An Analysis of the Impact of ChatGPT Usage on University Student's Creativity and Critical Thinking in the AI Era

Andri Sahata Sitanggang[1*], Novrini Hasti[1], Wahyuni Wahyuni[1], Ayu Pratiwi Ulfah[1], R Fenny Syafariani[1], Nizar Rabbi Radliya[1], Imelda Pangaribuan[2], Febilita Wulan Sari[3]

[1] Faculty of Engineering and Computer Science, Universitas Komputer Indonesia, Bandung, Indonesia
[2] Informatics Management, Universitas Komputer Indonesia, Bandung, Indonesia
[3] Legal Studies, Universitas Komputer Indonesia, Bandung, Indonesia
*andri.sahata@email.unikom.ac.id

Abstract. This study investigates the influence of ChatGPT usage on Indonesian undergraduate students' creativity, critical thinking, and learning dependency within the broader discourse of artificial intelligence in higher education. Employing a quantitative cross-sectional survey design, data were collected from 41 respondents through purposive sampling. The instrument, validated by expert review and tested for internal consistency (KR-20), measured six key constructs: frequency of use, direct application of outputs, ease of use, information relevance, impact on creativity, and potential dependency. Results indicate that 56.1% of students frequently used ChatGPT, and 80.5% acknowledged its assistance in completing assignments and perceived its outputs as relevant. However, 61.0% reported diminished creativity, while 80.5% admitted developing dependency, suggesting risks to originality and self-regulation. Statistical checks confirmed proportional distributions with 95% confidence intervals, highlighting both benefits and drawbacks. The findings underscore the dual role of ChatGPT as a facilitator of academic efficiency and a potential inhibitor of independent reasoning. Consequently, integration into curricula should emphasize higher-order thinking skills, verification routines, and AI literacy to ensure balanced outcomes. Limitations include the small purposive sample and cross-sectional design, with future research recommended to adopt longitudinal or experimental approaches across larger and more diverse cohorts.

Keywords: ChatGPT, Artificial Intelligence, Creativity, Critical Thinking, Higher Education.

1 Introduction

Large language models such as ChatGPT are reshaping higher education, offering benefits for feedback, practice, and personalization while demanding thoughtful pedagogy and governance to balance opportunities and risks [1]. Institutions are being urged to

L. Warlina and S. Luckyardi (eds.), *Proceedings of the 8th International Conference on Informatics, Engineering, Science & Technology (INCITEST 2025)*, Advances in Engineering Research 287,
https://doi.org/10.2991/978-94-6463-924-7_17

specify AI literacy competencies so students can engage critically with algorithmic systems rather than outsource understanding [2]. Recent frameworks distinguish literacy from competency and recommend explicit instruction and assessment across both dimensions in teacher and student populations [3]. Reviews in higher education track rapid growth in generative AI research and emphasize responsible integration tied to learning outcomes and assessment practices [4].

Evidence on learning outcomes is mixed and context dependent, which motivates studies with transparent constructs, instruments, and samples [5]. Meta analytic syntheses report overall improvements in academic performance and higher order thinking under guided use, alongside reductions in mental effort that may change how students allocate cognitive resources [5]. Experimental work shows that structured assistance can raise performance on complex creative problem solving in university students, suggesting benefits when task design and scaffolding are explicit [6]. At the same time, studies on creativity indicate heterogeneous effects that range from positive to neutral to dampened originality depending on instructions and evaluation rubrics [7].

Concerns about overreliance are grounded in contemporary cognitive research on transactive memory and cognitive offloading, where people shift storage and retrieval to external resources in ways that can alter what is learned and retained during study [8]. Effects of ever-present devices on cognition appear heterogeneous, with some experiments reporting lower cognitive performance when smartphones are present and others finding little to no effect in typical work contexts [9] [10]. Beyond memory and attention, domain reviews of AI supported decision environments warn about automation bias, where users over trust suggestions and reduce verification, underscoring the need for metacognitive checks and explicit verification routines in educational settings [11].

Against this backdrop, evidence from Indonesian undergraduates remains limited relative to international syntheses, reinforcing calls for contextual studies that align measurement with curricular goals and competency frameworks [3]. The present study responds by focusing on four outcomes central to university learning and academic self-regulation, namely motivation, critical thinking, creativity, and dependence, in the context of everyday use of ChatGPT among Indonesian undergraduates. We adopt a cross-sectional survey with purposive sampling and a dichotomous instrument that captures behaviors and perceptions related to those constructs, followed by descriptive analysis with planned checks for simple associations where appropriate. Positioning the results alongside current evidence on cognitive offloading and automation bias supports balanced interpretations and actionable recommendations for curriculum design, classroom policy, and AI literacy programming in higher education.

2 Literature Review

2.1 Artificial Intelligence in Education

Artificial Intelligence (AI) has become a transformative force in education, equipped with capabilities that simulate human cognitive processes such as reasoning, problem-

solving, and decision-making [1-4]. By investigating comprehensive datasets and crafting contextually valuable outputs, AI technologies enhance the provision of tailored educational resources for educators and learners, consequently supporting vibrant and interactive learning experiences. Within higher education, AI-powered tools particularly generative language models have been acknowledged for their capacity to personalize instruction, increase student engagement, and optimize academic tasks [3, 4, 12].

2.2 ChatGPT and Its Academic Applications

ChatGPT, established by OpenAI, personifies a premier generative AI construct talented at crafting cohesive and contextually pertinent written pieces. The latest studies reveal the value of its use in crafting academic texts, supporting scholarly composition, refining concept creation, and offering customized educational tools [5, 6, 13]. Such functionalities make ChatGPT an appealing tool for students and educators seeking to improve academic efficiency and resource accessibility [5, 6, 14].

2.3 Potential Risks and Ethical Concerns

With regard to its merits, ChatGPT has instigated discomfort over educational integrity, inventive thinking, and the advancement of critical reasoning capabilities. Overreliance on AI may diminish higher-order cognitive skills, foster instant thinking patterns, and reduce independent exploration [7, 12]. A variety of investigations have brought to light possible dangers including, yet not solely restricted to, deceit, the propagation of incomplete stories, and a marked dependence on technological remedies, which can profoundly jeopardize the integrity and authenticity of educational programs [8-11, 15].

To mitigate the risks associated with ChatGPT usage, scholars advocate for embedding Higher-Order Thinking Skills (HOTS) into curricula, encouraging analytical reasoning, reflective learning, and independent inquiry [16]. In addition, promoting AI literacy can enable students to critically assess AI-generated content and employ it as a complementary resource rather than a substitute for human reasoning [2, 3, 17].

3 Method

3.1 Research Design

This study uses a quantitative cross-sectional survey to examine the relation between ChatGPT use and six primary variables in undergraduate learning. The analytical approach follows prior work on AI supported learning in higher education and aligns with the procedures used in the original manuscript [12, 18, 19, 20]. The survey captured everyday academic uses of ChatGPT within one academic term through a self-administered online questionnaire delivered via official program channels.

3.2 Participants and Setting

The target population was active undergraduate students in Indonesia who had experience using ChatGPT for study related activities. Recruitment used purposive sampling

through official study program channels during one academic term. Eligibility criteria were age at least 18 years, current enrollment, prior use of ChatGPT for academic or study purposes, and completion of the questionnaire. Exclusions were incomplete consent and duplicate submissions detected through platform logs with one response enforced per account. A total of 41 students provided complete responses and form the analytic sample. Demographic characteristics such as age, year of study, and program were collected and are summarized for context.

3.3 Sample Size Determination

The minimum sample size was estimated using the Slovin rule with a 5% margin of error which is commonly used when only a finite population size and an error tolerance are available.

$$n = \frac{N}{1+N\times e^2}, e = 0.05 \quad (1)$$

Using the available program population indicated a feasible target. The realized sample of 41 respondents meets the minimum under the stated tolerance and matches the dataset used in the Results section.

3.4 Research Instrument and Measurement

The research instrument was organized into four primary sections:

(i). Respondent Profile: capturing demographic data, including age, gender, and academic program [21].

(ii). ChatGPT Usage Patterns; covering the frequency of use, purposes for which it is applied, and the perceived intensity of dependency

(iii). A study examining the role of ChatGPT in shaping different aspects; measured through standards that focus on the availability of education, the significance of knowledge, and its consequences for innovative and logical thought processes.

(iv). Measurement Scale: the questionnaire employed a two-point Likert scale (0 = No, 1 = Yes), following the format used in previous studies [16], [17].

3.5 Research Variables

This study examined six primary variables:

(i). Frequency of ChatGPT Usage: the number of times respondents engaged with the platform for academic purposes.

(ii). Direct Use of ChatGPT-Generated Results: the extent to which respondents applied outputs from ChatGPT without modification.Perceived Ease of Use: respondents' assessment of the platform's accessibility and user-friendliness.

(iii). The importance of data lies in how accurately and appropriately the answers from ChatGPT are viewed by users.

(iv). Influence on Original Thought – the extent to which ChatGPT influences participants' ability to produce novel concepts.

(v). Potential Dependency:the tendency of respondents to rely excessively on ChatGPT in academic activities.

3.6 Questionnaire Validation

Content Validity Procedure and Indices. Content validity was assessed by a small expert panel of 3 to 5 instructors experienced in learning design and educational technology who rated the relevance of each item on a 4-point scale where 3 means quite relevant and 4 means highly relevant. Item and scale level indices were computed as follows.

(i). Item level content validity index I CVI for item i

$$\text{I\_CVI}_i = \frac{A_i}{N} \tag{2}$$

(ii). Scale level content validity S CVI Ave

$$\text{S\_CVI\_Ave} = \frac{1}{k}\sum_{i=1}^{k} \text{I\_CVI}_i \tag{3}$$

(iii). Scale level content validity S CVI UA

$$\text{S\_CVI\_UA} = \frac{\text{number of items with universal agreement}}{k} \tag{4}$$

(iv). Modified kappa for chance adjusted agreement per item

$$k^* = \frac{\text{I\_CVI}_i - P_c}{1 - P_c} \tag{5}$$

With change agreement

$$P_c = \frac{N!}{A_i!(N-A_i)!} \times 0.5^N \tag{6}$$

Decision rules are reported alongside results for transparency for example retaining items at or above common I CVI thresholds and considering k^* when content coverage is essential.

3.7 Reliability Testing

Because items are dichotomous internal consistency was estimated with the Kuder Richardson 20 coefficient at the construct level. The KR 20 formula is

$$\text{KR20} = \left(\frac{k}{k-1}\right)\left[1 - \frac{\sum_{i=1}^{k} p_i q_i}{\sigma_t^2}\right] \tag{7}$$

where k is the number of items, p_i is the proportion endorsing item I, q_i=1−p_i and σ_t^2 is the variance of total scores. As a practical convention value around 0.70 or higher are considered adequate for early-stage instruments while interpretation also considers construct breadth and item count. In addition, item difficulty p_i and discrimination through item total correlations may be inspected to inform wording refinements when needed. This reliability approach is consistent with internal consistency analyses used in related AI and education instruments and complements the design and analysis

choices reported in the manuscript and supporting literature on AI supported learning outcomes [1, 12, 22].

3.8 Data Collection and Quality Control

The questionnaire was distributed through Google Forms and official program communication channels. Before responding participants viewed an information and consent statement describing purpose voluntary participation confidentiality and research team contacts. The platform enforced one submission per account. Quality controls included one attention check and screening for straight lining zero variance patterns. Direct identifiers were not collected. Deidentified data were stored on password protected systems accessible only to the research team.

3.9 Data Processing and Analysis

Data were exported with variable and value labels preserved and processed in SPSS version 26. The analysis sequence comprised data cleaning coding of dichotomous variables and descriptive summaries of constructs using counts and percentages and where useful confidence intervals for key proportions. Proportions are accompanied by two-sided 95 percent confidence intervals using the Wilson method

$$\hat{P}\text{Wilson} = \frac{\hat{P}+z^2/(2n)}{1+z^2/n} \pm \frac{z}{1+z^2/n}\sqrt{\frac{\hat{P}(1-\hat{P})}{n}+\frac{z^2}{4n^2}}\,, z = 1.96 \quad (7)$$

Exploratory associations among selected categorical variables used chi square tests or Fisher exact tests when expected counts were small and Cramers V is reported as an effect size. Findings from these checks are interpreted cautiously given the sample size and complement the descriptive objective of the study. This analysis plan is coherent with the prior analytical framing on AI in education and with the reporting approach in the manuscript [1, 22].

4 Results and Discussion

4.1 Results

Respondent Data Description. This research engaged 41 student volunteers, each of whom fulfilled the specified inclusion requirements. Analysis of the questionnaire results revealed variations in the frequency of ChatGPT usage, levels of dependency, and perceptions regarding both the relevance of the information provided and its influence on creativity.

Descriptive Analysis Results. We report counts and proportions with exact denominators, and for interpretability add two-sided 95 percent confidence intervals for key proportions using the Wilson method (8). For a proportion $\hat{P} = x \div n$ with $n = 41$.

Frequency of ChatGPT Use. A total of 23 respondents participated in this category, (56.1%) reported frequent use of ChatGPT to support academic activities, whereas 18 respondents (43.9%) indicated infrequent use respectively [41.0; 70.1] and [29.9; 59.0] for the 95% intervals.

Direct Use of ChatGPT Outputs. More than half of the respondents (56.1%) stated that they did not directly utilize ChatGPT-generated outputs without prior verification or modification, while the remainder (43.9%) reported using them in their original form [41.0; 70.1] and [29.9; 59.0] for the 95% intervals.

Ease in Completing Assignments. The majority (80.5%) agreed that ChatGPT facilitated the completion of assignments, particularly in locating relevant references and organizing materials.

Relevance of Information. A notable 80.5% of the participants considered the output from ChatGPT to be meaningful regarding their research questions or academic domains.

Impact on Creativity. A total of 61% acknowledged that ChatGPT use had diminished their creativity, whereas 39% reported no such reduction.

Potential for Dependency. The majority (80.5%) admitted to developing a dependency on ChatGPT for completing assignments, potentially limiting their capacity for independent thinking.

Overall findings for the 41 respondents are presented, see Table 1.

Table 1. Summary of descriptive result with 95% confidence intervals.

Variable	Category	n	Percent (%)	95% CI
Frequency of ChatGPT Use	Often	23	56.1	[41.0; 80.1]
	Rarely	18	43.9	[29.9; 59.0]
Direct Use of ChatGPT Output	Yes	18	43.9	[29.9; 59.0]
	No	23	56.1	[41.0; 70.1]
Assisted by ChatGPT	Yes	33	80.5	[66.0; 89.8]
	No	8	19.5	[10.2; 34.0]
Relevant Information	Yes	33	80.5	[66.0; 89.8]
	No	8	19.5	[10.2; 34.0]
Reduced Creativity	Yes	25	61.0	[45.7; 74.3]
	No	16	39.0	[25.7; 54.3]
Induced Dependency	Yes	33	80.5	[66.0; 89.8]
	No	8	19.5	[10.2; 34.0]

Table 1 shows a clear benefit risk balance. Helpfulness and relevance reach about eighty percent, indicating high instrumental value in day-to-day study. At the same

time, more than half report reduced creativity and four in five acknowledge dependence, pointing to the need for verification routines and tasks that require independent reasoning.

4.2 Discussion

Data points to a trend where a diverse group of learners are employing ChatGPT in their scholarly work. Most respondents regarded the platform as both relevant and beneficial, a result consistent with previous research [17] indicating that generative AI technologies can improve learning efficiency and expand access to information.

Still, the striking dependency ratio at 80.5% fuels apprehension regarding a potential setback in the intellectual and inventive capacities of pupils. This finding is in line with previous studies that caution against excessive reliance on AI within educational contexts, who emphasized that the use of AI without appropriate pedagogical strategies may impede the development of higher-order cognitive skills [1].

The reported decline in creativity among 61% of respondents aligns with the findings of [12], who identified one of ChatGPT's limitations as its tendency to encourage instant thinking patterns and diminish efforts toward independent exploration [12].

Consequently, the assimilation of ChatGPT within educational environments necessitates meticulously formulated policies and strategies, which should encompass the integration of Higher-Order Thinking Skills (HOTS) within the curriculum. This approach is consistent with the recommendations of previous studies [16], which highlighted the importance of promoting AI literacy among students as a means of reducing the risks associated with technological dependency [16, 22].

5 Conclusion

In a cross-sectional survey of Indonesian undergraduates (n = 41), 23 of 41 students reported using ChatGPT often for coursework (56.1%) and 18 of 41 used it rarely (43.9%); 33 of 41 agreed the tool helped them complete assignments (80.5%) and judged its information relevant (80.5%); 18 of 41 directly used outputs without further edits (43.9%) while 23 of 41 did not (56.1%); 25 of 41 perceived reduced creativity (61.0%) and 33 of 41 acknowledged a sense of dependence (80.5%). Taken together, these figures indicate strong perceived utility alongside material risks to originality and self-regulation. We therefore conclude that ChatGPT should be positioned as a complementary aid rather than a substitute for individual reasoning, with course designs that require verification routines, critical thinking prompts, and assessment rubrics that demand justification, source triangulation, and independent synthesis. The questionnaire captured core dimensions with documented content validity and internal consistency, providing a usable baseline for teaching and policy decisions. Nonetheless, the cross-sectional design, purposive sample size of 41, and dichotomous self-report measures limit generalization. Future work should test targeted pedagogical interventions in larger and more diverse cohorts, adopt longitudinal or experimental designs, incorporate richer multi point scales and learning analytics, and examine moderators

such as task type and prior ability so that integration of generative AI preserves learning quality while leveraging practical benefits.

References

1. Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., Stadler, M., Weller, J., Kuhn, J., Kasneci, G.: ChatGPT for good? On opportunities and challenges of large language models for education. Learning and Individual Differences. **103**, 102274 (2023).
2. Long, D., Magerko, B.: What is AI Literacy? Competencies and Design Considerations. In: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems. pp. 1–16. ACM, New York, NY, USA (2020).
3. Chiu, T.K.F., Ahmad, Z., Ismailov, M., Sanusi, I.T.: What are artificial intelligence literacy and competency? A comprehensive framework to support them. Computers and Education Open. **6**, 100171 (2024).
4. Ogunleye, B., Zakariyyah, K.I., Ajao, O., Olayinka, O., Sharma, H.: A Systematic Review of Generative AI for Teaching and Learning Practice. Education Sciences. **14**, 636 (2024).
5. Deng, R., Jiang, M., Yu, X., Lu, Y., Liu, S.: Does ChatGPT enhance student learning? A systematic review and meta-analysis of experimental studies. Computers & Education. **227**, 105224 (2025).
6. Urban, M., Děchtěrenko, F., Lukavský, J., Hrabalová, V., Svacha, F., Brom, C., Urban, K.: ChatGPT improves creative problem-solving performance in university students: An experimental study. Computers & Education. **215**, 105031 (2024).
7. Toma, R.B., Yánez-Pérez, I.: Effects of ChatGPT use on undergraduate students' creativity: a threat to creative thinking? Discover Artificial Intelligence. 4, (2024).
8. Gong, C., Yang, Y.: Google effects on memory: a meta-analytical review of the media effects of intensive Internet search behavior. Frontiers in Public Health. 12, (2024).
9. Hartanto, A., Lua, V.Y.Q., Kasturiratna, K.T.A.S., Koh, P.S., Tng, G.Y.Q., Kaur, M., Quek, F.Y.X., Chia, J.L., Majeed, N.M.: The effect of mere presence of smartphone on cognitive functions: A four-level meta-analysis. Technology, Mind, and Behavior. 5, (2024).
10. Skowronek, J., Seifert, A., Lindberg, S.: The mere presence of a smartphone reduces basal attentional performance. Scientific Reports. 13, (2023).
11. Abdelwanis, M., Alarafati, H.K., Tammam, M.M.S., Simsekler, M.C.E.: Exploring the risks of automation bias in healthcare artificial intelligence applications: A Bowtie analysis. Journal of Safety Science and Resilience. **5**, 460–469 (2024).
12. Farrokhnia, M., Banihashem, S.K., Noroozi, O., Wals, A.: A SWOT analysis of ChatGPT: Implications for educational practice and research. Innovations in Education and Teaching International. **61**, 460–474 (2023).
13. Heung, Y.M.E., Chiu, T.K.F.: How ChatGPT impacts student engagement from a systematic review and meta-analysis study. Computers and Education: Artificial Intelligence. **8**, 100361 (2025).
14. Bettayeb, A.M., Abu Talib, M., Sobhe Altayasinah, A.Z., Dakalbab, F.: Exploring the impact of ChatGPT: conversational AI in education. Frontiers in Education. 9, (2024).
15. Kovari, A.: Ethical use of ChatGPT in education—Best practices to combat AI-induced plagiarism. Frontiers in Education. 9, (2025).

16. Tlili, A., Shehata, B., Adarkwah, M.A., Bozkurt, A., Hickey, D.T., Huang, R., Agyemang, B.: What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. Smart Learning Environments. 10, (2023).
17. Baidoo-Anu, D., Owusu Ansah, L.: Education in the Era of Generative Artificial Intelligence (AI): Understanding the Potential Benefits of ChatGPT in Promoting Teaching and Learning. Journal of AI. **7**, 52–62 (2023).
18. Setiawan, A., Luthfiyani, U.K.: Penggunaan ChatGPT Untuk Pendidikan di Era Education 4.0: Usulan Inovasi Meningkatkan Keterampilan Menulis. JURNAL PETISI (Pendidikan Teknologi Informasi). **4**, 49–58 (2023).
19. Sitanggang, A.S., Irwansyah, I., Nurwicaksono, M.A., Choir, M.M., Bolkiah, S.M., Novansa, Y.S.: Rancangan Sistem Penilaian Kinerja Guru (Pkg) Dalam Rangka Penyelarasan Kesejahteraan Guru Dengan Kualitas Pendidikan Yang Diberikan. Jurnal Wahana Pendidikan. **9**, 115 (2022).
20. Sitanggang, A.S., Nurazizah, R., Trinanda, A.D., F, A.I.N., Nabila, A.: Peran Teknologi Digital dalam Membangun Pendidikan Generasi Emas . Jurnal Pendidikan Tambusai. **8**, 30802–30809 (2024).
21. Sitanggang, A.S., Syafariani, R.F., Hasti, N., Sari, F.W., Pasya, D.: LAN network architecture design at Nurul Jalal Islamic Boarding School, North Jakarta. International Journal of Advances in Applied Sciences. **13**, 123 (2024).
22. Jo, H.: From concerns to benefits: a comprehensive study of ChatGPT usage in education. International Journal of Educational Technology in Higher Education. 21, (2024).