



## Students' Perception of Artificial Intelligence (AI) as English Learning Tools at MTsN 4 North Aceh

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**Abstract:** This research investigates students' perceptions of Artificial Intelligence (AI) as a tool for learning English at MTsN 4 North Aceh. Quantitative descriptive method was employed in this study that involving 40 students as participants. Data were collected through Likert-scale questionnaires and semi-structured interviews to assess students' attitudes towards AI in relation to motivation, and skill development (listening, speaking, reading, and writing). The results indicate that most students perceive AI positively, appreciating its ability to enhance their understanding of English materials, increase motivation, and provide real-time feedback. Many students highlighted that AI tools offered interactive and flexible learning opportunities. Overall, artificial intelligence (AI) is not seen as a replacement for conventional teaching, even though it is a useful tool for learning English. The best strategy could be to combine AI with human instruction, maintaining a balance between the flexibility and immediate feedback that AI offers and the individualized help that teachers can provide.

**Keywords:** Students' Perception, Artificial Intelligence, MTsN 4 North Aceh

### 1. INTRODUCTION

Since the rapid development of technological innovation, all aspects of human life around the world have been facilitated by the influence of mechanical advancement. According to Tri et al. (2021), mechanical development affects all aspects of life, including the economy, governance, employment, culture, and even education. This mechanical development refers to artificial intelligence (AI) that has been developed by humans and has emerged in recent decades. Within this framework, artificial intelligence can function as a helpful learning assistant that is essential to refining the learning process (Gabriel et al., 2022; Seo et al., 2021). Artificial Intelligence (AI) can alternatively be described as the intelligent replication of human thought processes and behavior by machines or software (Mohammed & —Neill Watson, 2019).

Additionally, AI has a lot of potential for education because it can produce useful diagnostic and predictive models, assist in identifying at-risk students, deliver timely interventions, and lower dropout rates (Li et al., 2019; Shakhnoza Shokirovna, 2023.) Furthermore, according to an educational technologist, AI has the power to transform language instruction, making it more effective and accessible for students from a variety of backgrounds (Hatos, n.d.; Pokrivcakova, 2019). According to some earlier studies, using technology can undoubtedly foster students' creativity and support teachers (Marrone et al., 2022). In addition, artificial intelligence can assist teachers in providing more individualized instruction for their students, creating successful learning

opportunities, helping students identify their gifts, fostering greater creativity, and lightening the workload of educators (Haseski, 2019; Sekeroglu et al., 2019).

Artificial intelligence plays a significant role in the world of education, particularly in the learning process, as it can assist students in receiving education and information through media without the need for a teacher's presence. The use of artificial intelligence applications in education has been widely developed, including the implementation of intelligent tutoring systems, educational game applications, and the utilization of various applications as supplements in the learning process, especially foreign Language.

Foreign language education holds an important position in education in Indonesia. This lesson is expected to provide individuals who can communicate with foreigners through the languages of other countries. Through foreign language lessons, it is also hoped that students can easily absorb knowledge and technology on a global scale. Therefore, foreign language education is a necessary subject in Indonesian education, and it is even required starting from the Junior High School level, Senior High School, and Higher Education. One of the foreign languages that is an international language is English. In general, the competencies required in the English language subject in learning include writing, reading, listening, and speaking.

Utilizing AI can be used to support different stages of learning challenges and improve student accomplishment in learning the English language, both within and outside of the classroom. AI can expedite the process of successfully finishing tasks and improve in the development of an individual's skills. In 2023, Moulieswaran and Prasantha "there is a possibility that AI could replace traditional teaching methods, as improvements in this field are beginning to show results." Introducing AI-supported resources into English language learning classes requires extensive investigation of how students will react to these changes as AI develops popularity in the field of innovation and technology.

English is a subject that studied from elementary school through postsecondary education. To put it simply, students must be able to listen, speak, read, and write in English to utilize AI in classroom. The use of AI can help people acquire particular abilities, such as Abimanto's (2023) research result that "AI can enhance English speaking, reading, writing, and listening skills".

Students' educational experiences have changed as a result of AI's inclusion into the classroom, Al-Abbas et al., 2023 "it is very important to address the difficulties and factors related to AI integration, such as the importance of collaboration between humans and AI, bias, as well as data privacy and security." The purpose of this study is to

investigate how students view the role of artificial intelligence (AI) in English language learning and to identify the advantages, difficulties, and potential advancements that AI may provide to the field of English learning. The goal of this research is to know students' attitudes, ideas, and experiences in order to integrate AI in education in a way that best serves language learners.

It contributes to the role of AI in education and its transformative impact on language learning by developing an extensive comprehension of students' perspectives. As further findings from this study are educators and innovators can collaborate to realize the power of AI to enhance the English language learning process.

By examining students' perception of using AI in learning process, this study intends to add to the expanding body of knowledge on the use of AI in language education. It also offers important insights into the benefits, drawbacks, and implications of using AI in English language learning. Ultimately, this research seeks to improve the comprehension of how English learning is changing in the the era of AI technologies.

## **2. LITERATURE REVIEW**

The benefits of AI in language learning have been emphasized in numerous research since it has the potential for individualized instruction. The capacity of AI technology to analyze student language input, evaluate students' grammar, and offer complex feedback has been shown in the very early research (Bailin, 1987; Holland et al., 1993; Nagata, 1996). Along with improvements in technology, more recent study shows that AI has more potential. For example, it has been discovered that using AI in learning process has some advantages for students. Lu (2018) stated that AI is capable of having meaningful conversations. Besides, AI can be useful in roles requiring collaboration (Tafazoli et al., 2019). Regarding the advantages of English language learning, AI can improve reading comprehension and speaking skills (El Shazly, 2020; Yin et al., 2021). Additionally, Bailey et al. (2021) pointed the fact that employing AI tools in English class can improve students' inspiration and motivation. In accordance to the Sumakul et al. (2022) claimed all teachers expressed positive views about implementing AI in the classroom. The teachers agreed that AI may help with teaching and student learning. According to Alhalangy and Abd Algane (2023). The field of English language teaching (ELT) and learning is positively impacted by AI.

Similarly to another study by Sumakul et al. (2022), students had positive feelings about using the AI tool. The students enjoyed the lessons, and the AI program helped them with their writing. More precisely, Utami et al. (2023) listed three benefits of using AI in an Indonesian academic writing class: (1) Students seek out AI technology in academic writing for engaging learning; (2) AI-based learning tools are adaptable and accessible; (3) AI-based learning tools help students with academic research planning, topic creation, and paper draft development.

However, some studies found contradictory findings in spite of these positive findings. Early on, language studies' optimistic views of AI were critiqued for being overstated and misinterpreted (Last, 1989; O'Brien, 1993). Compared to more recent research, AI is not a trustworthy learning tool (Gallacher et al., 2018), and the language it produces is frequently unsuitable, unnatural, and decontextualized (Pace-Sigge & Sumakul, 2021; Wilson et al., 2021).

According to Rieland (2017) and Zawacki-Richter (2019), the teachers' lack of pedagogical knowledge or AI tools' inadequate pedagogical design could be the cause of the issues with implementing AI in the classroom. Kukulska-Hulme and Lee (2020) point out that while there is evidence that technology can help language learners, less exists about the role of teachers in integrating it into the classroom. Likewise, using chatbot technology in the classroom has serious problems.

Chatbots have the potential to gather student personal data, such as names, email addresses, and academic records (Liden & Nilros, 2020). Consequently, users' worries about privacy and security have a big influence on whether or not they want to use chatbots in the classroom (Shumanov & Johnson, 2021). Furthermore, Cassidy (2023) has raised concerns on multiple occasions about the potential for cheating with ChatGPT, which could negatively affect assessments.

### **3. METHODS**

This research employs a quantitative descriptive design to explore students' perceptions of the use of Artificial Intelligence (AI) in English language learning at MTsN 4 North Aceh. According to Sugiyono (2016), quantitative descriptive research focuses on objectively describing variables as they exist, using numerical data to support the findings. In this study, students' attitudes, beliefs, and experiences with AI in English learning are measured through surveys, and interview with the aim of identifying both the benefits and challenges that students face when using AI in their learning process.

Participants in the study are students at 8<sup>th</sup> MTsN 4 North Aceh, selected based on specific criteria to ensure the sample represents the school population. 40 students chosen to provide adequate representation for gathering insights into their experiences with AI. To make sure the survey instrument was valid and reliable, a pre-test was carried out before to the start of the research. Ethical considerations were also taken into account, with students' participation being voluntary, and anonymity guaranteed in all data reporting.

Data collection was conducted using a Likert scale-based questionnaire, which assessed the students' perceptions of AI in relation to its benefits, effectiveness, and challenges in enhancing their English language skills. The questionnaire covered several themes, including the perceived impact of AI on motivation, understanding of content, and language skill development (listening, speaking, reading, and writing). Additionally, semi-structured interviews were conducted with select students to gain deeper insights into their experiences and to enrich the quantitative data with qualitative context.

In data analysis, quantitative data from the questionnaires were processed using descriptive statistics, such as frequency counts, and percentages, to illustrate overall trends in students' perceptions. The qualitative data from interviews were transcribed and analyzed through thematic coding to identify recurring patterns or issues raised by the students. The combination of these methods allows for a comprehensive analysis of how students perceive the role of AI in English language learning and provides a nuanced understanding of both the positive and negative aspects of AI integration in the classroom.

#### **4. RESULTS**

The results of the research, which include information from the interview and survey, are presented in this section. The discussion analyzes these results, relating participant perspectives, identifying patterns, and providing an extensive overview of students' perception regarding the integration of artificial intelligence (AI) in language learning.

Forty participants completed the questionnaire, and the results provided intriguing insights into the concepts of AI and perception about the use of English language learning. As technological developments progress, over 50% of students are familiar with and adept to use artificial intelligence. This causes to different perspectives from every student about what they think about this issue when learning a foreign language, particularly English. The findings of a survey related to this study that approximately 40 participants at 8<sup>th</sup> grade in MTsN 4 North Aceh.

**Table 1.** Students' Perception on using AI in Learning English

No	Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I have heard about Artificial Intelligence (AI).	2.5%	5%	12.5%	30%	50%
2	I feel that the use of AI helps me understand English material better.	5%	12.5%	25%	37.5%	20%
3	AI makes learning English more interesting and enjoyable for me.		7.5%	17.5%	50%	25%
4	I feel more motivated to learn English after using AI.	2.5%	10%	20%	45%	22.5%
5	The use of AI in learning makes me more confident in speaking English.	7.5%	15%	25%	35%	17.5%
6	I have difficulty using AI tools in learning English.	17.5%	30%	20%	22.5%	10%
7	AI provides feedback that helps me in the process of learning English	5%	7.5%	25%	37.5%	25%
8	I feel AI can replace traditional teaching methods in learning English.	20%	25%	30%	15%	10%
9	I believe that AI can help improve my listening skills in English.	2.5%	7.5%	22.5%	42.5%	25%
10	AI helps me prepare for English exams better.		12.5%	30%	37.5%	20%
11	AI helps me practice my speaking skills in English	5%	17.5%	25%	32.5%	20%
12	AI helps me understand English grammar better.	2.5%	10%	20%	50%	17.5%
13	AI encourages me to think critically in learning English.		15%	35%	37.5%	12.5%
14	I worry that the use of AI could replace human interaction in English learning	25% %	20%	30%	12.5%	12.5%

15	Artificial intelligence is important to use today in education to prepare language learners to meet the language learning needs in education.		5%	15%	45%	35%
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The majority of participants had good impressions regarding AI integration. The qualitative information obtained from in-depth interviews with some of the participants revealed the complex ways in which students believe artificial intelligence (AI) in the context of learning English. A lot of participants were excited by the power of AI to offer regular practice chances, particularly for grammar. They appreciated the flexibility that AI provided, which let them practice whenever it was convenient for them.

## 5. DISCUSSION

Based on the survey's findings on how students react about artificial intelligence (AI) in English language learning provide important new perspectives on their attitudes and experiences. With 80% of respondents claiming they had heard of AI and 30% strongly agreeing, students generally showed a high level of knowledge with the technology. This indicates that artificial intelligence is growing in popularity as a useful tool in education, particularly as it applies in language learning. As AI becomes more integrated into educational systems, its presence and significance in helping students become familiar with technology is increasing, which is crucial in today's technological world.

Students' perceptions on the usefulness of AI in English language classes were mostly positive. While 25% were neutral, the majority (57.5%) agreed or strongly agreed that AI improves their understanding of English-language content, which may suggest that the impact of AI varies based on the user or the type of content presented. Furthermore, according to 75% of students, AI improved the interest and enjoyment of studying English. This implies that AI can provide a stimulating educational experience that traditional methods might not be able to provide. Additionally, 67.5% of respondents agreed or strongly agreed that AI motivates them to learn English more enthusiastically.

Students' confidence in speaking English is significantly impacted by AI. Among the students, 52.5% claimed AI increased their confidence in speaking a foreign language, while 25% claimed it had no effect. This illustrates the potential of AI capabilities like interactive conversation features and speech recognition, which can assist students in practicing speaking in a less intimidating environment. The more modest outcomes in this

area, however, may also be explained by the fact that technology is currently unable to completely duplicate human contact, which may further restrict students' confidence.

On the down side, some students faced trouble utilizing AI tools. The difficulties of implementing AI in the classroom are highlighted by the fact that over 47.5% of respondents indicated they had problems with the technology. Technical problems, inadequate training, or uneasiness with new technologies could be the cause of these challenges. Additionally, only 25% of students claimed that AI could completely replace conventional teaching methods, with 30% still neutral. It indicates that when AI can enhance learning, many students still believe that a human teacher is irreplaceable in providing individualized instruction, emotional support, and real-time interaction.

In short, most students realize the benefits of AI in learning languages, particularly in terms of motivation, feedback, and a more enjoyable learning process. They do, however, admit drawbacks including the lack of human interaction and technical challenges. Despite being an effective tool for improving learning, artificial intelligence is not thought to be an ideal replacement for conventional teaching techniques. Rather, it works better as a supplement that, when properly applied, can help students become more proficient in English, especially in listening and grammar. This illustrates how crucial it is to carefully integrate AI and ensuring that students receive adequate support and training to maximize its potential.

Furthermore, based on the interviews with 40 students at MTsN 4 North Aceh, AI is widely seen as a valuable tool in learning English. Many students enjoy how AI-based tools such as language apps and chatbots make learning interactive, engaging, and accessible. They feel that AI brings a level of excitement to their study routines, as it allows them to explore language concepts independently while still having the guidance of an automated system. For many, the AI functions like a personal tutor, always available to help with practice and immediate feedback.

In general, the students have had good experiences with AI tools. They value elements seen in many AI apps, such as grammar quizzes, pronunciation drills, and vocabulary games. Most students are particularly impressed with the real-time feedback, which enables them to identify and correct errors immediately rather than waiting for teacher approval. They think that what AI provides for learning at their own pace is a significant benefit, especially when it comes to enhancing speaking and listening abilities as they can emulate the pronunciation of native speakers.



However, students faced several difficulties when utilizing AI tools. Certain individuals still struggle with limited access to gadgets or dependable internet connections, which makes it more difficult to fully benefit from AI. Furthermore, some students complained that the explanations they received were too complicated or that AI algorithms could not comprehend their questions. Although scientists typically believe that these issues are minor in comparison to the overall utility of AI, they can disrupt the learning process.

Students believe that while AI is a useful addition to classroom instruction, it cannot completely replace it when compared to traditional teaching techniques. They appreciate the individualized explanations and emotional support that teachers provide, which AI cannot provide. Yet, a lot of people are inspired by AI's modified and interactive aspects, and they suggest incorporating AI more into regular classroom instruction. In order to help students advance their skills in English, they also recommend to enhance AI's capacity to offer clearer explanations and more authentic conversation practice.

Students generally have a positive perception of AI as a valuable tool for learning English, recognizing its benefits in providing flexible practice opportunities, interactive learning experiences, and real-time feedback. The survey shows that a majority of students appreciate how AI enhances their understanding of English, increases their motivation, and makes the learning process more enjoyable, particularly in grammar, listening, and speaking skills. However, AI still faces challenges, such as technical issues, limited access, and its inability to replicate human interaction, which some students find essential for emotional support and personalized explanations. While AI is seen as a beneficial supplement to traditional teaching methods, students believe it cannot fully replace human instructors. Instead, they suggest a balanced approach, integrating AI tools into classroom instruction while improving its ability to provide clearer explanations and authentic language practice, ensuring that both AI and human teachers work together to maximize students' learning outcomes.

## **6. CONCLUSION**

The integration of AI to students at MTsN 4 North Aceh have responded in the majority of positive ways to the use of AI into English language learning. They like the adaptability, interaction, and immediate feedback that AI-based resources provide. AI is an interesting alternate to students' study routines since it lets them practice vocabulary, grammar, and pronunciation whenever it's convenient for them. Particularly in speaking and listening tasks where students can imitate native speakers, AI offer prompt corrections and detailed instructions improves their comprehension of English learning.

However, Students do identify some of the drawbacks of employing AI, such as technical issues like restricted device access or internet availability and the occasionally confusing explanations produced by AI. As compared to human teachers, a few students complained that AI did not always comprehend their inquiries or offer relevant responses. For AI to be as effective in the classroom as possible, these problems show how crucial it is to remove training and technological obstacles.

Broadly, artificial intelligence (AI) is not regarded as a complete substitute for human teachers, yet it is seen as a useful addition to conventional teaching techniques. The emotional support, personalized explanations, and personal interactions that a human educator offers is still appreciated by students. Therefore, while teachers continue to play a vital role in offering individualized advice and boosting student confidence, AI functions best as an extra resource that enriches the learning experience, particularly in categories like grammar, listening, and motivation.

## **LIMITATION**

The study has certain inescapable constraints within its scope, although my best efforts to evaluate the data analysis. Due to schedule restrictions, it was not feasible to interview every student attending in MTsN 4 North Aceh. Only the 8th grade of students under my direct instruction were selected to take part in the research. Furthermore, even though there are many uses for AI technology, this study primarily concentrated on three tools that used in the classes: Chat GPT, Google Translate, and Chatbots. The researcher tried to involve every student in the class in completing the questionnaires in order to partially make up for the relatively small amount participants. To get a variety of perspectives from the students, the researcher also thoroughly analyzed the interviewers' answers.

## REFERENCES

- Al-Abbas, H. U. A.-I., Halim, H. H., & Nurjati, N. N. (2023). Harnessing the use of artificial intelligence in language assessment: A systematic comprehensive review. *Tell-Us Journal*, 9(3), 723–745. <https://doi.org/10.22202/tus.2023.v9i3.7366>
- Alhalangy, A. G. I., & AbdAlgane, M. (2023). Exploring the impact of AI on the EFL context: A case study of Saudi universities. *Journal of Intercultural Communication*, 23(2), 41–49. <https://doi.org/10.36923/jicc.v23i2.125>
- Bailey, D., Southam, A., & Costley, J. (2021). Digital storytelling with chatbots: Mapping L2 participation and perception patterns. *Interactive Technology and Smart Education*, 18(1), 85-103. <https://doi.org/10.1108/ITSE-08-2020-0170>
- Bailin, A. (1987). Artificial intelligence and computer-assisted language instruction: A perspective. *CALICO Journal*, 5(3), 25–45. <https://doi.org/10.1558/cj.v5i3.2545>
- Dhanan, A., & Mahendro, I. (2023). Efektivitas penggunaan teknologi AI dalam pembelajaran bahasa Inggris. *Sinar Dunia: Jurnal Riset Sosial Humaniora dan Ilmu Pendidikan*, 2(2).
- El Shazly, R. (2021). Effects of artificial intelligence on English speaking anxiety and speaking performance: A case study. *Expert Systems*, 38(3), e12667. <https://doi.org/10.1111/exsy.12667>
- Gabriel, F., Marrone, R., Van Sebille, Y., Kovanovic, V., & de Laat, M. (2022). Digital education strategies around the world: Practices and policies. *Irish Educational Studies*, 41(1), 85–106.
- Gallacher, A., Thompson, A., & Howarth, M. (2018). “My robot is an idiot!” – Students’ perceptions of AI in the L2 classroom. In P. Taalas, J. Jalkanen, L. Bradley, & S. Thoušny (Eds.), *Future-proof CALL: Language learning as exploration and encounters – short papers from EUROCALL 2018* (pp. 70-76). Research-publishing.net. <https://doi.org/10.14705/rpnet.2018.26.815>
- Haseski, H. I. (2019). What do Turkish pre-service teachers think about artificial intelligence? *International Journal of Computer Science Education in Schools*, 3(2), 3–23.
- Holland, V. M., Maisano, R., Alderks, C., & Martin, J. (1993). Parsers in tutors: What are they good for? *CALICO Journal*, 11(1), 28–46. <https://doi.org/10.1558/cj.v11i1.28-46>
- Kurshan, B. (2016). The future of artificial intelligence in education. *Forbes*. <https://www.forbes.com/sites/barbarakurshan/2016/03/10/the-future-of-artificial-intelligence-in-education/#35b8ffc42e4d>
- Last, R. (1989). *Artificial intelligence techniques in language learning*. Ellis Horwood.
- Li, J., & Liang, J. (2019). AI-based platforms for personalized language learning. *Journal of Language Education and Technology*, 46(3), 215-231.
- Lu, X. (2018). Natural language processing and intelligent computer-assisted language learning (ICALL). In *The TESOL encyclopedia of English language teaching* (pp. 1–6). <https://doi.org/10.1002/9781118784235.eelt0422>

- Marrone, R., Taddeo, V., & Hill, G. (2022). Creativity and artificial intelligence—a student perspective. *Journal of Intelligence*, 10(3), 65.
- Mouliswaran, N., & Kumar, P. (2023). Investigating EFL learners' perception and problems towards artificial intelligence (AI). *World Journal of English Language*, 13(5), 290-298. <https://doi.org/10.5430/wjel.v13n5p290>
- Nagata, N. (1996). Computer vs. workbook instruction in second language acquisition. *CALICO Journal*, 14(1), 53-75.
- O'Brien, P. (1993). eL: AI in CALL. In M. Yazdani (Ed.), *Multilingual multimedia: Bridging the language barrier with intelligent systems* (pp. 85–139). Intellect.
- Pace-Sigge, M., & Sumakul, D. T. (2021). What teaching an algorithm teaches when teaching students how to write academic texts. *Manuscript submitted for publication*.
- Pokrivcakova, S. (2019). Preparing teachers for the application of AI-powered technologies in foreign language education. *Journal of Language and Cultural Education*, 7(3), 135–153.
- Rieland, R. (2017). Is artificial intelligence the key to personalized education? *Smithsonian Magazine*. <https://www.smithsonianmag.com/innovation/artificial-intelligence-key-personalized-education-180963172/>
- Sekeroglu, B., Dimililer, K., & Tuncal, K. (2019). Student performance prediction and classification using machine learning algorithms. In *Proceedings of the 2019 8th International Conference on Educational and Information Technology* (pp. 7–11).
- Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The impact of artificial intelligence on learner–instructor interaction in online learning. *International Journal of Educational Technology in Higher Education*, 18(1).
- Sugiyono. (2016). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.
- Sumakul, D. T., Hamied, F. A., & Sukyadi, D. (2022). Students' perceptions of the use of AI in a writing class. In W. Strielkowski (Ed.), *Advances in Social Sciences, Education and Humanities Research* (Vol. 624, pp. 103-144). Atlantis Press. <https://doi.org/10.2991/assehr.k.220201.009>
- Tafazoli, D., María, E. G., & Abril, C. A. H. (2019). Intelligent language tutoring system: Integrating intelligent computer-assisted language learning into language education. *International Journal of Information and Communication Technology Education*, 15(3), 60-74. <https://doi.org/10.4018/IJICTE.2019070105>
- Tri, N. M., Hoang, P. D., & Dung, N. T. (2021). Impact of the industrial revolution 4.0 on higher education in Vietnam: Challenges and opportunities. *Linguistics and Culture Review*, 5(S3), 1–15.
- Utami, S. P. T., Andayani, Winarni, R., & Sumarwati. (2023). Utilization of artificial intelligence technology in an academic writing class: How do Indonesian students perceive? *Contemporary Educational Technology*, 15(4), ep450. <https://doi.org/10.30935/cedtech/13419>

- Woolf, B. P., Chad, L. H., 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>
- 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(1), 16-39. <https://doi.org/10.1186/s41239-019-0171-0>
- Zhang, C., & Lu, Y. (2021). Study on artificial intelligence: The state of the art and future prospects. *Journal of Industrial Information Integration*, 23, 100224.