International Journal of Engineering, Science and Information Technology
Volume 5, No. 4 (2025) pp. 498-505
eISSN: 2775-2674
Website: http://ijesty.org/index.php/ijesty
DOI: https://doi.org/10.52088/ijesty.v5i4.1515
Research Paper, Short Communication, Review, Technical Paper

Integration of Artificial Intelligence in Academic Research: To What Extent Do Students' Knowledge, Understanding, and Use Depend on Technology?

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The manuscript was received on 1 March 2025, revised on 10 July 2025, and accepted on 25 October 2025, date of publication 14 November 2025

Abstract

The development of artificial intelligence (AI) technology has had a significant impact on higher education. This study aims to assess the level of knowledge, understanding, and use of AI among students in the context of final project preparation. This study uses a quantitative descriptive approach to measure three main dimensions—knowledge, understanding, and practical use (application) in the context of academic research. The population in this study consisted of 172 students from the Faculty of Engineering, Universitas Negeri Jakarta, who were conducting academic research. The sampling technique employed was non-probability sampling, utilizing a purposive sampling approach. Data analysis used exploratory factor analysis (EFA). The results showed that students have excellent knowledge of AI. Meanwhile, the understanding of AI shows varying levels, with the majority falling into the sufficient and low categories, indicating a need to improve AI literacy. The use of AI by students is primarily focused on aspects of writing, research, and document creation, with a reasonably consistent usage pattern and an average duration of 1-2 hours per session. These findings confirm that students actively utilize various AI in the academic process, but still require training and supervision to ensure that AI use can be carried out ethically and responsibly. The results of this study are important as a basis for developing institutional policies and ethical regulations related to the integration of AI into academic processes, as well as a reference for designing effective training programs to improve students' competency in optimally utilizing AI technology.

Keywords: *Artificial Intelligence, Knowledge, Understanding, Usage, Final Project.*

1. Introduction

Advances in artificial intelligence (AI) have had a significant impact across various sectors, including higher education. The popularity and accessibility of AI continue to grow, enabling tools that support a wide range of user needs. It has been projected that by 2024, the number of visits to AI platforms will increase consistently [1]. In educational contexts, AI has reshaped perspectives on teaching, learning, and information access, and it has been shown to support students' academic success.

In the higher education environment, AI is utilised to automate processes such as providing feedback, selecting suitable instructional materials, and making curriculum adjustments tailored to student needs [2]. Emphasise the importance of AI in facilitating personalised learning systems that enable educators to design learning plans tailored to each student's characteristics and needs [3][4]. Moreover, AI can create more immersive learning experiences [5][6], track students' learning progress intelligently, and employ big data and machine learning for learning diagnostics and targeted interventions [5][7][8]. Examples of AI platforms cited in this study include (but are not limited to): Scite AI, HIX Translate, ChatDOC, Explain Paper, Humata AI, Elicit.org, Consensus AI, Spinbot, ChatPDF, Quillbot, ChatGPT, Claude, Connected Papers, DeepL, Bing Translator, Perplexity AI, Grammarly, ProWritingAid, Gemini, Bing Chat, Aizzy AI, Papago, Any Summary, SciSpace, Writeful AI, Research Rabbit, Paperpal, Google Translate, Semantic Scholar, and OpenRead. Each AI tool offers distinct strengths; consequently, students often combine several AI tools to complete a single academic task.

In Indonesian higher education, a mandatory graduation requirement for many students is the completion of a final project in the form of research. This project demonstrates critical thinking, disciplinary knowledge, and academic integrity. However, many students experience delays in final project completion due to factors such as time management limitations, insufficient ability to locate relevant literature, and uncertainty about the structure of scientific writing [9][10]. AI technologies present new opportunities to support students in completing final projects more effectively and efficiently. At the same time, the widespread use of AI in final project writing has generated debate among academics [11]. Unregulated reliance on AI can increase the risk of plagiarism and raise ethical concerns. The use of AI may contravene ethical guidelines and compromise originality [12]. Adetoun A. Oyelude [13] note the growing intersection between

academics and AI, where researchers increasingly adopt AI tools while voicing valid concerns about emerging risks. As AI has become a powerful research aid, this study aims to investigate the extent to which students integrate AI technology in terms of knowledge, understanding, and usage during the final project compilation process.

Several previous studies have highlighted the benefits of AI in education, particularly in enhancing learning outcomes, supporting personalised learning, and alleviating student learning anxiety [14][15][16]. These studies primarily focused on the technical effectiveness of AI, student engagement, and the application of AI in K–12 or general education scenarios. However, a significant gap remains unexplored: the research gap concerning how students utilise AI specifically within the context of final project completion at Indonesian universities. Existing studies tend to emphasise classroom learning, rather than formal academic tasks that require high integrity, such as final projects. Holistic investigations that measure students' knowledge, understanding, and intensity of AI use during academic research, particularly from ethical, autonomy, and plagiarism-risk perspectives, remain limited.

Furthermore, although it is acknowledged that AI has potential to help students overcome barriers such as limited literature, confusion in writing structure, and time management, there is not yet a systematic framework or evaluative instrument that comprehensively measures the extent of students' dependence on AI in compiling final projects, both in terms of functional knowledge, critical understanding, and actual usage practice. Based on this, one unique contribution of this study is to present an empirical foundation that can be used to formulate institutional policies or ethical regulations for the use of AI in final projects. These findings are highly relevant to addressing concerns about plagiarism, breaches of academic ethics, and scientific integrity, particularly in an era when AI technology is becoming increasingly accessible and widely utilised.

2. Literature Review

Previous literature confirms the presence of AI in academic activities and highlights significant trends in AI knowledge, understanding, and usage in learning contexts. Regarding knowledge, the theoretical understanding of AI integration in education has expanded rapidly, with self-regulated learning theory emerging as a prominent analytical framework (28.57%) in analysing AI effectiveness [17]. Report that chatbots are the most frequently used AI tools (50%) for self-regulated learning, followed by adaptive assessment systems (35.71%) [17].

From the perspective of understanding, a meta-analysis of 31 empirical studies suggests that AI-based personalised learning has statistically significant positive effects on student learning outcomes. However, its effectiveness varies by subject matter and student characteristics [16]. Dai et al. [18] similarly proved significant improvements in academic performance attributable to AI-based learning analytics. A study of 211 teachers shows a strong positive relationship between trust in AI and AI knowledge, with digital competencies predicting teachers' trust levels [19]. Systematic reviews of K–12 AI education have revealed a marked increase in evaluation research since 2017, although methodological diversity remains high [20].

In practical usage, AI implementation in education still faces substantial challenges related to infrastructure, resources, and institutional readiness [21]. A qualitative study on faculty perspectives toward generative AI reveals cautious optimism, accompanied by urgent needs for comprehensive training and concerns about academic integrity [22]. AI literacy frameworks for K–12 learners identify four core dimensions and emphasise the importance of scaffolding due to varying levels of understanding across age groups in the learning process [23].

Numerous studies have reported significant improvements in academic achievement through the use of AI assistance [24][25]. AI significantly enhances learning outcomes and student well-being [15], thereby maximising students' learning capacities and achievements [26]. One reason behind high motivation and achievement may be the promotion and enhancement of personalised learning experiences [27]. The use of ChatGPT as an AI tool offers several benefits, including increased student engagement, collaboration, and accessibility [28]. ChatGPT can be utilised to encourage distance learning. Distance learning is highly beneficial for students who are unable to attend class due to physical or mental health issues [29]. AI use also provides students with 21st-century skills, including critical thinking and creativity, thereby facilitating assessment of complex skills [30] and encouraging deep thinking through AI [14]. These findings suggest that AI has the potential to play a significant role in supporting students with learning difficulties and helping them reach their full potential. For the affective domain, AI use can help build confidence in learning outcomes [31]. AI can also enable students to learn in an engaging and comfortable environment [32], which increases self-confidence and reduces learning anxiety [19]. Interactions with AI or robots can help lower-performing students feel more competent and less embarrassed [14]. Crompton et al. [33] found that AI-based educational interventions effectively reduced anxiety among secondary school students. Taken together, these findings suggest that AI has the potential to alleviate learning anxiety and help students develop the skills and confidence necessary to succeed academically.

3. Methods

This study employed a quantitative descriptive approach to measure three primary dimensions —knowledge, understanding, and usage of AI —in the context of academic research. This method was chosen to obtain empirical descriptions based on numerical data collected directly from respondents. Data were collected through a closed-ended questionnaire distributed to students. The study population comprised all students at the Faculty of Engineering, Universitas Negeri Jakarta (UNJ), who were currently conducting academic research (N = 172). This population was chosen because these students were in the final stage of their studies and, therefore, likely to adopt AI tools during the completion of their final projects. The sampling technique employed was non-probability sampling, utilising a purposive sampling approach. Data analysis used Exploratory Factor Analysis (EFA) using the Principal Component Analysis method with varimax rotation. Data adequacy was evaluated using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. Factor extraction criteria included an eigenvalue greater than 1.0 (Kaiser criterion) and scree plot analysis. Instrument reliability was tested using Cronbach's Alpha coefficient.

4. Results and Discussion

4.1. AI Knowledge Variable

The AI knowledge variable showed very satisfactory results with a KMO value of 0.875, which is classified as "meritorious" according to Kaiser [34]. Bartlett's Test produced $\chi^2 = 2547.882$ ($df = 435$, $p < 0.001$), confirming significant correlations among items. Exploratory Factor Analysis (EFA) on the AI knowledge variable showed excellent psychometric characteristics. KMO of 0.875 indicates perfect

sample adequacy (excellent), far exceeding the minimum criterion of 0.5 and even exceeding the "good" criterion (0.8) according to Kaiser [34]. The results indicate that the intercorrelations among the AI knowledge items are very adequate for factor analysis, suggesting that the AI knowledge construct has a coherent internal structure.

Table 1. Kaise-Meyer-Olkin (KMO) & Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.875
Bartlett's Test of Sphericity	Approx. Chi-Square	2547.882
	df	435
	Sig.	0.000

Analysis identified seven main factors with eigenvalues greater than 1.0, which collectively explained 63.73% of the total variance. The first factor provided the most significant contribution (33.43%), indicating the presence of a dominant dimension in the AI knowledge construct. The scree plot confirmed a seven-factor structure with a clear "elbow" point at the seventh component. The communalities analysis showed that most items had extraction values greater than 0.5, with the best item reaching 0.760 (B18). Only two items (B26 = 0.469; B29 = 0.504) fell within the marginal range. The rotated component matrix indicated strong factor loadings, with the highest values at B22 (0.798) and B18 (0.790). The instrument's reliability was very high with a Cronbach's Alpha = 0.913, which is considered "excellent" by Nunnally's [35] standards. These results indicate perfect internal consistency across the 30 measurement items.

Table 2. Reliability Test

Cronbach's Alpha	N of Items
0.913	30

The Cronbach's Alpha coefficient of 0.913 for the AI knowledge variable indicates excellent internal consistency. This value not only exceeds the minimum criterion of 0.7 but also falls into the "excellent" category ($\alpha > 0.9$) according to Nunnally [35]. This high level of reliability indicates that the 30 AI knowledge items are highly interrelated and consistently measure the same construct. The high reliability of AI knowledge can be explained through several theoretical perspectives. First, declarative knowledge about AI tends to be factual and objective, thus having clear right-false answers that reduce measurement error. Second, the AI knowledge acquired by students through formal education tends to be homogeneous in content and structure, creating a consistent knowledge base among respondents.

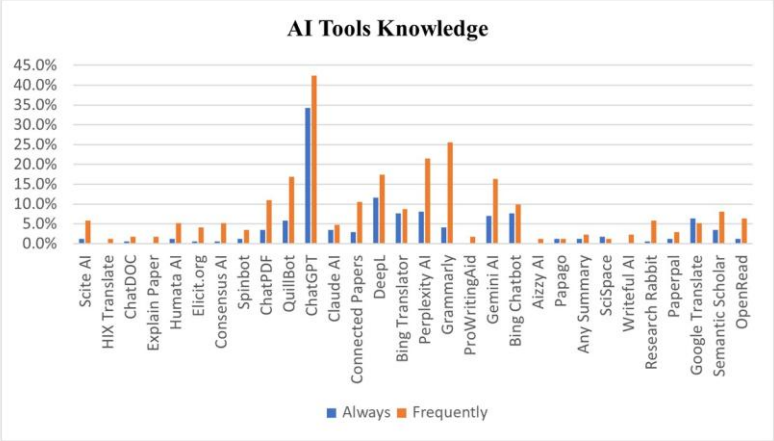

Fig 1. AI Tools Knowledge

Figure 1 shows that ChatGPT has the highest level of AI knowledge, with 34.3% of students always using it and 42.4% using it frequently. This data indicates that the majority of students (76.7%) actively utilise ChatGPT as a tool to assist with their final projects. The reason may be due to ChatGPT's popularity, ease of use, and usability, which allows students to obtain information quickly within seconds. This condition indicates a tendency for students to prefer using generative and versatile AI tools like ChatGPT, which can be utilised for various academic purposes, ranging from writing to data analysis.

4.2. AI Understanding Variable

The AI understanding variable showed a KMO value of 0.658 ("mediocre"), which still met the minimum criteria for factor analysis. Bartlett's Test produced $\chi^2 = 924.441$ ($df = 435$, $p < 0.001$), indicating a significant correlation between items.

Table 3. Kaise-Meyer-Olkin (KMO) & Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.658
Bartlett's Test of Sphericity	Approx. Chi-Square	924.441
	df	435
	Sig.	0.000

The AI understanding variable exhibits moderate but acceptable psychometric characteristics. The KMO value of 0.658 is classified as "moderate" but still exceeds the minimum threshold, indicating that the sample size is sufficient for factor analysis, although not optimal. Bartlett's chi-square test of 924.441 ($df = 435$, $p < 0.001$) remains significant, confirming the presence of sufficient correlation for factor extraction. The identification of ten factors with eigenvalues greater than 1.0, explaining 57.33% of the cumulative variance, suggests a more complex and distributed structure than AI knowledge. The relatively even distribution of variance among factors (the first factor accounts for only 14.48%) indicates that AI understanding is multifaceted, without the dominance of one particular dimension. This phenomenon reflects that a deep understanding of AI involves various relatively independent cognitive processes.

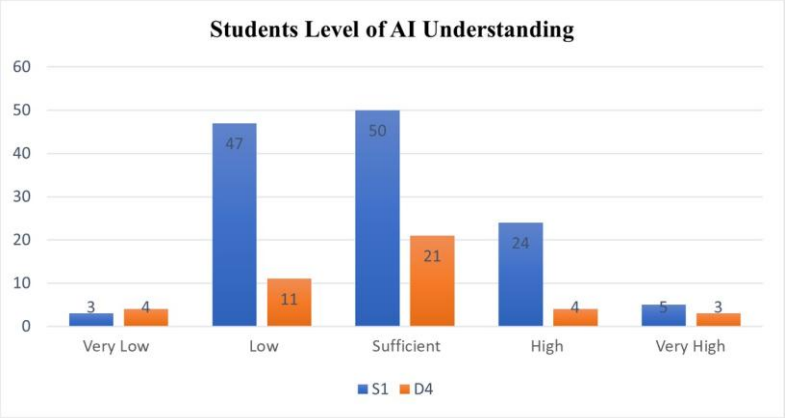

Fig 2. Student Level of AI Understanding

Figure 2 shows the distribution of students' understanding of AI. The majority of students, 71 respondents, fell into the "Sufficient" understanding category. Meanwhile, 58 respondents fell into the "Low" understanding category. Twenty-eight students demonstrated a "High" understanding, indicating the positive potential for AI adaptation in academic settings. Furthermore, eight students achieved a "Very High" understanding, indicating that a small proportion of respondents already have a deep understanding of AI. However, seven respondents fell into the "Very Low" category in terms of understanding AI as a tool for writing final projects. These results indicate that most students still have a limited understanding of the in-depth functions of the various AI tools available. The limitation could be due to a lack of experience in using AI. Students unfamiliar with this technology may struggle to understand its usefulness.

Table 4. Reliability Test

Cronbach's Alpha	N of Items
0.773	30

The Cronbach's Alpha coefficient of 0.773 for AI understanding indicates acceptable reliability for social research. While lower than for AI knowledge, this value still exceeds the minimum threshold and can be considered adequate for exploratory research. AI understanding, as a high-level cognitive process, involves the integration, application, and synthesis of knowledge across diverse contexts. The process naturally creates greater variability in responses because understanding is more subjective and context-dependent than factual knowledge. This variability, while reducing internal consistency, actually reflects fundamental differences in the depth and breadth of AI understanding among students.

4.3. AI Usage Variable

The AI usage variable exhibits a transparent and interpretable factor structure. The KMO value of 0.615 is considered "moderate" but adequate for analysis. At the same time, Bartlett's chi-square test (47.613) ($df = 3$, $p < 0.001$) remains significant, albeit at a smaller magnitude compared to the other variables.

Table 5. Kaise-Meyer-Olkin (KMO) & Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.615
Bartlett's Test of Sphericity	Approx. Chi-Square	47.613
	df	3
	Sig.	0.000

The identification of a single dominant factor, explaining 54.32% of the variance, indicates that a single underlying dimension can represent the behavioural aspects of AI use. This result suggests that overall usage duration, usage frequency, and session duration are manifestations of a single latent construct that can be interpreted as "AI usage intensity."

The instrument's reliability was assessed using Cronbach's Alpha, which yielded a value of 0.572, considered low by conventional standards. However, this value is acceptable given the limited number of items (three items).

Table 6. Reliability Test

Cronbach's Alpha	N of Items
0.572	3

Cronbach's Alpha coefficient of 0.572 for AI use is below the conventional threshold but can be considered in the context of the specific characteristics of this variable. Several methodological and substantive factors can explain the low reliability. Methodologically, the small number of items ($n = 3$) naturally limits the maximum possible reliability, as Cronbach's Alpha is sensitive to the number of items [36]. Substantively, behavioural measures such as technology use are inherently more variable than cognitive measures because various contextual factors, including availability, need, and personal preferences, influence them.

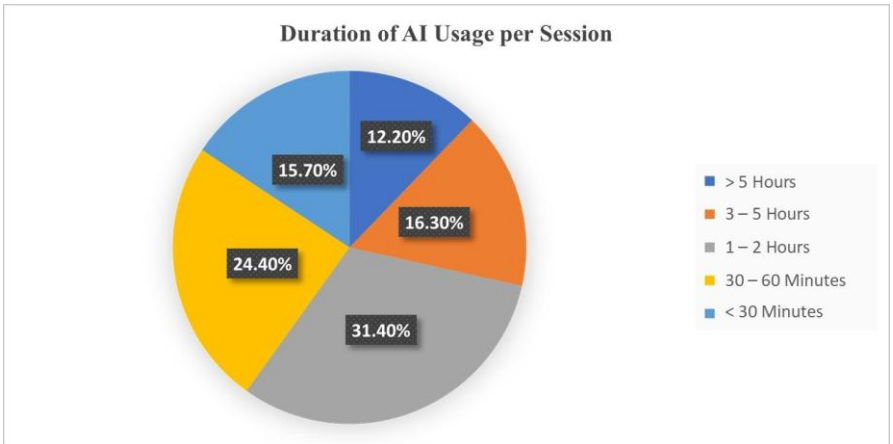

Fig 3. Duration of AI Usage per Sessions

Figure 3 illustrates the duration of AI usage per session by students, serving as a tool to assist them in completing their final projects. Research data shows that the duration of AI use per session for most students (31.40%) is 1-2 hours. 24.40% of students use AI for 30-60 minutes. 16.30% of students use AI for 3-5 hours per week. Meanwhile, 15.70% of students only use AI for less than 30 minutes. 12.20% of students are recorded as using AI for more than 5 hours in a single session. Variations in the duration of AI use suggest that students who frequently use AI also tend to use it for longer periods and in more extended sessions. This trend indicates a consistent pattern of use.

4.4. Discussion

Artificial intelligence (AI) has great potential as an academic research aid [37], including for students' final projects. Based on this study, knowledge, understanding, and usage of 30 AIs were analysed using Exploratory Factor Analysis (EFA). EFA results show that seven main factors were formed from the pattern of relationships among AIs, namely (1) writing; (2) research and analysis; (3) documents and references; (4) chatbots; (5) text summarisation; (6) paraphrase and translator; and (7) grammar checking.

The first factor is writing, which has the highest total contribution of 33.4%. The results indicate that writing is the dominant factor in students' use of AI as an aid for completing their final projects, compared to other factors. AIs such as ProWritingAid, Aizzy AI, Papago, Any Summary, SciSpace, and Writeful AI help students improve the quality of their final project writing, which ultimately facilitates the production of good final projects. Those AIs can also be personalised according to student needs in completing final projects, significantly helping students to improve writing aspects such as readability, content structure, and grammar accuracy [38].

The second factor is research and analysis, accounting for 7.3%. The results show that students tend to use AIs such as Scite AI, Explain Paper, Elicit.org, Consensus AI, and Connected Paper to search for literature and perform in-depth analysis of their final project topics. This factor highlights the importance of AI in accelerating the research process, particularly in establishing the theoretical foundation of research. HIX Translate also offers efficient translation features, supporting translation in 109 languages with various tones and contexts, thereby facilitating students' use of international literature. These findings align with Musib et al. [39], who found that AI supports researchers in defining appropriate theories for research themes by providing summaries, showing subject trends, and synthesising various references. Burger et al. [40] also found that AI can perform data analysis and literature reviews, such as Systematic Literature Reviews (SLRs). These AI capabilities certainly help students in starting and completing final projects.

The third factor is documents and references, with a 6.2% contribution. AIs such as ChatPDF help students manage documents relevant to their final project topics. Google Translate helps enrich vocabulary and facilitate direct sentence translation. Paperpal, with advanced grammar checking features, provides refinements for more structured and more precise writing. Semantic Scholar and OpenRead are designed to help students find and understand relevant research, thereby enriching references used in final project writing. Studies by Wibowo & Faridah [41] show that AI implementation in higher education focuses on improving information access and academic efficiency. Students can now access information more quickly and widely through AI. AI enables searching for journals, articles, and e-books within seconds to minutes, accelerating literature search [42]. The convenience of utilising AI can help students find references and information more quickly and accurately, allowing them to focus more on analysing and completing their final assignments.

The fourth factor is chatbots, which contribute 5.1%. ChatGPT and Gemini AI are included in this factor. Chatbots, interactive simulations, provide solutions to various questions related to final project topics, suggest ideas, and even help compose arguments. The presence of ChatGPT and Gemini AI shows how AI can be an effective discussion partner in solving academic problems. This result aligns with Rizki et al. [43] and Manu et al. [44], who state that ChatGPT has proven effective in supporting learning by providing precise and detailed explanations on various topics, answering questions, and assisting with writing and research, thereby demonstrating its popularity as one of the most prominent AIs today.

The fifth factor is text summarisation, contributing 4.3%. AIs capable of summarising text are helpful for students who want to condense scientific articles. ChatDOC and Humata AI help students grasp the essence of lengthy documents, while Spinbot provides the ability to reformulate sentences more concisely. Asril & Fathira [45] show that most students feel AI provides a better understanding because it summarises relevant information. With AI assistance in efficient summarisation, students can focus on data analysis and critical thinking rather than being trapped in searching for references [46].

The sixth factor is paraphrasing and translation, with a 3.7% contribution. AIs like Quillbot enable students to paraphrase text to avoid plagiarism. DeepL helps translate text with high accuracy, while Perplexity AI can summarise the most relevant information from various sources, such as websites and academic journals. AIs with paraphrase features provide direct suggestions to refine language and adjust sentence structure, which can directly help and educate students about effective writing techniques [47]. Furthermore, AI, with its primary advantage as a translation tool, is also beneficial for students in providing instant translations, which will undoubtedly speed up their work [48]. AI as a paraphraser and translator significantly assists students in completing their final assignments more efficiently.

The seventh factor is grammar checking, with the smallest contribution value of 3.6%. Grammarly becomes a very effective tool for students to ensure final projects are free from grammatical errors that can reduce the overall quality of writing. According to Pigola et al. [37], grammar checking that utilises AI is a valuable resource for writing academic essays because it is designed to identify mistakes that

the author may have missed. By utilising AI-assisted grammar help, students have been able to improve the quality of their writing and facilitate the writing process by scientific rules [41]. Thus, the use of AI demonstrates students' efforts to produce scientific work that is not only content-weighted but also well-composed and error-free in terms of language.

Data show that students are aware of AI and its applications, but most still have limitations in understanding the functions of the various AIs available. A lack of understanding is due to insufficient socialisation about the advantages of AI that can help students effectively complete their final projects. The primary information sources for students about AI are primarily obtained through social media, the internet, friends, books, scientific articles, technology news, and lectures. These findings are consistent with Abbas [49], who found 51.4% of respondents agreed that AI helps in completing final projects. AI use not only speeds up completion of final projects but also stimulates creativity, research independence, and critical and adaptive thinking toward technological change [41]. AI sophistication enables students to explore innovative solutions to complex problems.

Although AI significantly assists students in completing their final assignments, some students also recognise its limitations in terms of the validity of sources and the accuracy of the information provided [45]. Therefore, students must also critically evaluate the information and sources provided by AI to ensure the quality of their final assignments. Furthermore, concerns arise regarding the skills required to utilise AI effectively, as well as the potential costs associated with accessing certain features. These findings suggest that although students are familiar with and utilise AI, many still lack an understanding of how to effectively optimise its use as a tool to assist in completing final projects.

Institutional support, such as training or workshops, is necessary to enhance students' understanding of utilising AI effectively as a tool for final projects. Slimi [50] argues that providing students with an understanding and skills regarding available AI functions requires support from higher education institutions. This support can be realised by preparing academic professionals well-trained in AI, so they can guide students in understanding and effectively integrating AI. Students also must be guided on how to use AI wisely to gain maximum benefits without neglecting analytical aspects in completing final projects [51][52].

5. Conclusion

This study identified seven primary factors of AI use by students in final project completion, with writing tools representing the most dominant factors. AIs such as ProWritingAid, Aizzy AI, Papago, and SciSpace substantially contributed to improving writing quality. Other significant factors included research and analysis, document and reference management, chatbots, summarisation, paraphrasing and translation, and grammar checking. These findings indicate that AI not only helps accelerate the process of compiling final projects but also supports the improvement of content and language quality. Although students demonstrated relatively high factual knowledge of AI, many exhibited limited depth of understanding and suboptimal ability to maximise tool functionality. The primary information sources used by students come primarily from social media, the internet, friends, and lecturers, so the understanding obtained is often not systematic. Therefore, intervention from universities is needed through structured training or workshops, as well as support from competent academic personnel in the field of AI.

For future studies, researchers can adapt longitudinal studies by investigating changes in students' levels of knowledge, understanding, and usage of AI from enrollment to completion of final projects. This study can be conducted to see the development of AI literacy in students. Researchers can also conduct explanatory quantitative research to determine the relationship between AI usage and the completion time of final projects. This study can be conducted to help higher education management develop AI policies and finalise project regulations at universities.

Acknowledgement

The authors gratefully acknowledge support from the Faculty of Engineering, Universitas Negeri Jakarta and express appreciation to the students who participated as respondents and to the team members who assisted with research administration. This publication, presented at the International Conference on Innovation, Sustainability and Engineering for Global Transformation (INSEGT) 2025, held on 25 September 2025, is funded by the Indonesia Endowment Fund for Education (LPDP) on behalf of the Indonesian Ministry of Higher Education, Science and Technology, and managed under the EQUITY Program (Contract Number 4308/B3/DT.03.08/2025 and B/284/UN39/HK.07.00/2025).

References

[1] X. Chen and S. Feng, “Analyzing Students’ Information Behavior in Generative AI-Supported Small Group Discussions,” in *Proceedings of the Eleventh ACM Conference on Learning @ Scale*, New York, NY, USA: ACM, Jul. 2024, pp. 325–329. doi: 10.1145/3657604.3664657.

[2] J. A. B. Parra, Á. E. S. Escobar, and A. P. P. Martínez, “Artificial Intelligence in Education: Benefits, Challenges, and Ethical Considerations According to Scientific Evidence,” *J. Cris. Risk Commun.*, vol. 7, no. S5, pp. 48–65, 2024, doi: 10.63278/jicrcr.vi.606.

[3] J. Huang, S. Saleh, and Y. Liu, “A Review on Artificial Intelligence in Education,” *Acad. J. Interdiscip. Stud.*, vol. 10, no. 3, p. 206, May 2021, doi: 10.36941/ajis-2021-0077.

[4] G. Dishon, “New data, old tensions: Big data, personalized learning, and the challenges of progressive education,” *Theory Res. Educ.*, vol. 15, no. 3, pp. 272–289, Nov. 2017, doi: 10.1177/1477878517735233.

[5] A. J. Bingham, J. F. Pane, E. D. Steiner, and L. S. Hamilton, “Ahead of the Curve: Implementation Challenges in Personalized Learning School Models,” *Educ. Policy*, vol. 32, no. 3, pp. 454–489, May 2018, doi: 10.1177/0895904816637688.

[6] H. H. S. Ip *et al.*, “Design and Evaluate Immersive Learning Experience for Massive Open Online Courses (MOOCs),” *IEEE Trans. Learn. Technol.*, vol. 12, no. 4, pp. 503–515, Oct. 2019, doi: 10.1109/TLT.2018.2878700.

[7] G. Quer, E. D. Muse, N. Nikzad, E. J. Topol, and S. R. Steinhubl, “Augmenting diagnostic vision with AI.,” *Lancet (London, England)*, vol. 390, no. 10091, p. 221, Jul. 2017, doi: 10.1016/S0140-6736(17)31764-6.

[8] S.-H. Kong *et al.*, “Guest Editorial Introduction to the Special Issue on Intelligent Transportation Systems Empowered by AI Technologies,” *IEEE Trans. Intell. Transp. Syst.*, vol. 20, no. 10, pp. 3765–3770, Oct. 2019, doi: 10.1109/TITS.2019.2940856.

[9] H. Hariaty, V. Elita, and A. Dilaluri, “Gambaran Stres pada Mahasiswa Tingkat Akhir yang Sedang Mengerjakan Skripsi,” *J.*

Keperawatan Prof., vol. 11, no. 1, pp. 45–51, Feb. 2023, doi: 10.33650/jkp.v11i1.5539.
[10] M. Khalifa and M. Albadawy, "Using artificial intelligence in academic writing and research: An essential productivity tool," *Comput. Methods Programs Biomed. Updat.*, vol. 5, p. 100145, 2024, doi: 10.1016/j.cmpbup.2024.100145.
[11] L. Lukman, R. Agustina, and R. Aisy, "Problematika Penggunaan Artificial Intelligence (AI) untuk Pembelajaran di Kalangan Mahasiswa STIT Pemalang," *Madaniyah*, vol. 13, no. 2, pp. 242–255, 2024, doi: 10.58410/madaniyah.v13i2.826.
[12] A. Carobene, A. Padoan, F. Cabitza, G. Banfi, and M. Plebani, "Rising adoption of artificial intelligence in scientific publishing: evaluating the role, risks, and ethical implications in paper drafting and review process," *Clin. Chem. Lab. Med.*, vol. 62, no. 5, pp. 835–843, 2024, doi: 10.1515/cclm-2023-1136.
[13] Oyelude, A. A. Artificial intelligence (AI) tools for academic research. *Library Hi Tech News*, *41*(8), 18-20, 2024, https://doi.org/10.1108/LHTN-08-2024-0131
[14] T. K. F. Chiu, "The impact of Generative AI (GenAI) on practices, policies and research direction in education: a case of ChatGPT and Midjourney," *Interact. Learn. Environ.*, vol. 32, no. 10, pp. 6187–6203, Nov. 2024, doi: 10.1080/10494820.2023.2253861.
[15] R. Winkler and M. Soellner, "Unleashing the Potential of Chatbots in Education: A State-Of-The-Art Analysis," *Acad. Manag. Proc.*, vol. 2018, no. 1, p. 15903, Aug. 2018, doi: 10.5465/AMBPP.2018.15903abstract.
[16] P. Gu, "Enhancing Educational Outcomes by Boosting Artificial Intelligence Application in Personalized Learning," *Sci. Insights Educ. Front.*, vol. 24, no. 1, pp. 3831–3833, Sep. 2024, doi: 10.15354/sief.24.co346.
[17] M. Lan and X. Zhou, "A qualitative systematic review on AI empowered self-regulated learning in higher education," *npj Sci. Learn.*, vol. 10, no. 1, p. 21, May 2025, doi: 10.1038/s41539-025-00319-0.
[18] C.-P. Dai, F. Ke, Y. Pan, J. Moon, and Z. Liu, "Effects of Artificial Intelligence-Powered Virtual Agents on Learning Outcomes in Computer-Based Simulations: A Meta-Analysis," *Educ. Psychol. Rev.*, vol. 36, no. 1, p. 31, Mar. 2024, doi: 10.1007/s10648-024-09855-4.
[19] N. J. Kim and M. K. Kim, "Teacher's Perceptions of Using an Artificial Intelligence-Based Educational Tool for Scientific Writing," *Front. Educ.*, vol. 7, Mar. 2022, doi: 10.3389/feduc.2022.755914.
[20] K. Kim and K. Kwon, "A systematic review of the evaluation in K-12 artificial intelligence education from 2013 to 2022," *Interact. Learn. Environ.*, vol. 33, no. 1, pp. 103–131, Jan. 2025, doi: 10.1080/10494820.2024.2335499.
[21] N. T. Huyen, N. P. Lien, and P. T. Thuy, "Challenges of AI in Education: A Systematic Review," *IOSR J. Res. Method Educ.*, vol. 15, no. 3, pp. 37–46, 2025, doi: 10.9790/7388-1503013746.
[22] Y. Jin, L. Yan, V. Echeverria, D. Gašević, and R. Martinez-Maldonado, "Generative AI in higher education: A global perspective of institutional adoption policies and guidelines," *Comput. Educ. Artif. Intell.*, vol. 8, p. 100348, Jun. 2025, doi: 10.1016/j.caeai.2024.100348.
[23] L. Casal-Otero, A. Catala, C. Fernández-Morante, M. Taboada, B. Cebreiro, and S. Barro, "AI literacy in K-12: a systematic literature review," *Int. J. STEM Educ.*, vol. 10, no. 1, p. 29, Apr. 2023, doi: 10.1186/s40594-023-00418-7.
[24] H.-S. Kim, N. Y. Kim, and Y. Cha, "Is It Beneficial to Use AI Chatbots to Improve Learners' Speaking Performance?," *J. Asiat.*, vol. 18, no. 1, pp. 161–178, Apr. 2021, doi: 10.18823/asiatefl.2021.18.1.10.161.
[25] I. Khan, A. R. Ahmad, N. Jabeur, and M. N. Mahdi, "An artificial intelligence approach to monitor student performance and devise preventive measures," *Smart Learn. Environ.*, vol. 8, no. 1, p. 17, Dec. 2021, doi: 10.1186/s40561-021-00161-y.
[26] F. Clarizia, F. Colace, M. Lombardi, F. Pascale, and D. Santaniello, "Chatbot: An Education Support System for Student," in *Cyberspace Safety and Security*, A. Castiglione, F. Pop, M. Ficco, and F. Palmieri, Eds., Springer, 2018, pp. 291–302. doi: 10.1007/978-3-030-01689-0_23.
[27] Labadze, L., Grigolia, M., & Machaidze, L. Role of AI chatbots in education: systematic literature review. *International journal of Educational Technology in Higher education*, *20*(1), 56, 2023, https://doi.org/10.1186/s41239-024-00461-6
[28] D. R. E. Cotton, P. A. Cotton, and J. R. Shipway, "Chatting and cheating: Ensuring academic integrity in the era of ChatGPT," *Innov. Educ. Teach. Int.*, vol. 61, no. 2, pp. 228–239, Mar. 2024, doi: 10.1080/14703297.2023.2190148.
[29] P. H. Barber *et al.*, "Disparities in Remote Learning Faced by First-Generation and Underrepresented Minority Students during COVID-19: Insights and Opportunities from a Remote Research Experience," *J. Microbiol. Biol. Educ.*, vol. 22, no. 1, Apr. 2021, doi: 10.1128/jmbe.v22i1.2457.
[30] R. Luckin, "Towards artificial intelligence-based assessment systems," *Nat. Hum. Behav.*, vol. 1, no. 3, p. 0028, Mar. 2017, doi: 10.1038/s41562-016-0028.
[31] Y.-Z. Hsieh *et al.*, "ARCS-Assisted Teaching Robots Based on Anticipatory Computing and Emotional Big Data for Improving Sustainable Learning Efficiency and Motivation," *Sustainability*, vol. 12, no. 14, p. 5605, Jul. 2020, doi: 10.3390/su12145605.
[32] D. Rooein, "Data-driven EDU chatbots," in *Companion proceedings of the 2019 world wide web conference*, 2019, pp. 46–49.
[33] Hwang, G. J., & Chang, C. Y. A review of opportunities and challenges of chatbots in education. *Interactive Learning Environments*, *31*(7), 4099-4112, 2021, https://doi.org/10.1080/10494820.2021.1952615
[34] H. F. Kaiser, "An Index of Factorial Simplicity," *Psychometrika*, vol. 39, no. 1, pp. 31–36, Mar. 1974, doi: 10.1007/BF02291575.
[35] J. C. Nunnally, "An Overview of Psychological Measurement," in *Clinical Diagnosis of Mental Disorders*, Boston, MA: Springer US, 1978, pp. 97–146. doi: 10.1007/978-1-4684-2490-4_4.
[36] J. M. Cortina, "What is coefficient alpha? An examination of theory and applications.," *J. Appl. Psychol.*, vol. 78, no. 1, pp. 98–104, Feb. 1993, doi: 10.1037/0021-9010.78.1.98.
[37] A. Pigola, I. C. Scafuto, P. R. da Costa, and V. M. J. Nassif, "Artificial Intelligence in Academic Research," *Int. J. Innov.*, vol. 11, no. 3, pp. 01–09, 2023, doi: 10.5585/2023.24508.
[38] F. Al Mahmud, "Investigating EFL Students' Writing Skills Through Artificial Intelligence: Wordtune Application as a Tool," *J. Lang. Teach. Res.*, vol. 14, no. 5, pp. 1395–1404, Sep. 2023, doi: 10.17507/jltr.1405.28.
[39] M. Musib *et al.*, "Artificial intelligence in research," *Science (80-.).*, vol. 357, no. 6346, pp. 28–30, Jul. 2017, doi: 10.1126/science.357.6346.28.
[40] B. Burger, D. K. Kanbach, S. Kraus, M. Breier, and V. Corvello, "On the use of AI-based tools like ChatGPT to support management research," *Eur. J. Innov. Manag.*, vol. 26, no. 7, pp. 233–241, Dec. 2023, doi: 10.1108/EJIM-02-2023-0156.
[41] A. Wibowo and I. Faridah, "Integration of Artificial Intelligence in Completing Final Projects as a Form of Student Independence and Creativity," *J. Intelekt. J. Pendidik. dan Stud. Keislam.*, vol. 14, no. 3, pp. 449–466, Dec. 2024, doi: 10.33367/ji.v14i3.6453.
[42] K. Seo, J. Tang, I. Roll, S. Fels, and D. Yoon, "The impact of artificial intelligence on learner–instructor interaction in online learning," *Int. J. Educ. Technol. High. Educ.*, vol. 18, no. 1, p. 54, Dec. 2021, doi: 10.1186/s41239-021-00292-9.
[43] I. A. Rizki *et al.*, "Cooperative model, digital game, and augmented reality-based learning to enhance students critical thinking

skills and learning motivation," *J. Pedagog. Res.*, vol. 8, no. 1, pp. 339–355, Feb. 2024, doi: 10.33902/JPR.202423825.
[44] G. A. Manu, J. Enstein, D. Y. . Fallo, Y. A. Benufinit, M. M. B. Sogen, and K. J. Taku Neno, "Pendidikan dan Kecerdasan Buatan: Workshop Penerapan Chat GPT dan Text to Speech Prosa.ai untuk Meningkatkan Keterampilan Dosen di Nusa Tenggara Timur," *Pengabdi. Masy. Ilmu Pendidik.*, vol. 3, no. 2, pp. 16–21, 2023, doi: 10.37792/pemimpin.v3i2.986.
[45] L. Z. Asril and V. Fathira, "Utilization of Artificial Intelligence (AI) in Completing Final Project at University Level," *Lect. J. Pendidik.*, vol. 16, no. 1, pp. 254–265, Feb. 2025, doi: 10.31849/lectura.v16i1.25698.
[46] L. Chen, P. Chen, and Z. Lin, "Artificial Intelligence in Education: A Review," *IEEE Access*, vol. 8, pp. 75264–75278, 2020, doi: 10.1109/ACCESS.2020.2988510.
[47] S. D. Sulistyaningrum, "Utilizing Online Paraphrasing Tools to Overcome Students' Paraphrasing Difficulties in Literature Reviews," *J. English Lang. Stud.*, vol. 6, no. 2, p. 229, Sep. 2021, doi: 10.30870/jels.v6i2.11582.
[48] A. Puspa, D. B. Saputra, and L. Haryana, "The Use of Google Translate in EFL Essay Writing: Is It a Cheating?," *ENGLISH Fr. Acad. J. English Lang. Educ.*, vol. 7, no. 1, p. 47, May 2023, doi: 10.29240/ef.v7i1.6868.
[49] A. Abbas, "Analisis Survey Penggunaan Artificial Intelligence (AI) dalam Penulisan Tugas Akhir Karya Tulis Ilmiah (TA-KTI) di Kampus Akademi Ilmu Komputer (AIKOM) Ternate, Maluku Utara, Indonesia," *Pros. Semin. Nas. Univ. Muhammadiyah Bone*, vol. 1, no. 1, pp. 93–96, 2023, doi: https://doi.org/10.56983/prosidingkemahasiswaan.v1i1.1461.
[50] Z. Slimi, "The Impact of Artificial Intelligence on Higher Education: An Empirical Study," *Eur. J. Educ. Sci.*, vol. 10, no. 1, Mar. 2023, doi: 10.19044/ejes.v10no1a17.
[51] S. Zulfikasari, B. Sulistio, and W. Aprilianasari, "Utilization of Chat GPT Artificial Intelligence (AI) in Student's Learning Experience Gen-Z Class," *Lect. J. Pendidik.*, vol. 15, no. 1, pp. 259–272, Feb. 2024, doi: 10.31849/lectura.v15i1.18840.
[52] R. Marrone, V. Taddeo, and G. Hill, "Creativity and Artificial Intelligence—A Student Perspective," *J. Intell.*, vol. 10, no. 3, p. 65, Sep. 2022, doi: 10.3390/jintelligence10030065.