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Analysis of the Relationship between ChatGPT and Learning Outcomes and the Role of Digital Literacy in Individual Learning of Mahkota Tricom Unggul University Students

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ABSTRACT

This study aims to analyze the relationship between ChatGPT usage and learning outcomes, and to examine the role of digital literacy in the context of individual learning. The research method used a quantitative approach with a survey design. The study sample consisted of 120 students selected purposively. Data collection instruments included a Likert scale questionnaire to measure the level of ChatGPT usage and digital literacy, and learning outcomes were measured through academic grades. Data analysis was conducted using the Pearson correlation test and multiple regression analysis. This study found that ChatGPT usage has a positive and significant relationship with individual student learning outcomes. Digital literacy was shown to have a stronger influence on learning outcomes than ChatGPT use alone, while also acting as a moderating variable, strengthening the relationship. Students with high levels of digital literacy can utilize ChatGPT more effectively, critically, and ethically, resulting in optimal learning outcomes. These findings indicate that AI technologies like ChatGPT cannot stand alone as learning solutions but must be integrated with adequate digital literacy skills. Without digital literacy, the use of AI can potentially lead to misunderstandings or misuse of information.

Keywords: AI, ChatGPT, Individual Learning, Digital Literacy, Learning Outcomes

1. Introduction

Today, digitalization and technological developments, particularly artificial intelligence (AI)-based technologies, have great potential to transform the way we learn and teach. However, as is well known, there are several challenges that need to be overcome to understand the role of AI technology, digital literacy, and the concept of individualized learning in student learning outcomes (Dwivedi et al., 2023). The importance of digital literacy and adapting to AI technology cannot be underestimated. Through the use of AI-based learning tools such as ChatGPT, universities can create more immersive, interactive, and tailored learning experiences tailored to individual student needs (Dalgıç et al., 2024). This can help students develop the digital skills needed to succeed in an increasingly digitalized world (Rejeb et al., 2024). A Populix survey found that 52% of respondents in Indonesia had used AI applications (Nugroho, 2024). The following are the survey results from 2023:

Figure 1. Survey of AI Application Usage

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The digital business study program at Mahkota Tricom Unggul University represents a very positive step in facing the digitalization era. With this study program, the university has the opportunity to lead the way in implementing digitalization comprehensively, providing students with a deep understanding of digital technology in a business context (Banuari, 2023). However, the current state of Mahkota Tricom Unggul University indicates that almost all students are not yet familiar with or understand how technology works. Furthermore, there is a significant conceptual gap in the use of ChatGPT in student learning, as is the case with digital literature. The digital literature used by students does not directly contribute to student learning outcomes. Therefore, the conceptual framework for how ChatGPT is used does not significantly impact student learning outcomes.

Digital literacy is a crucial prerequisite for effective online learning. Currently, students with low levels of digital literacy are at higher risk in online environments. This suggests that students' ability to understand, evaluate, and effectively use digital technology significantly impacts their learning experience in online contexts (Chiu, 2022). Furthermore, students experience decreased motivation and learning success in online environments. Lack of skills in using digital technology can be a significant barrier to accessing information, participating in learning activities, and interacting with Digital Business lecturers and peers in online learning (Demir, 2023).

Utilizing ChatGPT in the educational process can create a more immersive and personalized learning experience, providing a strong foundation (Gupta, 2023). Students can gain a deeper understanding of how AI technology can impact learning, identify existing opportunities and challenges, and develop strategies to maximize its use to improve the quality of education in the future (Rospigliosi, 2023).

The research problem formulation in this study is to determine the relationship between ChatGPT, as an artificial intelligence technology, and student learning outcomes. Second, to examine the role of digital literacy and individual learning on student learning outcomes. The problem-solving approach in this research involves studying AI-based learning tools. ChatGPT can serve as an important tool in shaping the future of student education and also produce a more in-depth and customized learning experience, which ultimately transforms graduates into more skilled and qualified individuals. Some basic elements of ChatGPT, such as natural language processing, problem-solving, and reasoning (Campello de Souza, 2023), optimize the learning process and virtual learning process (Ng et al., 2023). The results of this study are expected to be able to answer research questions related to the relationship between ChatGPT, digital literacy, and individual learning, so that students can learn AI-based learning tools, develop digital skills, and reveal how ChatGPT can serve as an important tool in shaping the future of students at Mahkota Tricom Unggul University.

2. Literature Review

ChatGPT and Generative AI Tools in Education

Generative AI tools such as ChatGPT are now being used in learning contexts as flexible and responsive learning companions. A study at a senior high school (SMAN) showed that implementing ChatGPT as part of a Problem-Based Learning (PBL) model significantly improved students' cognitive learning outcomes: a 25% increase in cycle 1 and 77% in cycle 2 in a Classroom Action Research (CAR) conducted in March–May 2023 (Faldi, 2023). Furthermore, research on personal AI tutors for psychology students— utilizing GPT-3 to generate micro-questions (micro-learning) and applyspaced retrieval practice—resulted in a 15th percentile increase in scores compared to the control group (Baillifard, 2023). This finding is consistent with a meta-analysis on theadaptive learningwhich showed that approximately 86% of 37 studies reported a positive effect of adaptive AI on student learning outcomes. However, there are also critical caveats: for example, students who rely too heavily on generative AI like Khanmigo experience lower performance on real-world exams, highlighting the importance of instructional guidance to avoid overreliance. Overall, ChatGPT and other generative AI platforms have great potential to improve learning outcomes when integrated with appropriate pedagogical strategies and adequate academic supervision (Baillifard, 2023).

H1: The use of ChatGPT has a positive effect on students' individual learning outcomes.

Individual Learning and Adaptive Learning Systems/ITS

AI-guided individualized learning and intelligent tutoring systems(ITS) are highly effective in improving student learning outcomes. Squirrel AI—a large-scale adaptive platform—constructs the smallest concept representations (knowledge points) and tailors material to each student based on initial diagnoses, which is more effective than traditional learning in China (Chiu, 2021). A meta-analysis on ITS showed that of 50 controlled evaluations, 92% showed that students using ITS outperformed students in conventional classrooms, witheffect size (The median ES) of 0.66, representing an increase in performance from the 50th to the 75th percentile.

Reviews of AI in education also emphasize that AI can provide personalized and adaptive learning experiences tailored to students' needs (Shaalan, 2005). Broader perspectives, such as a Financial Times article, demonstrate how platforms like Khanmigo provide readily available learning support and challenge students' critical thinking, promising a personal scale previously only accessible to established institutions (Murphy, 2024). The combination of high personalization and adaptive response makes AI-

based individualized learning an effective approach in situations where human guidance is limited.

H2: Digital literacy has a positive effect on students' individual learning outcomes.

Digital Literacy

Digital literacy is a crucial skill encompassing technical mastery, the ability to assess and utilize digital information, and has been shown to significantly impact academic achievement. A recent quantitative study at the University of Jambi (2025) showed that digital literacy significantly contributes to student academic achievement (Fatkhiyah, 2025). Research at UMG Southeast Sulawesi also found that digital literacy and the ability to adapt to online learning simultaneously significantly impacted academic performance ($t = 7.38$; $t = 7.98$; $F = 90.12$; $p < 0.001$) (Juwairiyah, 2024). At the Faculty of Teacher Training and Education, Muhammadiyah University of Bengkulu, digital literacy and independent learning jointly influenced student learning outcomes ($R^2 = 0.367$), indicating that 36.7% of the variance in learning outcomes was explained by these two factors. Furthermore, digital literacy also has a positive correlation with student writing creativity—students with higher digital literacy demonstrated stronger academic creativity (Susilowati, 2024). A summary of digital literacy profiles at several universities revealed that factors such as online communication, critical thinking, digital ethics, information seeking, and electronic security were in the moderate to excellent category (Ririen, 2022). Thus, digital literacy is not just a technical skill: it is a crucial mediator that determines the extent to which students can utilize AI like ChatGPT effectively and ethically in individual learning.

H3: Digital literacy moderates the relationship between ChatGPT use and learning outcomes.

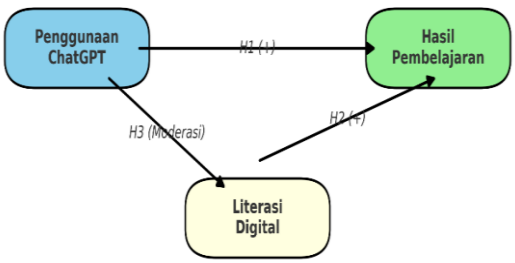

Figure 2. Conceptual Framework

3. Methodology

In an effort to find solutions to the problems faced, especially in student learning outcomes in the use of artificial intelligence (AI) and the role of digital literacy as individual learning for students at Mahkota Tricom Unggul University. Therefore, the approach to this research problem uses the SEM (Structural Equation Model) model (Rusiadi, 2014). It is expected that the results of the research model that will be built by students will provide a strong understanding of the basic concepts of AI, AI development techniques, and practical applications of AI in various fields. The population in this study was students of Mahkota Tricom Unggul University in the 2024/2025 academic year who were classified as active in college. Then the sampling technique used was accidental sampling, where 120 students were selected to be the sample of this study. Accidental sampling is a *non-probability sampling* technique in which respondents are selected based on their accessibility and availability at the time of data collection, making it suitable when researchers face time and access constraints, albeit with limitations regarding the generalizability of the findings (Nikolopoulou, 2022).

The types and sources of data used in this study are primary data, namely data obtained directly from questionnaires distributed to respondents and interviews with students of Mahkota Tricom Unggul University. Secondary data, namely, data that supports the primary data obtained from documents through documentation studies.

4. Research Result

Respondent Description

This research involves120 studentsfrom various study programs at a university in Indonesia. Fifty-sixty-seven percent of respondents were female, and 43.3% were male. The age range was 18–23 years, with the majority in their second to fourth semesters.

Table 1. Descriptive Statistics of Variables

Variable	Mean (M)	Standard Deviation	Category	Scale
ChatGPT Usage	3,45	0,71	Currently	1–5
Digital Literacy	3,89	0,65	High	1–5
Learning Outcomes (GPA/Grade)	3,54	0,31	High	0–4 / 0–100*

Assumption Test

Before conducting the hypothesis test, a normality test (Kolmogorov–Smirnov) was performed, which showed that all variables had a normal distribution ($p > 0.05$). The multicollinearity test showed a VIF value < 5 and a tolerance value > 0.10, indicating no multicollinearity problems.

Hypothesis Testing

H1: The use of ChatGPT has a positive effect on students' individual learning outcomes.

- The results of simple regression analysis show that the use of ChatGPT has a positive and significant effect on learning outcomes ($\beta = 0.312$, $t = 3.745$, $p < 0.001$).
- The coefficient of determination (R^2) = 0.097, meaning that 9.7% of the variation in learning outcomes can be explained by the use of ChatGPT.

H2: Digital literacy has a positive influence on students' individual learning outcomes.

- The results of simple regression show that digital literacy has a significant positive

influence on learning outcomes (β = 0.458, t = 5.982, p < 0.001).
- R^2 = 0.210, which means 21% of the variation in learning outcomes can be explained by digital literacy.

H3: Digital literacy moderates the relationship between ChatGPT use and learning outcomes.
- Moderation regression analysis with an interaction term approach shows that the interaction between the use of ChatGPT and digital literacy has a significant effect on learning outcomes (β = 0.167, t = 2.315, p = 0.022).
- These results indicate that the influence of ChatGPT on learning outcomes is stronger in students with high digital literacy than in those with low digital literacy.

Interpretation

The results of this study indicate that the use of ChatGPT positively contributes to individual student learning outcomes. Digital literacy has a greater influence than direct ChatGPT use, indicating that digital competence is key to the successful use of AI in learning. Furthermore, the moderating role of digital literacy indicates that students with high digital literacy can utilize ChatGPT more effectively, for example, by verifying answers, filtering information, and integrating it into self-learning processes.

5. Discussion

Hypothesis 1 (H1) examined the effect of ChatGPT use on individual student learning outcomes. The findings indicate that the use of ChatGPT has a positive and significant effect on learning outcomes, thus supporting H1. This result is consistent with previous studies reporting that the integration of Large Language Models (LLMs), such as ChatGPT, provides fast, adaptive, and contextual learning support that enhances students' understanding of learning materials and critical thinking skills (Kasneci et al., 2023). From a theoretical perspective, this finding aligns with Cognitive Load Theory (Sweller, 1994), which posits that learning effectiveness increases when extraneous cognitive load is minimized. ChatGPT functions as a form of cognitive scaffolding by offering concise, relevant explanations that help reduce extraneous load, thereby allowing students to focus on essential learning processes and schema construction (germane load). Theoretically, this study extends Cognitive Load Theory by demonstrating that AI-based conversational agents can serve as effective learning companions in self-directed digital learning contexts when used appropriately.

Hypothesis 2 (H2) tested the direct effect of digital literacy on learning outcomes. The results demonstrate that digital literacy has a stronger positive influence on learning outcomes than the use of ChatGPT alone, thereby supporting H2. This finding is consistent with the Digital Literacy Framework proposed by Eshet-Alkalai (2004), which conceptualizes digital literacy as a multidimensional construct encompassing technical, cognitive, and ethical competencies. Students with high levels of digital literacy are better equipped to critically evaluate ChatGPT-generated content, avoid academic misconduct such as plagiarism, and integrate relevant information into their independent learning processes. This finding also corroborates previous empirical evidence indicating a positive relationship between digital literacy, academic achievement, and learner autonomy in higher education settings (Pratama et al., 2024). Theoretically, these results reinforce the central role of digital literacy as a foundational competence that enables meaningful and responsible engagement with AI-based learning technologies.

Hypothesis 3 (H3) addressed the moderating role of digital literacy in the relationship between ChatGPT use and learning outcomes. The findings confirm that digital literacy significantly strengthens this relationship, indicating that students with higher digital literacy benefit more from ChatGPT use than those with lower digital literacy. This moderating effect can be explained through the lens of Mediated Learning Experience theory (Feuerstein, 1980), which emphasizes that learning outcomes are shaped by the learner's ability to interpret, process, and adapt information from mediating tools or agents. In this context, ChatGPT acts as a mediating learning resource whose effectiveness depends on the learner's digital competence. Without adequate digital literacy, reliance on ChatGPT may lead to mislearning due to inaccurate, biased, or misinterpreted information. Conversely, students with strong digital literacy can critically filter AI-generated outputs and integrate them with prior knowledge to support deeper learning. Theoretically, this finding highlights digital literacy as a key moderating mechanism that determines the pedagogical value of AI in individual learning environments.

From a practical perspective, these findings suggest that higher education institutions should not merely introduce ChatGPT as a learning tool but must simultaneously strengthen students' digital literacy through curriculum design and instructional strategies. Specifically, lecturers are encouraged to design AI-assisted learning activities that emphasize critical evaluation, synthesis, and reflection rather than simple content generation. In addition, universities should establish clear academic policies and ethical guidelines governing the use of AI in learning to ensure that ChatGPT functions as a supportive learning aid rather than a substitute for independent thinking.

Despite its contributions, this study has several limitations that should be acknowledged. First, the reliance on self-reported data may introduce subjective bias. Second, the cross-sectional research design limits the ability to draw causal inferences among the studied variables. Future research could employ longitudinal designs or experimental approaches to examine the long-term and causal effects of ChatGPT use on learning outcomes. Furthermore,

measurements of digital literacy could be expanded to include additional dimensions such as cybersecurity awareness, digital creativity, and online collaboration. Addressing these limitations may provide deeper theoretical and methodological insights into the sustainable integration of AI technologies in higher education learning systems.

Overall, the findings strengthen the evidence that the effectiveness of ChatGPT integration in individual student learning is determined not solely by the frequency or intensity of its use, but more importantly by students' levels of digital literacy. Consequently, pedagogical strategies that integrate AI technologies with systematic digital literacy development hold strong potential for fostering more effective, ethical, and sustainable learning outcomes in higher education.

6. Conclusions and Recommendations

This study found that ChatGPT usage has a positive and significant relationship with individual student learning outcomes. Digital literacy was shown to have a stronger influence on learning outcomes than ChatGPT use alone, while also acting as a moderating variable, strengthening the relationship. Students with high levels of digital literacy can utilize ChatGPT more effectively, critically, and ethically, resulting in optimal learning outcomes. These findings indicate that AI technologies like ChatGPT cannot stand alone as learning solutions but must be integrated with adequate digital literacy skills. Without digital literacy, the use of AI can potentially lead to misunderstandings or misuse of information.

Beyond confirming the positive role of ChatGPT in individual learning, this study contributes to the field of education by empirically demonstrating that digital literacy functions as a central mechanism that determines the effectiveness of AI-supported learning, rather than merely serving as a complementary skill. The novelty of this research lies in its integration of digital literacy as both a direct predictor and a moderating variable in the relationship between ChatGPT use and learning outcomes, offering a more comprehensive explanatory model of AI-enhanced learning in higher education. By conceptualizing ChatGPT as a mediated learning companion whose pedagogical value depends on students' digital literacy competencies, this study bridges educational technology research with established learning theories and provides theoretical as well as practical insights for the sustainable and responsible integration of generative AI in individual learning contexts.

The recommendations from this research are as follows:

1. Strengthening Digital Literacy in the Curriculum
   Universities need to incorporate structured digital literacy training into courses or student development programs. Materials should cover critical thinking skills, information verification, digital security, and the ethical use of AI.
2. Utilizing ChatGPT as a Supporting Tool, not a Replacement
   Lecturers need to design learning strategies that position ChatGPT as a discussion facilitator, feedback provider, and source of inspiration, not as the sole source of answers.
3. Developing the Guidelines for the Use of AI in Academic Environments
   Institutions should develop formal policies governing the use of AI, including aspects of academic integrity, plagiarism, and data security.
4. Increasing Lecturer Capacity
   Training for lecturers on the use of ChatGPT and educational AI is necessary so that supervision, guidance, and learning design can optimize the benefits of these technologies.
5. Conducting Further Research
   Future studies are recommended to use longitudinal designs or controlled experiments to test the long-term effects of ChatGPT use on individual learning, as well as expanding the variables studied, such as learning motivation, creativity, and online collaboration.

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This study has several limitations that need to be considered in the interpretation of the results. First, the cross-sectional study design limits the researcher's ability to draw causal conclusions between ChatGPT use, digital literacy, and learning outcomes. Second, the variables were measured using a perception- based questionnaire, which is susceptible to subjective biases such as recall bias and social desirability bias. Third, this study has not combined objective data from learning analytics, eye tracking, EEG, or emotional recognition to capture cognitive and affective aspects more accurately. Fourth, the scope of the study was limited to the context of one higher education institution in Indonesia, so generalizations to the global student population still require caution.

To overcome these limitations, future research is suggested to develop a platform for adaptive learning systems that combines ChatGPT with learning analytics, so that materials, quizzes, and feedback can be personalized based on students' learning profiles. Furthermore, further studies could measure the cognitive and affective impacts of AI use through multimodal approaches, such as incorporating eye tracking, EEG, or emotional expression analysis. Research could also explore the integration of ChatGPT with other multimodal AI models (e.g., DALL·E or Gemini Vision) in cross-disciplinary project-based learning. Longitudinal studies over several semesters or years are also needed to test the sustainability of the effects of ChatGPT and digital literacy on learning outcomes. Finally, cross-country ethical and policy analysis is important to build a global ethical framework that can be adapted by higher

education institutions, as well as to develop ChatGPT-based learning modules specifically aimed at improving higher-order thinking skills (HOTS) students.

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