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The ChatGPT phenomenon: an exploration of physics education students' use of ChatGPT in completing physics assignment

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Article

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Abstract

This study aims to describe the use of ChatGPT in completing physics assignments by students in the Physics Education programme at Mulawarman University. This study employed a descriptive quantitative method involving 60 students as participants. A Likert-scale questionnaire was developed to measure five aspects: level of understanding and usage, effectiveness, attitude towards usage, ethics of usage, and the significance of using ChatGPT. The data were analysed using descriptive statistics, including percentages, means, and standard deviations. The results indicate that students generally hold a positive perception of ChatGPT usage, particularly regarding its ability to enhance learning motivation, aid conceptual understanding, and solve physics problems. The 'attitude towards usage' dimension scored highest, whilst the 'ethics of usage' dimension scored lowest, highlighting the need to raise awareness of responsible technology use. The findings of this study suggest that ChatGPT has the potential to be an effective learning aid. Recommendations from this study include the importance of integrating ethical literacy into the use of AI technology, as well as the development of more adaptive and responsible AI-based physics learning strategies.

INTRODUCTION

The advancement of artificial intelligence (AI) technology has brought significant changes in various fields, including education. One AI-based innovation widely used in the context of learning is ChatGPT, a natural language processing model based on the Generative Pre-trained Transformer (GPT) developed by OpenAI. ChatGPT is designed to generate quick and relevant text responses to help users understand concepts, solve problems, and support academic writing [1]. The integration of ChatGPT into the world of education has garnered attention due to its ability to provide flexible and easily accessible learning support [2]. ChatGPT enables tailored educational experiences by generating customized content based on student needs [3,4]. Its use continues to grow as students gain greater access to digital technology and the need for efficient learning resources increases.

In physics education, which is known for its high level of complexity, particularly in understanding abstract concepts and solving mathematical problems, ChatGPT offers an interactive and instant learning alternative. Several studies indicate that AI-based chatbots are capable of answering questions, explaining concepts, and effectively assisting students in resolving academic challenges [5]. The use of ChatGPT is also associated with improved conceptual understanding, learning motivation, critical thinking skills, and students' science literacy [6,7]. Additionally, ChatGPT can help students complete assignments, understand course material, and support self-directed learning through adaptive and flexible interactions [8]. ChatGPT's conversational nature lets students ask questions without hesitation and receive feedback, supporting personalized learning. It enhances accessibility in education by offering tailored resources, supporting curriculum development, and facilitating information retrieval. Its integration promotes active learning, making support accessible for healthcare and teacher education sectors [9].

Previous research has shown that ChatGPT still has limitations in solving visual problems, such as interpreting graphs, diagrams, and complex symbolic representations commonly found in physics education [10]. Additionally, concerns have been raised regarding ethical issues, student reliance on AI, academic integrity, and the potential for inaccurate information [11]. Students lacking adequate critical evaluation skills tend to accept AI-generated information without verification, potentially leading to misconceptions and superficial conceptual understanding [12].

For physics education students, ChatGPT warrants attention because they are not only technology users but also future educators who will integrate AI into the learning process. Without adequate digital literacy and an understanding of ethics, AI use could affect learning quality and academic integrity in higher education. Excessive reliance on AI has the potential to diminish students' critical thinking abilities, problem-solving skills, and deep conceptual understanding [13]. Furthermore, a lack of understanding regarding the ethics of AI use can lead to plagiarism and the misuse of information in academic activities [14]. Therefore, it is important to determine the extent to which Physics Education students utilize ChatGPT in completing physics assignments, as well as how this affects their learning motivation, conceptual understanding, and academic independence.

A questionnaire with a 5-point Likert scale was used as a measurement instrument to assess each of these aspects, which were developed from indicators sourced from previous studies [15]. Previous research indicates that ChatGPT facilitates concept comprehension, problem-solving, and the development of learner autonomy. However, there is limited data regarding the utilization of ChatGPT by education students for physics assignments. This study seeks to provide a comprehensive analysis of the extent to which Physics Education students employ ChatGPT for assignments and to assess the advantages and challenges associated with the use of AI technology in university-level Physics education.

RESEARCH METHOD

This study employs a descriptive quantitative approach aimed at describing the patterns of ChatGPT utilization by students in completing physics assignments. The research subjects were 60 students from the Physics Education Program at Mulawarman University, selected using purposive sampling, that is, the deliberate selection of respondents based on the criterion that they had used ChatGPT in academic activities, specifically in completing physics assignments.

The research instrument was a questionnaire using a 5-point Likert scale, consisting of five main aspects: (1) level of understanding and use of ChatGPT, (2) effectiveness of use, (3) attitudes toward use, (4) ethics of use, and (5) significance of use in the learning process. The instrument was developed based on indicators adapted from previous research on AI-assisted learning and the use of ChatGPT in education [15]. The questionnaire consists of 25 items distributed proportionally across the five aspects, with each aspect represented by five items.

The first aspect, namely the level of understanding and use of ChatGPT, measures students' knowledge of and frequency of using ChatGPT to complete physics assignments. Examples of statements in this aspect include: "I understand how to use ChatGPT to help solve physics problems" and "I often use ChatGPT when working on physics assignments." The second aspect, effectiveness of use, aims to measure students' perceptions of ChatGPT's benefits in supporting learning activities. Examples of statements include: "ChatGPT helps me understand physics concepts more easily" and "ChatGPT helps me find solutions to physics problems quickly." The third aspect, attitude toward use, evaluates students' responses and acceptance of ChatGPT's integration into learning activities. Examples of statements in this aspect include: "I feel comfortable using ChatGPT as a learning tool" and "Using ChatGPT increases my motivation to study physics." The fourth aspect, ethics of use, focuses on students' awareness regarding the responsible and ethical use of AI technology in academic activities. Examples of statements include: "I use ChatGPT responsibly without violating academic integrity" and "Information generated by ChatGPT needs to be verified before being used in assignments." The fifth aspect, perceived utility, measures students' perceptions of the importance of ChatGPT and its

contribution to their overall learning process. Examples of statements in this aspect include: "ChatGPT plays an important role in helping me complete my physics assignments" and "Using ChatGPT supports independent learning."

Data collection was conducted online in May 2025 via a Google Form distributed to respondents through the class WhatsApp group. Students were given one week to complete the questionnaire independently. The collected data were analyzed using descriptive statistics, namely percentages to determine the distribution of responses, the mean to identify general trends, standard deviation to assess variation, and kurtosis and variance to describe the distribution of respondents' data in greater detail. A 5-point Likert scale was used to measure respondents' level of agreement with each statement in the questionnaire. The scale classification is presented in Table 1.

Table 1. Likert Scale

Scale	Score	Scale Range
Strongly Agree (SA)	5	4.20 – 5.00
Agree (A)	4	3.40 – 4.19
Somewhat Agree (SA)	3	2.60 – 3.39
Disagree (D)	2	1.80 – 2.59
Strongly Disagree (SD)	1	1.00 – 1.79

Based on Table 1, a higher score indicates a more positive level of agreement among respondents regarding the use of ChatGPT in the physics learning process. Conversely, the lower the score obtained, the greater the rejection or negative perception of ChatGPT's use. Scale range classification was used to facilitate the interpretation of data analysis results, thereby revealing trends in attitudes, understanding, effectiveness, ethical use, and the perceived significance of ChatGPT based on respondents' answers.

RESULTS AND DISCUSSION

This study aims to describe the patterns of ChatGPT usage in completing physics assignments by Physics Education students. Based on the results of data analysis of five aspects measured through a Likert scale questionnaire, a general picture emerged that the majority of students demonstrated a positive attitude toward the use of ChatGPT. Data from 60 respondents were analyzed using descriptive statistics, including mean, standard deviation, variance, and kurtosis. These statistical measures were used to identify the general tendency, distribution, and variability of students' responses regarding the use of ChatGPT in completing physics assignments. The findings provide an overview of the patterns and intensity of ChatGPT use among students, as well as their perceptions of its effectiveness and impact on the learning process. Previous studies have shown that AI-based learning tools such as ChatGPT can support conceptual understanding, improve learning motivation, and facilitate independent learning through interactive and adaptive responses [6,7]. In addition, the use of descriptive statistical analysis enables researchers to interpret students' attitudes and experiences toward technology integration in education more comprehensively [12,13]. Therefore, the analysis results in this study are expected to provide deeper insights into the opportunities and challenges of implementing AI technology in physics learning at the university level. Furthermore, the results of the descriptive analysis for each aspect are presented in the Table 2.

Based on data in this study, analysis of the five dimensions of ChatGPT utilization indicates that physics education students respond positively to using ChatGPT for assignments. The attitude aspect toward ChatGPT use (TOTALX.3) showed the highest mean value 18.00, with a standard deviation of 2.449, indicating that students view ChatGPT as beneficial and supportive of task completion. This finding aligns with the study stating that AI use in education can enhance motivation and foster positive attitudes toward learning. The perceived meaning of ChatGPT use (TOTALX.5) and its effectiveness

in supporting physics assignments (TOTALX.2) also showed mean scores, 17.50 and 17.08. Students recognized ChatGPT as an effective tool for understanding concepts and solving problems.

Table 2. Descriptive Statistical Analysis

	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Variance Statistic	Kurtosis	
								Statistic	Std. Error
TOTALX.1	60	11	12	23	16.90	1.834	3.380	2.532	.608
TOTALX.2	60	8	13	21	17.08	1.759	3.095	.229	.608
TOTALX.3	60	11	13	24	18.00	2.449	6.000	-.216	.608
TOTALX.4	60	15	9	24	15.72	2.387	5.698	2.449	.608
TOTALX.5	60	10	12	22	17.50	1.987	3.949	.447	.608
Valid N (listwise)	60								

The aspect of understanding and using ChatGPT (TOTALX.1) received an average score of 16.90, with the highest kurtosis value (2.532), indicating consistency in respondents' answers regarding this aspect. This means that most students already have a sufficient understanding of how ChatGPT works and how to access it for academic needs. However, the aspect of ethics and responsible use (TOTALX.4) showed the lowest average score, namely 15.72 with a standard deviation of 2.387. This indicates that there are still weaknesses in students' understanding of the ethical use of ChatGPT in accordance with academic principles. This finding is significant, given that Physics Education students are future educators who will eventually influence students' academic culture. Therefore, the need to integrate digital literacy and AI usage ethics into the curriculum is strongly emphasized.

Overall, the average scores for all aspects were above the Likert scale midpoint, indicating that students' use of ChatGPT is generally good. However, variation in scores and perceptions across aspects suggests this technology is still uneven in understanding, responsibility, and effectiveness. Therefore, guidance and education on AI use in learning must be systematic so its utilization is optimal, ethical, and responsible.

These findings demonstrate students' positive response to ChatGPT and reflect a paradigm shift in digital-age learning. ChatGPT is a versatile educational tool because of its scalability and accessibility. It facilitates personalized learning through student engagement and prompt feedback, also showing its potential to transform teaching practices and improve learning outcomes [16]. ChatGPT plays a significant role in education by providing personalized, real-time interactions that enhance access to information and support. Its integration enables customized learning experiences, which in turn improve student motivation and engagement. Furthermore, it assists educators in the creation of educational content and assessments [17,18]. While AI contributes to personalized learning, automates assessments, and aids in content creation, issues related to academic integrity, misinformation, and overdependence on AI-generated content remain prevalent [19].

The disparate adoption of technology among institutions presents substantial concerns regarding regulatory deficiencies, academic integrity, and the readiness of faculty members [20]. Balancing collaboration between human expertise and AI capabilities to enhance educational practice is highly recommended [18]. The integration of AI technologies like ChatGPT into higher education demands institutional readiness to provide ethical guidelines, digital literacy training, and adaptive pedagogical approaches. Hal ini dilakukan untuk mengatasi kekhawatiran tentang bias dan integritas akademik [21]. Without systematic guidance, the use of this technology risks fostering a pattern of instant yet superficial learning. Therefore, the role of faculty members as facilitators of technological literacy and academic ethics becomes increasingly crucial in shaping the character and competencies of 21st-century students.

CONCLUSION

Research findings indicate a positive trend among physics education students using ChatGPT for assignments. Students reported that ChatGPT improved their understanding of physics concepts, aided problem-solving, and increased motivation to learn. The highest scores concerned attitudes toward use and perceived benefits, reflecting acceptance of this technology as a learning tool. However, ethics and responsible use scored lower, underscoring challenges in digital literacy and ethical awareness of AI in academic contexts. The study recommends broader, more diverse samples, mixed methods for qualitative data, objective learning outcomes to assess ChatGPT's impact on academic performance, and comprehensive tools for ethical literacy in AI use in education.

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AUTHOR CONTRIBUTIONS

Conceptualization, F.A and S.B.. Methodology, F.A.. Software, F.A.. Validation, F.A. and S.B.. Formal Analysis, F.A.. Investigation, F.A.. Resources, F.A and S.B. Data Curation, F.A. Writing–Original Draft Preparation, F.A. Writing–Review and Editing, F.A. and S.B. Visualization, F.A. Supervision, S.B. Project Administration, F.A.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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