the most contentious claim of the role of teachers, to mitigate AI use, in the AI learning environment. In summary, the findings support the just use of AI tools in teaching English and proclaim the introduction of 'teacher-less instruction' on AI (Parker, et al., 2025).

CONCLUSION

This study has shown that AI powered language models have an important positive impact in the field of English language learning and teaching. In the study, AI was shown to enhance learning results, boost learning independence, and assist in teaching more efficiently (Li, et al., 2025). Additionally, the study found that the AI tools, when utilized properly and in a timely fashion, assist students in vocabulary growth, writing, and increased participation. Also, the study has shown that teaching benefits through having a reduced amount of work from the AI providing more effective feedback to students. Regardless of the positive results from the study, more research needs to be done on the educationally driven AI to avoid an imbalanced overreliance on the tool. For the greatest learning advantages, ethical guidelines need to be in place and teacher supervision must be provided. We need more empirical research to further the field and educational AI (Kasneci, et al., 2023). We need to have balance and ethical teaching to responsibly incorporate AI language models in English education. Overall, the results from the study show that AI has the potential to be very effective in the teaching of English as a second language. The study results provide a basis to undertake further experimental research, especially longitudinal studies.

RECOMMENDATIONS

1. Educators need to provide training on the AI integration and pedagogical practices and principles. Professional development training will help teachers understand how best to use AI technology in the classroom. This will help teachers understand how to use AI in classroom targeted and meaningful ways. This training will help teachers build comfort utilizing AI in the classroom. Ultimately, teachers will be trained to effectively use the technology to increase the learning opportunities for students.
2. Educators will need to design classroom tasks and assignments to help students use the AI technologies in productive learning activities. Using the AI technologies should be used for language tasks but should not be the primary learning and instruction utilized in the classroom. . Using the AI correctly and balanced will provide students with skill development and learning opportunities.

3. Educational institutions need to develop policies around the use of AI in educational language. . AI technologies need to be used with academic integrity, data privacy, transparency, and responsible use of AI design, to support ethical use of AI.
4. Having clear policies in place may prevent the misuse and unethical use of AI and guarantee fairness in technology access. Ethical guidelines will also safeguard the rights of the learners as well as their data. These protocols will be crucial for the equitable and sustainable application of AI.
5. Further studies should focus on longitudinal designs to capture the impact of AI on learning and teaching practices over time. Longitudinal designs will provide insights into the acquisition of new skills and their retention, along with behavioral shifts. They also will provide insights into establishing the relationships between AI and positive learning outcomes. These findings will enhance the field's evidence base. Longitudinal studies will form the basis of evidence for effective educational design.

REFERENCES

- Albadarin, Y., Saqr, M., Pope, N., ... Tukiainen, M. (2024). A systematic literature review of empirical research on ChatGPT in education. *Discover Education*, 3, Article 60. <https://doi.org/10.1007/s44217-024-00138-2>
- Baig, M. I., & Yadegaridehkordi, E. (2024). ChatGPT in the higher education: A systematic literature review and research challenges. *International Journal of Educational Research*, 127, 102411. <https://doi.org/10.1016/j.ijer.2024.102411>
- Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access*, 8, 75264–75278. <https://doi.org/10.1109/ACCESS.2020.2988510>
- Chen, X., Xie, H., Zou, D., & Hwang, G.-J. (2020). Application and theory gaps during the rise of artificial intelligence in education. *Computers and Education: Artificial Intelligence*, 1, 100002. <https://doi.org/10.1016/j.caeai.2020.100002>
- Chen, X., Xie, H., & Hwang, G.-J. (2020). A multi-perspective study on artificial intelligence in education: Grants, conferences, journals, software tools, institutions, and researchers. *Computers and Education: Artificial Intelligence*, 1, 100005. <https://doi.org/10.1016/j.caeai.2020.100005>
- Chiu, T. K. F., Ahmad, Z., & Çoban, M. (2024). Development and validation of teacher artificial intelligence (AI) competence self-efficacy (TAICS) scale. *Education and Information Technologies*, 30, 6667–6685. <https://doi.org/10.1007/s10639-024-13094-z>
- Ding, L., Zou, D., & Kohnke, L. (2025). ChatGPT as an automated writing evaluation tool: How students perceive it and how it affects their writing. *Education and Information Technologies (advance online publication)*. <https://doi.org/10.1007/s10639-025-13775-3>
- Huang, W., Hew, K. F., & Fryer, L. K. (2022). Chatbots for language learning—Are they really useful? A systematic review of chatbot-supported language learning. *Journal of Computer Assisted Learning*, 38, 237–257. <https://doi.org/10.1111/jcal.12610>
- Karatay, Y., & Karatay, L. (2024). Automated writing evaluation use in second language classrooms: A research synthesis. *System*, 123, 103332. <https://doi.org/10.1016/j.system.2024.103332>

- Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., ... Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274. <https://doi.org/10.1016/j.lindif.2023.102274>
- Li, Y., Zhou, X.-Y., & Chiu, T. K. F. (2024). Systematics review on artificial intelligence chatbots and ChatGPT for language learning and research from self-determination theory (SDT): What are the roles of teachers? *Interactive Learning Environments*, 33(3), 1850–1864. <https://doi.org/10.1080/10494820.2024.2400090>
- Li, Y., Zhou, X.-Y., Yin, H.-B., & Chiu, T. K. F. (2025). Design language learning with artificial intelligence (AI) chatbots based on activity theory from a systematic review. *Smart Learning Environments*, 12, Article 24. <https://doi.org/10.1186/s40561-025-00379-0>
- Ma, Y., ... (2025). The human touch in AI: optimizing language learning through balanced AI and teacher-led instruction: exploring the influence of AI on EFL students' motivation, engagement, and proficiency. *Frontiers in Psychology*. <https://doi.org/10.3389/fpsyg.2025.1568239>
- Parker, M. J., Anderson, C., Stone, C., et al. (2025). A large language model approach to educational survey feedback analysis. *International Journal of Artificial Intelligence in Education*, 35, 444–481. <https://doi.org/10.1007/s40593-024-00414-0>
- Pérez, J. Q., Daradoumis, T., & Puig, J. M. M. (2020). Rediscovering the use of chatbots in education: A systematic literature review. *Computer Applications in Engineering Education*, 28(6), 1549–1565.
- Wang, S., Wang, F., Zhu, Z., Wang, J., Tran, T., & Du, Z. (2024). Artificial intelligence in education: A systematic literature review. *Expert Systems with Applications*, 252(Part A), 124167. <https://doi.org/10.1016/j.eswa.2024.124167>
- Wang, S., Xu, T., Li, H., Zhang, C., Liang, J., Tang, J., Yu, P. S., & Wen, Q. (2024). Large language models for education: A survey and outlook. *arXiv*. <https://arxiv.org/abs/2403.18105>
- Wei, P., Wang, X., & colleagues. (2023). The impact of automated writing evaluation on second language writing skills of Chinese EFL learners: A randomized controlled trial. *Frontiers in Psychology*, 14, 1249991. <https://doi.org/10.3389/fpsyg.2023.1249991>
- Wiboolyasarini, W., et al. (2025). AI-driven chatbots in second language education: A systematic review of their efficacy and pedagogical implications. *Asia Pacific Management Review (or associated outlet)*, Article 100224. <https://doi.org/10.1016/j.amper.2025.100224>
- Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, 16, Article 39. <https://doi.org/10.1186/s41239-019-0171-0>