Impact of AI-Powered ChatBots on EFL Students' Writing Skills, Self-Efficacy, and Self-Regulation: A Mixed-Methods Study

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Abstract

Purpose – The study explores the impact of AI-powered ChatBots on English as a Foreign Language (EFL) students' writing skills, self-efficacy, and self-regulation. Given the rapid integration of digital tools in education, particularly in language learning, the research aims to fill a gap in understanding how ChatBot technology can enhance writing abilities, address psychosocial factors, and support self-regulated learning among EFL students.

Design/Methods/Approach – A sequential explanatory mixed-methods approach was employed, involving 40 EFL students from IAIN Curup. Participants were divided into a control group (traditional writing instruction) and an experimental group (ChatBot-assisted instruction). Quantitative data on writing proficiency, self-efficacy, and self-regulation were collected through pre- and post-tests, followed by qualitative insights gathered through semi-structured interviews with the experimental group. Statistical analysis, including paired t-tests and ANCOVA, was used to assess differences between groups.

Findings – The results revealed that students using ChatBots showed significant improvements in writing proficiency (post-test scores increased from 55.84 to 88.92), self-efficacy (from 20.46 to 30.38), and self-regulation (from 14.51 to 19.65). Interviews highlighted increased confidence, motivation, and engagement among students, though concerns about over-reliance on ChatBots and the risk of plagiarism were noted.

Originality/Value – This research offers new insights into the use of AI-powered ChatBots in enhancing EFL students' writing skills, self-efficacy, and self-regulation. It addresses gaps in the literature by focusing on the psychosocial factors influencing writing performance and the potential benefits and drawbacks of AI integration in education.

Practical Implications – The findings suggest that educators can use ChatBots to improve writing instruction, fostering autonomy and providing immediate feedback. However, strategies must be developed to avoid over-reliance on AI tools, ensuring students maintain creativity and critical thinking.

Keywords AI-powered ChatBots, EFL writing, self-efficacy, self-regulation, language learning.

Paper type Research paper

1.   Introduction

In recent decades, the rapid development of internet technologies and digital tools has significantly transformed the field of education, with online technologies becoming an integral part of classroom instruction (Huong & Hung, 2021; G. Z. Liu et al., 2022). These advancements have provided both teachers and students with enhanced opportunities for interaction and improved learning outcomes. Technology increases student engagement and facilitates more efficient knowledge transfer, contributing to more effective teaching and learning processes (Raja & Nagasubramani, 2018). Additionally, the rise of Web 2.0 technologies has made it easier to create, share, and access information, particularly in the domain of teaching English as a second language. Web 2.0 tools enable students to collaborate on language-related tasks, fostering both positive attitudes and motivation (Hung et al., 2022; Kazazoglu & Bilir, 2021). These tools are especially effective in improving students' writing skills, as they provide opportunities for interaction through computer-mediated communication (CMC), which has been shown to enhance language acquisition (Lin, 2015).

In response to these technological advancements, the Ministry of Higher Education and Scientific Research has encouraged the integration of various digital tools in English language instruction. Technologies such as Edmodo, Google Classroom, Zoom, Google Meet, and AI-powered ChatBots are increasingly employed to enhance the quality of education and support the learning process. Research demonstrates the positive impact of educational technology on learning outcomes, particularly in the area of language learning (Xu et al., 2019). Previous studies have focused on specific aspects of language learning, such as reading comprehension and writing skills, and have highlighted the benefits of technology in promoting student engagement and autonomy (Azari, 2017; Shadiev et al., 2017; Zou et al., 2016).

One of the most significant technological innovations in recent years is the AI-powered ChatBot, which has the potential to revolutionize language learning. ChatBots, which use natural language processing and machine learning, offer personalized learning experiences through dialogue-based interactions (Guo et al., 2022). These tools support self-regulated learning (SRL) by providing immediate feedback, fostering student autonomy, and encouraging self-correction (Molenaar, 2022). AI systems can adapt to students' skill levels, further enhancing their learning experience (Chen et al., 2021). In addition to supporting SRL, AI tools have been shown to improve students' self-efficacy, particularly in language learning contexts (Karaoglan Yilmaz & Yilmaz, 2022).

The integration of ChatBots into education extends beyond self-regulated learning, as they also contribute to improving user interaction and accessibility. ChatBots provide an intuitive user interface (UI) that allows students and teachers to interact using natural language queries, facilitating the retrieval of relevant information and creating a more user-friendly learning environment. This feature enables students to access information beyond the limitations of traditional learning management systems (LMS), further promoting ubiquitous learning opportunities (Clark, 2018). Moreover, ChatBots reduce the administrative burden on teachers, allowing them to offer personalized assistance to students with limited resources (Cai et al., 2021; Li & Zhu, 2017).

Despite the growing body of research on the use of technology in education, there remains a significant gap in understanding how ChatBots can impact individual student differences and psychosocial factors, particularly in relation to writing skills. Writing, a cognitively demanding task, requires a balance of logical and emotional elements (Dai et al., 2023), and individual differences play a critical role in students' ability to succeed. The importance of psychosocial factors in motivating students and guiding their focus during

the writing process has been emphasized (Han & Hiver, 2018). This underscores the need to investigate how ChatBot-based writing instruction can influence students' mental models, motivation, and self-regulation.

The present research aims to address these gaps by examining the use of AI-powered ChatBots in enhancing students' writing skills, self-efficacy, and self-regulation. A preliminary observation of students in the English study program at IAIN Curup revealed that many students struggle to organize their thoughts and produce high-quality writing. Recognizing these challenges, the current study explores how ChatBot technology can support students in overcoming these difficulties and improving their writing abilities.

Prior research has demonstrated the potential of AI to improve students' writing skills and self-confidence (Dai et al., 2023; Xiao & Zhi, 2023). Additionally, the role of ChatBots in language acquisition has been highlighted, emphasizing their efficacy in providing tailored feedback and fostering student learning (Kohnke et al., 2023). By investigating the impact of ChatBot-assisted writing instruction at IAIN Curup, this study seeks to fill the existing gap in the literature and provide insights into how AI tools can support students in developing critical language skills. Specifically, the research will focus on the following objectives: (1) to evaluate the impact of AI-powered ChatBots on students' writing skills, (2) to examine the influence of ChatBots on students' self-efficacy, and (3) to explore how ChatBots support self-regulated learning in the context of English language instruction. This study has the potential to offer significant contributions to both theory and practice by advancing our understanding of how AI technologies can enhance the learning process and promote student autonomy in language education.

2.   Methods

2.1   Research Design

The study employed a sequential explanatory mixed-methods approach (Creswell et al., 2003). Initially, quantitative data were gathered and analyzed to assess the impact of ChatBot-assisted and non-ChatBot collaborative writing instruction on EFL students' writing proficiency, self-regulation, and self-efficacy. This was followed by qualitative data collection through semi-structured interviews to gain a deeper understanding of the students' experiences and perspectives, specifically focusing on English students currently enrolled at IAIN Curup. The rationale behind this design was to provide a comprehensive understanding by first collecting and analyzing numerical data and then using qualitative insights to explain or enhance the quantitative findings. The integration of both data types aimed to improve the precision of the results and provide a more detailed explanation of the impact of the different instructional methods.

2.2   Research Participants

The study sample consisted of 40 EFL students from IAIN Curup, all actively engaged in English learning during the final quarter of the 2023/2024 academic year. The participants were divided into two groups: a control group (20 students) that received traditional writing instruction and an experimental group (20 students) that used AI-powered ChatBot for collaborative writing. Convenience sampling was employed to select the participants, and students were randomly assigned to the two groups to ensure a balanced comparison between the methods of instruction.

2.3   Research Instruments

2.3.1 Writing Test Instrument

Two writing tasks were administered, one before and one after the intervention, to evaluate the students' writing quality. Content validity was ensured through expert review. These tasks were assessed by an experienced writing expert using a predefined rubric to evaluate various aspects of writing, such as content, organization, and language use.

2.3.2 Writing Self-Efficacy Instrument

The writing self-efficacy of the participants was measured using a seven-item instrument adapted from a previous study, with each item rated on a five-point Likert scale (Han & Hiver, 2018). The reliability of the scale was demonstrated by a Cronbach's Alpha score of 0.80.

Table 1. Writing Self-Efficacy Questionnaire

No	Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I possess a strong sense of assurance when it comes to my ability to write in the English language.					
2	I have the skill to effectively create written content in English.					
3	I compose written content in the English language while employing a fundamental framework of logical organization.					
4	With sufficient dedication and diligence, I am confident in my ability to develop proficient writing skills in the English language.					
5	I possess the ability to compose essays that are pertinent and suitable in accordance with the given task.					
6	I adeptly articulate my perspective or assertions with precision and efficacy in the context of English composition.					
7	I am confident in my ability to excel in writing classes, despite their challenging nature.					

2.3.3 Writing Self-Regulation Instrument

The writing self-regulation of the students was assessed using an instrument adapted from previous studies, consisting of nine subscales rated on a five-point Likert scale (Han & Hiver, 2018; Tseng et al., 2006). The instrument demonstrated strong reliability with a Cronbach's Alpha score of 0.83.

Table 2. Writing Self-Regulation Scale

No	Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I possess the knowledge of mitigating my stress levels associated with the process of acquiring proficiency in English writing.					
2	I employ certain strategies to effectively attain my learning objectives in the realm of English writing.					
3	I am content with the efficacy of my personal strategies for alleviating the tension associated with writing in the English language.					
4	I employ specific strategies to enhance my concentration while engaging in the process of learning English writing.					
5	I demonstrate unwavering determination in pursuing the objectives I set for myself in the process of acquiring proficiency in English writing.					
6	I am confident that I can expedite the attainment of my objectives in English writing beyond initial projections.					
7	I am able to effectively manage the tension associated with acquiring proficiency in English writing promptly.					
8	In the context of acquiring proficiency in English writing, I find my strategies for managing procrastination to be efficacious.					
9	I possess knowledge regarding the optimization of the learning environment to enhance efficiency in the acquisition of English writing skills.					

2.3.4 Semi-Structured Interview

A semi-structured interview was conducted with 17 students from the experimental group who used ChatBot for collaborative writing. The interview questions aimed to explore the students' perspectives and opinions on the use of ChatBot in writing instruction. To ensure confidentiality, pseudonyms (S1, S2, etc.) were assigned to each participant. The interviews, lasting approximately 30 minutes, were conducted in the students' native language (Indonesian) and later transcribed and translated into English for analysis. Member checking (Creswell, 2007) was employed to verify the accuracy of the transcriptions, with participants reviewing the transcriptions to ensure the correctness of their responses.

Table 3. Interview Guidelines

No	Interview Questions
1	Did you find the writing course facilitated by the ChatBot enjoyable? If so, could you kindly elaborate on your sentiments regarding the writing course?
2	What impact do you believe taking a writing course in English with a ChatBot had on your work during that time?
3	Did you sense less stress, worry, or fear when writing in English, either because of the course or otherwise?
4	Can you say that your English writing skills have improved as a result of taking the writing course facilitated by a ChatBot?
5	Is it something you think should be taught in every English writing classroom? Provide further detail if you can.
6	How different was the writing course facilitated by ChatBots from previous English as a foreign language (EFL) courses you had taken before?

2.4   Data Analysis

2.4.1 Quantitative Analysis

The quantitative data were analyzed using paired samples t-tests to examine the differences in students' writing performance, self-regulation, and self-efficacy before and after the intervention. The students' scores on the Second Language Writing Skills (SLWS) and Second Language Writing Strategy Scale (SLWSS), which were specifically designed to assess second language writing proficiency, were compared. To evaluate the differences between the control and experimental groups, a unidirectional between-groups analysis of covariance (ANCOVA) was conducted, following established guidelines (Pallant, 2020). This statistical approach allowed the researchers to isolate the effect of the ChatBot intervention on writing performance and self-regulation.

2.4.2 Qualitative Analysis

For the qualitative data from the interviews, a thematic analysis was conducted. The analysis identified key themes related to students' experiences with the ChatBot, their writing processes, and how they perceived the effect of collaborative writing on their stress levels and motivation. The interview data were carefully transcribed, and the responses were categorized into thematic areas such as "reduced anxiety," "peer feedback," and "group engagement." Member checking was employed to verify the accuracy of the transcriptions, further strengthening the trustworthiness of the data.

2.5   Ethical Considerations

All participants were informed about the study's objectives and provided informed consent prior to data collection. They were also informed of their right to withdraw from the study at any time without penalty. Anonymity was maintained by using pseudonyms for all participants, and the research protocol was reviewed and approved by the IAIN Curup Research Ethics Committee. All data were securely stored to ensure participants' privacy and confidentiality. Additionally, the member checking process ensured that participants had the opportunity to review and confirm the accuracy of the interview data.

3.   Results

3.1   Quantitative Analysis

To answer the first research question, which was about how a writing course using ChatBot technology affected EFL writing proficiency, Table 1 shows that the average writing score of the ChatBot group went from 55.84 (standard deviation = 8.99) to 88.92 (standard deviation = 10.87) on the post-test. Similarly, after the intervention, the control group's writing scores increased, going from 56.53 (SD = 9.42) to 66.67 (SD = 9.97). Writing proficiency differs significantly among groups ($F_{(1, 40)}$ = 59.51 (p 0.001, partial eta squared = 0.54) after adjusting for the covariate (pre-test writing scores), as shown in Table 2. The findings show that the participants' writing abilities were significantly enhanced by using ChatBot technology in writing training. The improvement was substantially bigger in the ChatBot group compared to the control group.

As for the second study's topic, it looked at the effects of ChatBot training on the self-perception of writing abilities among EFL students in the English programme at IAIN Curup. The experimental group had an average pre-test score of 20.46 (standard deviation = 4.65) as shown in Table 1 of the descriptive data. An further evaluation revealed an increase of 30.38 (SD = 7.45). The control group also showed an improvement in their writing confidence, with an average post-test score that rose from 20.10 (SD = 4.28) to 22.80 (SD = 4.90). Once the self-efficacy ratings were taken into account as a covariate, the ANCOVA findings showed statistical significance (for more information, see Table 3). The results showed that the two groups' self-assessments of writing ability were significantly different (F statistic $(1, 40)$ = 23.11, p 0.001, partial eta squared = 0.31). Researchers found that students' self-esteem in their writing took a major leap when ChatBot technology was included into the English course at IAIN Curup.

The final goal of this research was to determine whether or not EFL students in the English program at IAIN Curup may benefit from a chat-based education in terms of improving their ability to self-regulate their writing. Table 1 displays the study's findings, with descriptive statistics revealing an average pre-test score for writing self-regulation among the experimental group of 14.51 (SD = 3.05). After that, throughout the course of the post-test, this number went up to 19.65 (with a standard deviation of 3.95). In a similar fashion, the control group's average score on the writing self-regulation exam increased from 15.53 (standard deviation = 3.35) on the pre-test to 17.42 (standard deviation = 3.80) on the post-test, exhibiting a trend of upward movement. After the covariate was changed—more precisely, self-efficacy ratings were altered—the analysis of covariance (ANCOVA) yielded statistically significant results (for details, see Table 4). In terms of their capacity to control their own writing, the results showed a significant difference between the two groups (F statistic $(1, 40)$ = 56.54, (p 0.00, partial eta squared = 0.46)). Findings from this study demonstrated that EFL students in IAIN Curup's English study programme greatly benefit from the incorporation of ChatBot technology into writing instruction, particularly with regard to their capacity to self-regulate their writing.

Table 3. The statistics of pre-test and post-test results

	Group	N	Mean	Std. Deviation	Std. Error mean
Pre-writing	Experimental	20	55.84	8.99	1.79
	Control	20	56.53	9.42	1.78
Post-writing	Experimental	20	88.92	10.87	2.17
	Control	20	66.67	9.97	1.88
Pre Self-efficacy	Experimental	20	20.46	4.65	0.93

	Control	20	20.1	4.28	0.62
Post Self-efficacy	Experimental	20	30.38	7.45	1.49
	Control	20	22.80	4.9	0.73
Pre Self-Regulation	Experimental	20	14.51	3.05	0.51
	Control	20	15.53	3.35	0.59
Post Self-Regulation	Experimental	20	19.65	3.95	0.50
	Control	20	17.42	3.80	0.67

Table 4. Writing performance investigating by using ANCOVA

Source	Type III sum of squares	df	Mean square	F	Sig.	Partial eta squared
Group	6470.38	1	6470.38	59.51	0	0.54

Table 5. Writing self-efficacy investigating by using ANCOVA

Source	Type III sum of squares	df	Mean square	F	Sig.	Partial eta squared
Group	723.829	1	723.829	23.11	0	0.31

Table 6. Writing self-regulation investigating by using ANCOVA

Source	Type III sum of squares	df	Mean square	F	Sig.	Partial eta squared
Group	163.60	1	163.60	56.54	0	0.46

Figure 1. The use of ChatBot in writing class

Figure 2. How to operate ChatBot

Figure 3. Writing with ChatBot

3.2   Qualitative Analysis

The quantitative findings were supplemented with qualitative data that was obtained and analysed. Students who took part in the ChatBot group writing assignment were interviewed individually using a semi-structured interview to have a better grasp of the study's findings. The researchers did this because the research showed that compared to non-ChatBot collaborative writing, ChatBot collaborative writing significantly improved EFL students' writing performance, self-regulation, and self-efficacy. To find out why the ChatBot group performed better than the non-ChatBot group in terms of writing performance, writing self-regulation, and writing self-efficacy, the researchers conducted a thorough quantitative and qualitative data analysis. Because of this, the researchers have a thorough and comprehensive grasp of the repercussions.

A semi-structured interview was carried out with seventeen EFL students who participated in the ChatBot group writing assignment in order to delve deeper into their experiences with the tool and to offer a more comprehensive analysis of the results mentioned earlier.

The positive effect of ChatBot collaborative writing on students' increased writing confidence was one of the disclosed themes. With ChatBot features that make it easier, such as providing prompts those are able to answer user needs. For instance, the English as a Foreign Language students thought that working with the ChatBot to write in groups helped them overcome their writing fear because it is able to give students writing needs. In this particular context, S3 meant:

"In the past, writing used to make me feel anxious. Because the ChatBot was there for me, I slowly felt less nervous."

They further stated that they exerted greater diligence in completing the writing chores when cooperating online in the ChatBot. As an example, S9 said that:

"As the first few lessons went on, I felt so ashamed when I saw how badly my writing was compared to that of my friends. After that, I worked hard to make my writing better, and I think it helped. Besides, ChatBot fastened the task."

The most recent subject in the "full writing confidence" category focused on the enhancement of writing confidence among EFL students in a collaborative writing environment with ChatBots. S3 provided a report stating:

"Writing used to be one of my flaws. ChatBot helped me feel empowered and sure of myself when writing in English. However, I am afraid that I will lose my creativity if I over-reliance on ChatBot."

Additional themes centred on the students' incentive to complete the writing assignments through the use of a ChatBot. The students claimed that engaging in ChatBot collaborative writing provided them with a unique experience as it allowed them to transcend the constraints of time and distance. Specifically, the individuals had the ability

to complete their collaborative writing assignments from any location and time that they deemed suitable, resulting in increased involvement in the writing tasks. S10 stated:

"I have always liked learning in groups in the classroom, but this was really cool because we did not just have to come up with ideas in class."

According to their assessment, the ChatBot offered an easy platform for generating ideas. S5 claimed that:

"It was a delightful experience to be able to complete a writing assignment with our own support. But, we cannot do over-reliance on ChatBot. We still need our human capability."

In relation to the category of "strong motivation," the students additionally contended that they may utilize various capabilities of the ChatBot to collectively include and modify the writing assignments. S7 expressed the following:

"We had a great time because we could give instructions, figure out what to do, and change the material."

According to the students, this collaboration may boost their incentive to participate in writing activities, since they were aware that the ChatBot could fulfill their requests. S11 stated the following:

"When we realized that the ChatBot could give us everything we need for our writing tasks, we became more interested and paid more attention. However, ChatBot is ChatBot, it still needs human ability to check the writing projects."

In addition, within the area of "detailed attention", the students expressed that they may enhance their focus on minute aspects of their writing abilities by utilizing a ChatBot. S1, for example, argued that:

"ChatBots could help students focus more on the material, structure, and style of their writing assignments. But, ChatBot is not same as human. We are afraid of making plagiarism when using it fully."

The EFL students asserted that engaging in collaborative writing with a ChatBot facilitated their enhancement of writing microstructures, including grammar, vocabulary, and punctuation. S13 contended that:

"I liked when we worked together by using ChatBot. Collectively, we got better at finding mistakes in both sentences and words."

Participants reported an increase in their own writing talents across the board, including in the category of "individual writing improvement." Students in a ChatBot-based writing class said they felt more accountable for their contributions because of the format. S2 made the following observation:

"In order to complete our writing assignment, the ChatBot must first provide us with an outline. This might make us more accountable for our words on the page."

The students also said that their individual writing improved substantially thanks to the ChatBot. For instance, S8 included that:

"I came away from the course with a new outlook on writing and the tools to make improvements on my own. ChatBot should use in another subject."

Under the heading of "writing efficiency," the EFL students said that using ChatBots to complete writing assignments saved them time. Regarding this topic, S15 stressed on:

"Using the ChatBot allowed us to produce better content in less time."

They also reported that the high quality of their writing was enhanced by working in a ChatBot-based writing environment. S4 claimed:

"We learned to write higher-quality texts, get more engaged in the writing process, and obtain the essential ideas by drafting with a ChatBot, all of which enhanced the quality of our work."

In conclusion, the qualitative analysis confirmed that the use of ChatBot-assisted collaborative writing significantly benefited EFL students by improving their confidence, motivation, attention to writing details, individual writing skills, and efficiency. However, concerns about over-reliance on the technology and the potential impact on creativity and plagiarism were also noted, suggesting the need for a balanced approach to integrating ChatBots in writing education.

4.   Discussion

This research aimed to examine the effects of ChatBot-mediated writing instruction on the writing skills, writing self-efficacy, and writing process self-regulation of English as a Foreign Language (EFL) students at IAIN Curup. The findings suggest that the use of ChatBot-based writing instruction had a positive impact on the writing ability of EFL students, aligning with previous research that highlights the potential of AI technology in enhancing educational experiences. Additionally, improvements in writing self-efficacy and self-regulation were observed, supporting the argument that AI tools foster collaborative learning and self-directed skills development. Despite these benefits, concerns about over-reliance on ChatBots and its potential effects on creativity, critical thinking, and plagiarism were raised by students.

The data indicates that using ChatBot-based writing improved the writing abilities of EFL students, corroborating previous findings (C. Liu et al., 2021; Ouyang et al., 2022). These studies emphasized the value of integrating AI technologies to create comprehensive learning environments, which in turn enhance the academic performance of EFL students. Additionally, it is supported that AI platforms facilitate peer feedback, which is crucial for improving writing skills (Ma, 2020). The learner-centric nature of AI environments appears to provide an ideal platform for EFL learners to collaborate and enhance their writing.

EFL students in this study reported heightened writing self-efficacy, confirming previous findings that feedback in online learning can boost learners' confidence and competence (Peechapol et al., 2018). This aligns with Bandura's theory, which argues that collaborative, supportive environments can significantly enhance self-efficacy (Dai et al., 2023). Moreover, technology-driven environments tend to elevate integrative motivation, contributing to the development of self-efficacy (Aysu, 2020; Su et al., 2018). Therefore, it is reasonable to suggest that the collaborative nature of AI tools enhances students' confidence in their writing abilities.

The findings also demonstrate that ChatBot-based writing instruction improved EFL students' ability to self-regulate their writing processes. This conclusion is supported by previous research, which found that technology can enhance self-regulation practices among students (Boykin et al., 2019). AI environments offer opportunities for students to practice setting writing goals, organizing ideas, and monitoring their progress (Su et al., 2018). Additionally, collaborative writing in AI contexts helps students develop better self-regulation, as evidenced by Vygotsky's social-constructivist theory, which suggests that proficient students help less proficient peers, further enhancing their writing performance (G. Z. Liu et al., 2022).

The results align with existing literature that emphasizes the role of AI in improving academic outcomes. Similar to previous findings, this study shows that the use of AI-based tools like ChatBots can foster improved writing abilities in EFL learners (C. Liu et al., 2021; Ouyang et al., 2022). Furthermore, the enhancement of self-efficacy and self-regulation through AI tools corroborates findings from earlier research, adding to the growing body of evidence that suggests technology can provide supportive learning environments (Boykin et al., 2019; Peechapol et al., 2018).

However, the concerns raised by students regarding over-reliance on ChatBots reflect a new dimension that is less discussed in previous studies. This is an area that future research may need to explore in depth, as the risk of diminished creativity, critical thinking, and the possibility of plagiarism are valid concerns.

The research contributes to the theoretical understanding of how AI technologies, specifically ChatBot-mediated writing, can enhance writing skills, self-efficacy, and self-regulation in EFL students. The findings support Bandura's self-efficacy theory and Vygotsky's social-constructivist theory by illustrating how AI environments can foster collaborative learning and self-regulated behaviors. These findings also align with contemporary theories of technology-enhanced learning, which propose that AI can provide personalized and adaptive learning experiences that enhance student outcomes.

In practice, the findings suggest that incorporating ChatBot-based writing tools into EFL instruction could significantly improve students' writing abilities, self-efficacy, and self-regulation. Educators might consider integrating such AI tools into their curricula to foster collaborative learning environments and provide immediate feedback to students. However, educators should also be mindful of the potential drawbacks, such as over-reliance on AI tools, and incorporate strategies to mitigate these concerns, such as encouraging critical thinking and creativity in writing tasks.

Several limitations should be noted in this study. First, the research was conducted with a relatively small sample of EFL students from a single institution, limiting the generalizability of the findings. Additionally, the study relied heavily on self-reported data, which may be subject to bias. Furthermore, the study did not deeply explore the long-term effects of ChatBot-based writing instruction, particularly with regard to the concerns about over-reliance on AI tools.

Future research should address these limitations by conducting studies with larger, more diverse samples to enhance the generalizability of the findings. Additionally, longitudinal studies could provide insights into the long-term impacts of ChatBot-based instruction on writing skills, self-efficacy, and self-regulation. Further exploration into the potential drawbacks of AI in writing instruction, such as its effects on creativity and critical thinking, is also warranted. Research into effective strategies to mitigate these concerns could be beneficial for educators.

In summary, this study contributes to the growing body of literature on the impact of AI in education by demonstrating that ChatBot-mediated writing instruction can enhance writing skills, self-efficacy, and self-regulation in EFL students. The findings align with existing theories of collaborative and technology-enhanced learning but also highlight the need to address potential drawbacks, such as over-reliance on AI tools. This research underscores the importance of balanced integration of AI technologies to support, rather than replace, critical and creative thinking in the writing process.

5.   Conclusion

This study has demonstrated the positive impact of AI-powered ChatBot-based writing instruction on the writing proficiency, self-efficacy, and self-regulation of English as a Foreign Language (EFL) students at IAIN Curup. By employing a mixed-methods approach, the research has provided robust evidence that ChatBots can significantly enhance students' writing abilities and foster self-regulated learning. These findings align with existing literature on the benefits of AI tools in education, reinforcing the idea that technology can support students in developing critical language skills.

The research objectives—evaluating the impact of ChatBots on writing skills, self-efficacy, and self-regulation—have been effectively addressed. Quantitative data showed substantial improvements in writing performance, with ChatBot users demonstrating

significantly greater progress than those in the control group. Similarly, the data revealed notable increases in self-efficacy and self-regulation among students using ChatBots, reflecting the potential of AI to foster autonomy and self-directed learning.

In practice, these findings suggest that AI tools like ChatBots can be effectively integrated into English language instruction to enhance student outcomes. Educators may consider adopting ChatBot technology to promote collaborative learning, provide immediate feedback, and support students in managing their writing processes. However, caution is needed to prevent over-reliance on AI tools, as students in this study expressed concerns about losing creativity and critical thinking skills, and the risk of plagiarism.

The limitations of the study include the small sample size and its focus on a single institution, which restrict the generalizability of the results. Additionally, the short-term nature of the study did not allow for an exploration of the long-term effects of ChatBot-based instruction. Future research should address these gaps by conducting studies with larger, more diverse populations and investigating the long-term impacts of AI on writing development. Further exploration is also required to mitigate potential drawbacks, such as over-reliance on AI and its effects on creativity.

In conclusion, this research provides valuable insights into the role of AI in language education, highlighting both its potential and limitations. The balanced integration of AI tools, alongside strategies that promote critical thinking and creativity, is essential to ensuring that technology serves as a support mechanism rather than a replacement for essential human cognitive skills.

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Declarations

Author contribution statement
Eka Apriani: Conceptualization, Methodology, Investigation, Writing - Original Draft, Writing - Review & Editing, Project Administration. **Luis Cardoso:** Data Collection, Software, Formal Analysis, Writing - Review & Editing. **Ahmed J. Obaid:** Methodology, Investigation, Writing - Review & Editing, Supervision. **Muthmainnah:** Formal Analysis, Resources, Data Curation, Writing - Review & Editing, Visualization. **Erfin Wijayanti:** Resources, Data Curation, Writing - Original Draft, Visualization. **Farida Esmianti:** Investigation, Validation, Writing - Review & Editing, Visualization. **Dadan Supardan:** Supervision, Writing - Review & Editing, Project Administration, Funding Acquisition.

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Data availability statement
The data that support the findings of this study are available from the corresponding author upon reasonable request.

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No potential conflict of interest was reported by the authors.

Additional information

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