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An Analysis of the Influence of ChatGPT Usage on the Improvement of Students' Higher Order Thinking Skills (HOTS) in the Era of Merdeka Belajar

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ABSTRACT

Abstrack_This study aims to analyze the influence of ChatGPT on students' Higher Order Thinking Skills (HOTS), specifically in the areas of analysis, evaluation, and creation. The study employed a quantitative approach with a quasi-experimental design involving two groups: an experimental group that used ChatGPT as a learning tool and a control group that received conventional instruction. Data were collected through HOTS pre-test and post-test instruments, along with a questionnaire measuring students' perceptions of ChatGPT in supporting critical and creative thinking. The results showed a significant improvement in the experimental group, with an average increase of 20.6%, compared to only 5.2% in the control group. Linear regression analysis indicated that ChatGPT contributed 27% to the variance in HOTS improvement, with the strongest effect observed in analytical skills, followed by evaluation and creation. Most students reported that ChatGPT enhanced their engagement, critical thinking, and creativity. These findings suggest that ChatGPT is an effective tool for strengthening students' HOTS, aligned with the principles of Merdeka Belajar which emphasize flexible, technology-based, and higher-order thinking–oriented learning.

Keywords: Chatgpt, Higher Order Thinking Skills, Critical Thinking

I. INTRODUCTION

The rapid advancement of artificial intelligence (AI) in recent years has significantly reshaped the field of education. AI technologies have evolved from simple administrative aids into sophisticated systems capable of supporting complex cognitive processes. Modern AI tools are now embedded in various educational applications, functioning as interactive learning media, adaptive tutoring platforms, and autonomous learning agents capable of responding intelligently to student input. Tools such as ChatGPT, which utilize natural language processing (NLP), have introduced new dimensions to learning by providing immediate responses, elaborative explanations, and dialogic interactions that simulate human-like support (Chou et al., 2023). These

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developments align with global trends that emphasize the integration of intelligent technologies to foster more dynamic, efficient, and engaging learning environments.

In the Indonesian context, the transformation of the education system has been accelerated by the Merdeka Belajar policy, which encourages schools to adopt more flexible, student-centered, and technology-based learning approaches. Merdeka Belajar highlights the need to cultivate students' Higher Order Thinking Skills (HOTS), which include the abilities to analyze, evaluate, and create—skills essential for navigating the challenges of the 21st century. These competencies are emphasized not only for academic purposes but also to prepare students to engage critically and creatively in real-world situations (Anderson & Krathwohl, 2016). Despite its conceptual strength, the practical implementation of HOTS within Indonesian classrooms often faces limitations, including insufficient teacher preparation, lack of appropriate assessments, and uneven technological access.

Amid these challenges, AI-based tools like ChatGPT offer significant potential as pedagogical innovations. With its ability to generate context-relevant explanations, provide alternative perspectives, and stimulate inquiry-based learning, ChatGPT creates opportunities for students to think more deeply about the content they encounter. The interactive nature of ChatGPT allows learners to ask follow-up questions, test hypotheses, and refine their understanding, thereby supporting cognitive processes associated with HOTS. Recent literature demonstrates that AI applications can effectively enhance students' critical and creative thinking by enabling them to engage with information in more complex and analytical ways (Mahapatra, 2024; Bahl & Singh, 2023).

Furthermore, ChatGPT can support teachers by acting as a supplementary instructional tool that enriches learning activities. Teachers can use ChatGPT to generate HOTS-based questions, provide differentiated materials, or design problem-based learning scenarios. This can be particularly helpful in classrooms where diverse student needs require more adaptive instructional approaches. As a result, ChatGPT not only facilitates student learning but also strengthens teachers' capacity to implement the principles of Merdeka Belajar effectively. However, these opportunities can only be realized when educators possess the pedagogical and technological competence necessary to integrate AI meaningfully into their teaching.

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Despite the promising potential of ChatGPT, its use in Indonesian schools remains at an early stage, and empirical research on its effectiveness is still limited. In many educational settings, teachers and students are unfamiliar with AI tools or unsure how to implement them ethically and responsibly. Concerns regarding academic integrity, over-reliance on technology, and data privacy continue to emerge, demonstrating the need for clear guidelines and informed pedagogical frameworks. These issues highlight the importance of examining how AI tools like ChatGPT should be integrated in ways that enhance learning without undermining essential human cognitive processes such as reasoning, judgment, and creativity.

In addition, there is a pressing need to evaluate whether ChatGPT can effectively complement existing teaching practices to enhance HOTS. While international studies indicate positive outcomes, the applicability of these findings in Indonesia—especially at the junior secondary school level—remains uncertain due to differences in curriculum, teacher competence, and infrastructural conditions. Indonesian students may respond differently to AI-assisted learning due to cultural, contextual, or pedagogical factors that shape their learning behaviors. Therefore, further research is necessary to determine whether ChatGPT can indeed empower students to think more critically and creatively within these local conditions.

Moreover, students' perceptions play an instrumental role in determining the success of technology adoption in education. If students view ChatGPT as helpful, engaging, and relevant to their learning needs, they are more likely to use it proactively to deepen their understanding. Conversely, if they perceive it as confusing or merely a shortcut to obtaining answers, its potential for supporting HOTS will be diminished. Understanding students' attitudes toward ChatGPT thus offers valuable insights into how AI can be effectively leveraged to cultivate higher-order cognitive competencies in diverse learning contexts. Given this background, the present study seeks to contribute empirical evidence on the role of ChatGPT in improving students' HOTS within the Merdeka Belajar framework. Specifically, the study investigates how ChatGPT influences students' analytical, evaluative, and creative thinking abilities, and how students perceive its usefulness in supporting critical and creative learning processes. By addressing these questions, this research aims to provide a more comprehensive understanding of how AI technologies can be integrated effectively into Indonesian

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classrooms to strengthen HOTS development and support educational transformation in the digital era.

II. RESEARCH METHOD

This study employed a quantitative approach using a quasi-experimental design with a pre-test–post-test control group structure. The experimental group received instruction supported by ChatGPT, while the control group participated in conventional learning. The population consisted of students from SMPN 1 Maospati, and purposive sampling was used to select 60 students with sufficient technological access. These students were divided equally into the experimental and control groups to ensure a balanced comparison.

Two key instruments were utilized in the data collection process: a HOTS test administered as both a pre-test and post-test to assess students' analytical, evaluative, and creative abilities, and a student perception questionnaire aimed at measuring attitudes toward the use of ChatGPT in learning. The research procedures involved validating the instruments, orienting teachers, introducing ChatGPT to students, administering the pre-test, conducting a four-week instructional intervention, administering the post-test, and finally distributing the questionnaire to the experimental group.

Data analysis was conducted using descriptive statistics to summarize scores, paired sample t-tests to determine significant differences between pre-test and post-test results, and linear regression to identify the extent of ChatGPT's contribution to HOTS improvement. Qualitative responses from the questionnaire were examined using thematic analysis to provide deeper insight into students' perceptions regarding the integration of ChatGPT in the learning process.

III. RESULT AND DISCUSSION

Pre-test and Post-test Results

The results of the pre-test revealed that both the experimental and control groups possessed comparable initial levels of Higher Order Thinking Skills (HOTS), with mean scores hovering around 55%. This similarity indicates that the two groups began the study with relatively equivalent cognitive abilities, making them suitable for comparison. Following the four-week intervention period, notable differences emerged in the post-test results. The experimental group, which utilized ChatGPT as a learning aid, demonstrated a substantial increase in their HOTS scores, reaching an average of 75.2%, representing

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a gain of 20.6%. In contrast, the control group, which underwent conventional learning methods, improved only modestly, with a post-test average of 60.4%—an increase of just 5.2%. Statistical analysis using the paired sample t-test further confirmed that the improvement in the experimental group was significant ($p < 0.05$), whereas the control group's improvement was not statistically meaningful. These results provide strong empirical evidence that the incorporation of ChatGPT leads to a significantly greater enhancement of HOTS compared to traditional instructional approaches.

Influence of ChatGPT on HOTS

To further examine the extent of ChatGPT's impact on HOTS development, a linear regression analysis was conducted. The regression coefficient ($\beta = 0.52$, $p < 0.05$) demonstrated a significant positive influence of ChatGPT usage on the improvement of HOTS scores. This suggests that increased engagement with ChatGPT correlates with a higher likelihood of cognitive gains in the areas assessed. Additionally, the coefficient of determination ($R^2 = 0.27$) indicated that 27% of the variance in students' HOTS improvement could be attributed directly to the use of ChatGPT. Although the remaining variance may be influenced by other factors such as individual motivation, teacher guidance, or prior knowledge, a contribution of 27% represents a meaningful and substantial impact. This finding aligns with previous studies highlighting the potential of AI-powered tools to enhance higher-order cognitive processes by facilitating deeper engagement, providing immediate feedback, and supporting self-directed learning.

Most Affected HOTS Domains

A closer examination of the specific HOTS domains revealed that the aspect of analysis experienced the highest degree of improvement among students who used ChatGPT. This suggests that ChatGPT was particularly effective in helping students interpret information, differentiate between concepts, identify relationships, and examine ideas more critically. The system's ability to offer detailed explanations, generate comparative perspectives, and respond to follow-up questions appears to have played a significant role in strengthening analytical skills. The evaluation domain also showed moderate improvement, as students became more capable of assessing the accuracy, validity, and relevance of information presented to them. However, the increase in the evaluation domain was not as pronounced as in the analysis domain, likely due to the reflective and judgment-based nature of evaluative thinking, which requires deeper

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internalization and experience. Meanwhile, the creation domain showed the least improvement among the three. Although ChatGPT provided inspiration and alternative ideas, generative tasks ultimately still depend heavily on students' originality, imagination, and ability to synthesize information independently. This indicates that while ChatGPT can support the creative process, it does not fully replace the need for students' own innovative thinking.

Student Perception

The analysis of the student perception questionnaire further reinforces the positive role of ChatGPT in the learning process. A significant majority of students (85%) reported that ChatGPT improved their understanding of lesson content, suggesting that the tool effectively clarified complex concepts and provided accessible explanations. Additionally, 80% of students indicated that learning became more engaging when ChatGPT was integrated into classroom activities, reflecting the interactive and dynamic nature of AI-assisted learning. Approximately 75% of respondents felt that their critical thinking abilities improved with the use of ChatGPT, demonstrating the tool's capacity to stimulate inquiry, encourage deeper questioning, and support analytical reasoning. Furthermore, 74% reported enhanced creativity, as ChatGPT helped them explore ideas, generate new perspectives, and approach problem-solving tasks with increased confidence. Collectively, these responses indicate that students not only benefited cognitively from the use of ChatGPT but also developed greater motivation, curiosity, and self-assurance in their learning processes. This positive perception is crucial because student engagement and attitudes play a vital role in determining the success of technology integration in educational settings.

IV.CONCLUSION AND SUGGESTION

Conclusion

This study concludes that the integration of ChatGPT significantly enhances students' Higher Order Thinking Skills (HOTS), particularly in analytical abilities. Students who used ChatGPT outperformed those receiving conventional instruction, as evidenced by higher post-test gains and meaningful statistical differences. Regression analysis further showed that ChatGPT contributed 27% to the variance in HOTS improvement, indicating a substantial impact. In addition, students expressed highly positive perceptions regarding its role in improving engagement, critical thinking,

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creativity, and confidence. These findings demonstrate that ChatGPT effectively supports the goals of Merdeka Belajar by promoting flexible, technology-driven, and higher-order thinking–oriented learning environments.

Suggestions

Teachers are encouraged to incorporate ChatGPT into structured learning activities that stimulate analysis, evaluation, and creation, ensuring that the tool is used as a cognitive aid rather than a shortcut. Students should engage with ChatGPT actively for exploration and reasoning, not merely for obtaining direct answers. Technology developers are advised to refine contextual feedback features to better support personalized learning. Additionally, schools should strengthen digital infrastructure and provide continuous professional development to ensure effective and ethical integration of AI tools into teaching practices.

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