Continuous Education : Journal of Science and Research
Volume 6 Issue 2 July 2025
Journal Homepage:
https://pusdikra-publishing.com/index.php/josr

Promoting Critical Thinking Skills Using Voice-Based Chatbots in an Integrated Listening and Speaking Class

Lely Desilia Flora Saulahirwan[1], Daniel Ari Widhiatama[2]
[1,2] *Universitas Mercu Buana Yogyakarta, Indonesia*
Corresponding Author: desiliaflora@gmail.com

ARTICLE INFO
Article history:
Received
31 July 2025
Revised
05 August 2025
Accepted
10 August 2025

ABSTRACT

This study aims to test the effectiveness of using voice-based chatbots (VBC) in improving students' critical thinking skills in integrated listening and speaking and to investigate their perspectives on the use of VBC in the classroom. This study uses a pre-experimental design to determine the effectiveness of using voice-based chatbots (VBC) in improving students' critical thinking skills in integrated listening and speaking classes and employs qualitative research methods such as interviews to explore students' perceptions of using voice-based chatbots to support their critical thinking and communication skills. The study involved 32 participants from a private university in Yogyakarta. The research results showed that the average pre-test score was 69.28 with a standard deviation of 3.78, and the average post-test score increased to 77.00 with a standard deviation of 4.83. In terms of descriptive statistics, there was an improvement in learning outcomes after using the chatbot. The paired-sample t-test revealed a significance value of 0.000 ($p < 0.05$), indicating a significant difference between pre-test and post-test scores after the intervention using the voice-based chatbot.

Key Word
Voice Based Chatbot, Critical Thinking, Listening and Speaking Skills, Technology Based Learning, EFL.

How to cite
https://pusdikra-publishing.com/index.php/josr

INTRODUCTION

Critical thinking is now essential for understanding information and making the right decisions. Critical thinking has many definitions from experts. One definition provided by Ennis (1991) states that critical thinking is an introspective and rational act focused on making decisions. Academic success, problem solving, and readiness to face complex global challenges require this skill in the 21st century. Cottrell (2005), on the other hand, describes critical thinking as an active cognitive process that involves analyzing arguments, evaluating evidence, and systematically and logically organizing thoughts to reach appropriate conclusions. Contemporary education requires students to think critically and communicate effectively in professional and social contexts.

Critical thinking (CT) is very important in English language learning (ELT) because it helps students communicate better, expand their vocabulary, and improve their understanding of language use in various contexts and situations (Harizaj & Hajrulla, 2017). Listening and speaking skills are important components of language learning because they contribute to the development of students' ability to interact effectively and meaningfully with others. Listening, however, is often considered a complex and challenging skill (Chen, 2017; Bidabadi & Yamat, 2014), as it requires listeners to receive sounds, understand meaning aurally, and interpret messages based on the available context. In Critical Listening and Speaking (CLS) classes, critical thinking skills are essential because students are not only required to understand messages literally but also to think, evaluate, and respond reflectively. Therefore, many argue that CT should be part of the ELT curriculum because it is an important competency that helps students prepare for global communication challenges. This aligns with the government's Merdeka Curriculum policy, which emphasizes enhancing critical thinking skills as part of the Pancasila student profile (Ministry of Education, Culture, Research, and Technology, 2022).

In learning English as a foreign language (EFL), listening and speaking are important skills because they improve one's speaking ability and critical thinking skills. Ramazani et al. (2016) found that critical thinking skills are related to the speaking ability of EFL students. In addition, according to Collins and Stevens (1981), dialogue and reflection activities during speaking and listening can help students develop higher-order thinking skills. Based on Bloom's Taxonomy and the task-based language teaching approach, which emphasizes the integration of higher-order thinking skills with fluency and accuracy in language use, language teaching should include the development of cognitive skills such as analysis and evaluation (Skehan & Robinson, 2001; Bloom et al., 1956). Students have to do this if they are to become proficient language users and critical and reflective communicators. In this regard, outdated teaching strategies and limited opportunities for students to speak English in the classroom pose particular challenges to their critical thinking skills (Baek & Lee, 2018; Chen & Hwang, 2019; Wang, 2014).

English as a foreign language (EFL) learning in Indonesia faces significant challenges in terms of critical thinking skills. Research by Defianty and Wilson (2022) found that many EFL teachers in Indonesia do not fully understand the concept and application of critical thinking teaching. As a result, CTS teaching practices are still limited. This means that there are not many classroom activities that encourage students to think, evaluate, and analyze information. However, according to Facione (1990), critical thinking involves interpretation,

analysis, evaluation, inference, and explanation, all of which support logical decision-making. Vygotsky (1978) also emphasized the importance of social interaction and language as tools for thinking that enable the development of higher intelligence in language learning. However, EFL teaching in Indonesia often focuses on mastering grammar and memorizing vocabulary rather than developing higher-order thinking skills. Therefore, to improve students' abilities not only in language but also in critical thinking, a language teaching approach that combines communicative and reflective tasks with critical thinking skills is essential (Skehan & Robinson, 2001).

The Integrated Listening and Speaking course is provided in a dynamic and contextual learning environment to support the development of critical thinking skills in the English Education Study Program. Students are trained to listen actively, interpret information, ask questions, and respond reflectively during this class. Brown (2000) states that listening activities improve understanding and effective speaking skills. On the other hand, Richards and Rodgers (2001) state that a communicative approach in language classes encourages students to evaluate information and make oral arguments through real-world tasks. Additionally, the topics discussed are diverse and relevant to current global issues, such as the environment, politics, education, and so on. Therefore, this integrated class not only teaches language skills but also serves as a strategic approach to developing critical and reflective thinking through meaningful oral interaction.

Artificial Intelligence (AI) technology has significantly changed language education in this age of rapid technological growth, especially in English Language Teaching (ELT). The usage of ChatGPT is one illustration of AI's rising popularity. There are worries about how this contact may affect students' capacity to critically analyze material, even when ChatGPT offers immediate access to contextualized and individualized information (Enkelejda Kasneci et al., 2023). However, because ChatGPT enables students to examine a subject from several angles, it can be a helpful tool for improving critical thinking abilities (Rudolph et al., 2023). Students' vistas, cognitive processes, and ability to see a subject from various angles can all be enhanced by this varied analytical process (Mollick & Mollick, 2022).

Additionally, educators are using voice-based chatbots (VBCs). Adamopoulou & Moussiades (2020) stated that this technology is highly beneficial in the learning process because it has the ability to interactively enhance students' critical thinking skills. Through analytical and reflective questions, VBCs encourage students to think more deeply about the context and content of the learning. For example, research by Winkler & Söllner (2018)

found that voice chatbots used in learning can increase students' cognitive engagement and thinking skills. Furthermore, through contextual conversations, such as discussions about global issues in the language students are learning, VBCs help them develop arguments, justify opinions, and think critically (Abdallah, 2024). Students can learn at their own pace and style with support such as instant feedback, personalization, and 24/7 access. Pressure-free interactions also help students understand language and cultural rules. They also become less afraid of speaking in a second language (Huang et al., 2023). Voice chatbots help people learn to think critically while learning a language and also communicate.

Chatbots are becoming increasingly popular in English language learning, but there is still little research on how effective they are in building critical thinking skills especially in integrated listening and speaking activities. While the cognitive dimension has not been thoroughly studied, most research still concentrates on more linguistic aspects, such as vocabulary or grammar (Klimova & Pikhart, 2023). However, chatbots and artificial intelligence-based technologies can help students think critically and participate in discussions in a dynamic and argument-based manner (Fryer & Nakao, 2020). Therefore, further research is needed to determine whether chatbots help people learn languages effectively or not. Research should also determine how well chatbots can promote more advanced cognitive processes in language learning.

The purpose of this study is to examine how voice-based chatbots can improve students' critical thinking skills in integrated listening and speaking classes, and how they perceive them as tools to help them communicate and reflect. Chatbots can interact quickly and clearly with people through voice recognition and language processing (Colace et al., 2018), which can enhance cognitive engagement and more reflective learning. It is hoped that this study will contribute to ELT practice by emphasizing the use of technology to improve language skills and foster deeper thinking.

The participants in this study were a class of English students at one of the private university in Yogyakarta. In the critical listening and speaking class. This study used A mixed-method, using pre-test, and post-test for data collection.

Based on background, the questions were (1) How effective are voice-based chatbots in promoting students' critical thinking skills in an integrated listening and speaking class? (2) What are students' perceptions of using voice-based chatbots to support their critical thinking and communication skills?

The first objective of this research is to find out how effective a voice-based chatbot is in improving students' critical thinking skills in integrated

listening and speaking courses. Listening skills are very important in learning English as a foreign language because they play a role in determining speaking skills. Voice-based chatbot technology equipped with speech recognition and natural language processing allows for interaction like a real conversation. In this way, artificial intelligence can encourage students to actively and critically participate in conversations.

The second objective was to determine students' perceptions of the use of voice-based chatbots in supporting their critical thinking and communication skills. The use of chatbots is proven to be able to increase students' interest in speaking. In addition, this technology can also increase self-confidence and provide a flexible learning experience that suits the needs of each student.

RESEARCH METHODE

This study employed a quantitative pre-experimental one-group pretest-posttest design, involving 32 fourth-semester English department students from a private university in Yogyakarta. This design was chosen to evaluate the effectiveness of voice-based chatbots in enhancing students' critical thinking skills in Integrated Speaking and Listening classes, without the use of a control group. Research instruments included pretests, posttests, and a Critical Thinking Skills Self-Assessment (CTSA) questionnaire adapted from Mbato (2013) and Tasaki & Inagaki (2016), aligned with Facione's (1990) critical thinking framework focusing on analysis, interpretation, and evaluation.

Data collection was carried out in three stages. In the initial stage, the researcher identified the problem and developed research instruments. During the implementation stage, students were assigned five chatbot-based speaking tasks using platforms such as ParlaLingo, Copilot, and C-AI. These tasks, completed outside regular class time, involved interacting with chatbots based on specific topics, recording the conversations, and submitting video assignments to demonstrate their speaking performance and engagement with the technology.

In the final stage, data from pretests and posttests were analyzed using a paired sample t-test to determine any significant differences in students' critical thinking skills before and after the intervention. This method allowed the researcher to track changes in learning outcomes within the same group. The study concludes that chatbot-assisted learning can promote independent learning, boost speaking confidence, and serve as an effective tool for enhancing students' cognitive and communication skills in language education.

RESULT AND DISCUSSION

Initial Measurement Data (*Pre-Test*)

Based on purposive sampling techniques, one Critical Listening and Speaking class consisting of 32 participants was selected as the sample in this study. The participants were given treatment in the form of learning intervention using a voice-based chatbot. Before the intervention was carried out, the researchers administered the Critical Thinking Self-Assessment (CTSA) instrument to measure the participants' critical thinking disposition. In this study, the CTSA instrument was modified from Hirayama and Kusumi (2004), through a study titled Effect of critical thinking disposition on interpretation of dramatic issues: Evaluating evidences and drawing conclusions, published in the Japanese Journal of Educational Psychology (vol. 52, pp. 186–198). This instrument was developed to assess students' critical thinking dispositions through four main dimensions, namely awareness of logical thinking, objective attitude, motivation to ask questions (inquiry-mindedness), and evidence-based assessment (Hirayama & Kusumi, 2004). The results are presented below:

Table 1.
Pre-Test Critical Thinking Self-Assessment (CTSA)

Descriptive Statistic	Value
Number of Participants (N)	32
Minimum Score	63
Maximum Score	77
Mean	69,28
Standard Deviation	3,78

Based on the results of the pre-test conducted using the Critical Thinking Self-Assessment (CTSA) instrument, an average score of 69.28 was obtained from 32 participants. The minimum score obtained was 63, while the maximum score reached 77. The standard deviation value of 3.78 indicates that the variation in participants' critical thinking abilities at the initial stage was moderate. This data serves as a basis for comparing changes that occur after the implementation of voice chatbot-based learning interventions.

The calculation of the mean value, minimum and maximum scores, and standard deviation in this study used a descriptive statistical approach as explained by Pallant (2013). Descriptive statistics are used to provide an overview of the data, such as distribution, central tendency, and score dispersion. The mean was obtained by dividing the total score by the number of participants, while the standard deviation was calculated to determine the extent of variation in participants' scores from the mean.

Treatment Result Data

In this study, the intervention was a voice chatbot-based learning experience in a critical listening and speaking class. The goal was to determine whether this technology could help students think more critically. The participants were 32 students from Mercu Buana University, Yogyakarta, who were taking the class. To measure their critical thinking skills, a tool called the Critical Thinking Self-Assessment (CTSA) was used. This test was administered twice before the start of the lesson (pre test) and after the lesson (post test) so that researchers could determine whether there had been any improvement in their skills following the intervention.

Final Measurement Data (Post-Test)

Tabel 2.
Post-Test Critical Thinking Self-Assessment (CTSA)

Descriptive Statistic	Value
Number of Participants (N)	32
Minimum Score	67
Maximum Score	87
Mean	77,00
Standard Deviation	4,83

The post-test results using the Critical Thinking Self-Assessment (CTSA) instrument showed that out of 32 participants, the average score was 77.00. The minimum score was 67, while the maximum score was 87. The standard deviation of 4.83 indicated an increase in score variation compared to the pre-test, indicating the diversity of participants' responses to the learning intervention provided.

Normality Test

The normality test is one of the analysis requirements to determine whether the data obtained from the results of the variables that have been studied are normally distributed or vice versa. The basis for decision-making in the Kolmogorov-Smirnov normality test using a 5% significance level is as follows:

1) If the significance score (Sig.) > 0.05, the research data are normally distributed.
2) If the significance score (Sig.) < 0.05, the research data are not normally distributed.

The results of the normality test in this study are shown in the following table:

Table 3.
Tests of Normality

		(Data>100) Kolmogorov-Smirnov[a]			(Data<100) Shapiro-Wilk		
	Kelas2	Statistic	df	Sig.	Statistic	df	**Sig.**
Hasil2	Pre-Test2	,102	32	,200*	,966	32	**,392**
	Post-Test2	,168	32	,022	,939	32	**,070**

Interpretation of Results:

1. Pre-Test Data
   The significance is 0.392, where Sig. > 0.05, indicating a normal distribution.
2. Post-Test Data
   The significance is 0.070, where Sig. > 0.05, indicating a normal distribution.

Proof of Hypothesis

The data analysis technique employed in this study was the Paired Sample T-Test, a comparative statistical method used to examine differences between pre-test and post-test scores within the same group. The test aimed to evaluate whether the implementation of a voice-based chatbot in an integrative Listening and Speaking class significantly improved students' critical thinking skills. Statistical analyses were conducted using IBM SPSS software.

Paired-samples t-tests are used when one group is tested twice to see the effect of treatment (Ross & Willson, 2017).

Based on Santoso (2014), the decision-making guidelines in the Paired Sample T-Test based on significance values are as follows:

- If the significance value is <0.05, then H_0 is rejected and H_1 is accepted.
- If the significance value is >0.05, then H_0 is accepted and H_1 is rejected.

The hypotheses tested are as follows:

- H_0: The use of voice-based chatbots in integrative Listening and Speaking classes is ineffective in improving students' critical thinking skills.
- H_1: The use of voice-based chatbots in integrative Listening and Speaking classes is effective in improving students' critical thinking skills.

Paired Sample T-Test

Table 4.
Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Pre-Test2 - Post-Test2	-7,719	5,974	1,056	-9,873	-5,565	-7,309	31	,000

Based on the results of the Paired Sample T-Test analysis conducted using IBM SPSS software in the table above, the mean score difference was -7.719 and a significance value (2-tailed) of 0.000. This value is less than 0.05, so H_0 is rejected and H_1 is accepted.

Therefore, it can be concluded that the use of voice-based chatbots significantly improves students' critical thinking skills in Listening and Speaking lessons.

Interview Results

This study examines students' perceptions of the use of voice-based chatbots in English speaking learning using the MALL approach. Based on interviews with five students, six main themes were identified: (1) Learning experiences with chatbots, (2) Frequency and quality of speaking practice, (3) Learning independence, (4) Fun and engagement aspects, (5) Ease of use, and (6) Confidence in speaking.

Learning Experience with Chatbots

Most students had a positive experience when using chatbots in their speaking lessons. They said that at first it felt strange to talk to AI, but then they got used to it and felt comfortable.

> "Actually, it was an interesting experience for me, because at the first I felt a bit weird talking to a chatbot, but after a few minutes, I got used to it." (R1)
>
> "I felt comfortable speaking with chatbots because there's no pressure when I want to like confessing my idea." (R4)

This is in line with the MALL concept, which allows for flexible and non-intimidating learning interactions (Li & Hegelheimer, 2013).

Frequency and Quality of Speaking Practice

The use of chatbots increases the intensity of English speaking practice for students. They feel more free to repeat exercises without pressure.

> "I could repeat things as many times as I wanted without feeling bad about it." (R1)
>
> "Yes, I practiced more than usual. The chatbot was always ready to talk so I could practice anytime I wanted." (R2)

In the context of MALL, the presence of an always-available chatbot supports informal out-of-classroom conversations, significantly expanding the learning space (Kukulska-Hulme, 2009).

Independence in Learning

Chatbots also provide students with the opportunity to learn independently, in line with the principles of mobile technology-based learning.

> "I could control the pace and choose what topics I wanted to talk about, and if I didn't understand about something, I could ask it to explain again, or use simpler words and it's like having a tutor that's always there, but doesn't get frustrated with me."(R1)
>
> "Yes, it helped me learn on my own. I didn't have to wait for a teacher or class." (R2)

Students can choose topics, ask for clarification, and set the pace of conversation, demonstrating a high degree of learning autonomy within the MALL framework (Stockwell, 2013).

The Aspects of Enjoyment and Engagement

All respondents stated that using chatbots in speaking lessons was fun and interesting.

> "It was so fun because the chatbot could talk about different topics, and he even had some personality. Sometimes I, the chatbot, would ask me questions that made me think deeper and it was not as boring as doing grammar exercise from a textbook, something like that." (R1)
>
> "Yes. Even I cannot stop to learn with the chatbot by speaking. Why? Because by speaking with the chatbot, the conversation felt alive and the chatbot also made the conversation wider and with much information or even like interesting facts and the chatbot also asked me for some questions or like my experience. So from that, it is interesting because I can have the freedom to express myself, to have some gestures of my hands and I really like how the feedback of the chatbot about my story, I felt like appreciated by it and I feel like studying by speaking with chatbot is really fun and I want it next." (R3)

Responsive and engaging interactions strengthen student engagement in the learning process, in line with the characteristics of MALL, which enables adaptive and engaging learning content (Burston, 2015).

Ease and Obstacles in Using Chatbots

In general, students feel that chatbots are easy to use. However, there are several technical challenges such as internet connection and misunderstandings by chatbots.

> "It was easy to use. The interface was simple, and I could just talk to it naturally. For me, the biggest challenge is, was the chatbot didn't understand my pronunciation or when I used the wrong words. So, I had to repeat, repeat talk to it several times." (R1)

These findings highlight the importance of technical aspects in the implementation of MALL, such as connection stability and voice recognition sensitivity.

Confidence in Speaking

Most students reported an increase in confidence when speaking English using chatbots. They felt they were not being judged when they made mistakes.

> "Yes, I felt confident because there's no judgement, and I know it won't laugh at my mistakes or get impatient. So, I can take my time to think about what I want to say." (R1)
>
> "Yes, I feel more confident. I'm not afraid to make mistakes because the chatbot doesn't laugh or judge. It helps me feel safe when I learn." (R2)

Data Analysis Discussion

Based on the normality test analysis using the Kolmogorov-Smirnov test in IBM SPSS Statistics, it was found that the pre-test and post-test significance values for the same group, both pre-test and post-test, were greater than 0.05. This indicates that the data has a normal distribution. This finding aligns with Sugiyono (2019:79), who stated that the use of parametric statistics is recommended when the data meets the assumption of a normal distribution.

The results of hypothesis testing using the Paired Sample T-Test conducted through the IBM SPSS Statistics program show that the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted, because the value of Sig. (2-tailed) value obtained is 0.000, which is smaller than the significance limit of 0.05. This finding shows that the use of voice-based chatbots in Listening and Speaking classes has a significant effect on improving students' critical thinking skills.

This finding is in line with the views of King et al. (2019) who stated that the use of interactive technologies, such as voice-based chatbots, can increase

student engagement in the learning process and encourage the development of critical thinking skills through reflective and responsive interactions.

CONCLUSION

The statistical test results using Paired Sample T-Test showed a significant difference between students' critical thinking scores before and after using the chatbot. The significance value of Sig. (2-tailed) of 0.000, which is smaller than the significance limit of 0.05, indicates that students' post-treatment scores are significantly higher. This indicates that the chatbot actively helped students become smarter and more independent. This finding is in line with (Sweller, 1988) Cognitive Load Theory, which states that the reduction of cognitive load through immediate feedback can improve learning effectiveness. Chatbot as a technological tool provides personalized support so that students are able to focus on the critical thinking process and understand the content more deeply. Thus, the use of voice chatbot is proven to be effective in teaching listening and speaking skills while significantly improving critical thinking ability.

The interview results show that students are interested in and like interacting with the voice chatbot. Since they are not afraid of being judged or shamed when they make mistakes, the majority of students feel comfortable and confident when speaking. In addition, they stated that they had the freedom to learn independently, choose topics flexibly, and practice outside of class hours. The chatbot was also rated as fun and interactive. Students felt valued, encouraged to think further, and experienced conversations that resembled real-world interactions. Despite technical issues such as internet connection or voice recognition, their enthusiasm for learning remained high. This phenomenon is in line with (Kardong-Edgren, 2013), which emphasizes that students' confidence increases when they feel capable of achieving learning goals without external pressure. Fear-free and supportive interactions contribute directly to their intrinsic motivation and the development of their communication skills.

Overall, the voice chatbot proved effective in improving critical thinking skills and was positively received by students as a learning tool. This technology is able to create a learning experience that is flexible, fun, and encourages students to be more active and independent in thinking and communicating.

REFERENCES

Bedir, H., & Daskan, A. (2023). The Significance of Body Language in Foreign Language Learning and Teaching. *International Journal of Social Sciences &*

Educational Studies, *10*(1), 111–121. https://doi.org/10.23918/ijsses.v10i1p111

Bjelland, C., Ludvigsen, K., & Møgelvang, A. (2024). Unveiling the Impact of Ai Chatbots on Higher Education: Insights From Students. *INTED2024 Proceedings*, *1*(March), 1458–1465. https://doi.org/10.21125/inted.2024.0428

Colace, F., De Santo, M., Lombardi, M., Pascale, F., Pietrosanto, A., & Lemma, S. (2018). Chatbot for e-learning: A case of study. *International Journal of Mechanical Engineering and Robotics Research*, *7*(5), 528–533. https://doi.org/10.18178/ijmerr.7.5.528-533

Ennis, R. (1991). *ġ ª ġ & " \ ġ L ġ _ & yġ S ġ ġ ġ ġ ¦ ġ ġ ġ ġ ġ ġ ġ , ġ ġ ġ * ġ ġ *" ġ ġ ġ. 14*, 1.

Hardani, Auliya, N. H., Andriani, H., Fardani, R. A., Ustiawaty, J., Utami, E. F., Sukmana, D. J., & Istiqomah, R. R. (2020). Buku Metode Penelitian Kualitatif. In *Revista Brasileira de Linguística Aplicada* (Vol. 5, Issue 1).

Harizaj, M., & Hajrulla, V. (2017). Fostering Learner's Critical Thinking Skills in EFL: Some Practical Activities. *European Scientific Journal, ESJ*, *13*(29), 126. https://doi.org/10.19044/esj.2017.v13n29p126

Kardong-Edgren, S. (2013). Bandura's self-efficacy theory... something is missing. *Clinical Simulation in Nursing*, *9*(9), e327–e328. https://doi.org/10.1016/j.ecns.2013.07.001

Maulana, A., Musthafa, I., & Hayati, T. N. (2020). The efficiency of teaching listening and speaking skills to develop students' communicative competences. *Universal Journal of Educational Research*, *8*(3), 802–808. https://doi.org/10.13189/ujer.2020.080310

Mridha, M. M., & Md. Muniruzzaman, S. (2020). DEVELOPING ENGLISH SPEAKING SKILLS: Barriers faced by the Bangladeshi EFL learners. *Englisia: Journal of Language, Education, and Humanities*, *7*(2), 118. https://doi.org/10.22373/ej.v7i2.6257

Oktavian, R., Aldya, R. F., & Arifendi, R. F. (2024). Artificial Intelligence Dan Pendidikan Era Society 5.0. *Inteligensi : Jurnal Ilmu Pendidikan*, *6*(2), 143–150. https://doi.org/10.33366/ilg.v6i2.5798

Olatunde-Aiyedun, T. G. (2024). *Volume 1 Nomor 1 Januari 2024*. *1*(2023), 1–14. https://economic.silkroad-science.com/index.php/IJAIFD

Pujihastuti, I. (2010). Isti Pujihastuti Abstract. *Prinsip Penulisan Kuesioner Penelitian*, *2*(1), 43–56.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, *12*(2), 257–285. https://doi.org/10.1016/0364-0213(88)90023-7

Woolf, B. P., Lane, H. C., Chaudhri, V. K., & Kolodner, J. L. (2013). AI grand challenges for education. *AI Magazine*, *34*(4), 66–84. https://doi.org/10.1609/aimag.v34i4.2490

Xue, Y., & Wang, Y. (2022). Artificial Intelligence for Education and Teaching. *Wireless Communications and Mobile Computing*, *2022*. https://doi.org/10.1155/2022/4750018

Zahara, S. L., Azkia, Z. U., & Chusni, M. M. (2023). Implementasi Teknologi Artificial Intelligence (AI) dalam Bidang Pendidikan. *Jurnal Penelitian Sains Dan Pendidikan (JPSP)*, *3*(1), 15–20. https://doi.org/10.23971/jpsp.v3i1.4022