

Determinants of scientific writing creativity: ChatGPT and academic engagement

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Abstract

The phenomenon of ChatGPT usage among students today often occurs instantly, which potentially reduces critical thinking processes and independent idea development in scientific writing. Furthermore, suboptimal student engagement levels across cognitive, affective, and behavioral dimensions also affect the quality of creativity in the resulting scientific articles. This research aims to empirically examine the influence of ChatGPT usage and student engagement on scientific writing creativity both partially and simultaneously. Using a quantitative associative approach, this study involves Office Administration Education students at State University of Surabaya, batches of 2022 and 2023, as primary respondents. Data were analyzed in-depth using multiple linear regression techniques through SPSS version 27 for Mac software. The research findings indicate that ChatGPT usage significantly influences writing creativity with a contribution of 28.7%. Simultaneously, the combination of ChatGPT usage and student engagement significantly impacts variations in writing creativity by 70.6%, while the remainder is influenced by factors outside this research model. This study concludes that the integration of artificial intelligence technology must be balanced with comprehensive active student participation. The synergy between AI technological convenience and personal engagement is crucial for producing scientific articles that are more innovative, systematic, and possess original academic analytical depth.

Keywords: ChatGPT; Student Engagement; Creative Writing; Scientific Articles; Artificial Intelligence

Introduction

Major changes in the use of digital technology have become increasingly evident since the COVID-19 pandemic, when various sectors of life, including education, had to adapt to remote learning conditions (Maksum & Fitria, 2021). This significant impact has also forced the education sector to undergo a massive digital transformation. Conventional learning systems shifted to online methods, prompting educators and students to adapt quickly to mastering digital technology (Darwin et al., 2025). This transformation has paved the way for innovations in Artificial Intelligence (AI), particularly generative language models like ChatGPT, which was introduced in late 2022 and saw a significant global increase in usage by 2025 (Farman et al., 2024). In academic settings, this technology is no longer a secondary tool but an integral part of supporting productivity and simplifying complex writing processes (Al-Shafei, 2024; Fauzi et al., 2023).

However, this ease of use has sparked controversy regarding the quality of education. Educators have voiced concerns about the long-term impact of AI use on student engagement and creativity, particularly if students merely copy AI outputs without engaging in critical thinking (Romaniuk & Łukasiewicz-Wieleba, 2024). This phenomenon is evident in the Office Administration Education Program at State University of Surabaya. The use of ChatGPT to complete assignments in the Research Methodology course was found to be actively employed by over 85% of students, as revealed by the results of a survey that has been conducted. However, the graduate profile of the Office Administration Education Program at State University of Surabaya requires students to become prospective professional educators who not only master technology but also possess critical, creative, and adaptive thinking skills (Universitas Negeri Surabaya, n.d.).

Creativity in writing scientific articles represents the pinnacle of language skills, integrating the ability to read, analyze, and interpret information systematically (Amelia & Solikhah, 2024; Setyorini, 2020). Creativity in writing scientific articles is highly dependent on student engagement, which encompasses cognitive (deep engagement), affective (emotional response), and behavioral (active participation) dimensions (Appleton et al., 2006; Fredricks et al., 2004). Although previous research indicates that ChatGPT can stimulate creative ideas (Harapan & Suwanda, 2025; Nasution et al., 2024), there is a gap in the literature, as most studies have examined these variables separately (Anjarani et al., 2024; Hardjito et al., 2025). Tests of integrative models that synergize psychopedagogical and technological variables simultaneously are still rare, particularly when contextualized within the field of office administration education. The development of digital technology has also introduced the concept of Augmented Creativity, an approach that explains how technology can enhance human creative processes. Digital technology does not replace an individual's creative abilities but serves as a tool that expands the exploration of ideas, imagination, and the process of generating new concepts. With the support of interactive technology, individuals can develop ideas more flexibly through continuous processes of exploration, experimentation, and reflection (Zünd et al., 2015).

This study was conducted to examine how the use of ChatGPT and students' level of academic engagement influence creativity in scientific article writing. This study is expected to provide theoretical contributions to AI research in higher education as well as practical insights for academic programs in designing ethical AI-based learning strategies. The structure of this article begins with an introduction, theoretical framework, and literature review, followed by an associative quantitative research method, results and discussion of statistical tests, and concludes with findings and recommendations for the advancement of scientific knowledge. This study is novel in that it tests an integrative model that simultaneously combines technological factors (ChatGPT) and psychopedagogical factors (student engagement) to explain students' creativity in writing scientific articles.

Methods

This study employs a quantitative approach with an associative research design aimed at testing the relationships among variables. This approach was used to analyze the influence of the independent variables, namely the use of ChatGPT (X1) and student engagement (X2),

on the dependent variable, which is creativity in writing scientific articles (Y). The study was conducted from January to March 2026.

Population and Sample

The population of this study includes all students in the Bachelor's Program in Office Administration Education (PAP) at State University of Surabaya from the 2022 and 2023 academic cohorts, totaling 576 students. The sample size was determined based on the Krejcie and Morgan table at a 95% confidence level, resulting in 234 respondents. The sampling technique used was purposive sampling, with the criterion that respondents were active students who used ChatGPT to complete academic assignments (Krejcie & Morgan, 1970).

Research Instruments and Data Collection Techniques

Primary data in this study were collected through a closed-ended questionnaire distributed online using the Google Forms platform. The research instrument was designed using a five-point Likert scale ranging from strongly disagree to strongly agree (Awaludin et al., 2023). The questionnaire items were developed by referencing several previous research instruments, namely:

1. ChatGPT usage, adapted from the ChatGPT Usage Scale (Nemt-allah et al., 2024).
2. Student engagement, adapted from behavioral, emotional, and cognitive dimensions (Reeve & Tseng, 2011).
3. Writing creativity, adapted from indicators of reflective writing, creative identity, and basic skills (Mitchell et al., 2021).

Data Analysis Techniques

Data analysis was conducted using SPSS version 27. The analysis stages included validity and reliability tests of the instruments to ensure data suitability. Subsequently, classical assumption tests were performed, covering normality, multicollinearity, and heteroscedasticity. After meeting the assumptions, multiple linear regression analysis was performed to test the influence of independent variables on the **dependent** variable both partially and simultaneously. Additionally, a t-test was used to determine partial effects, an F-test for simultaneous effects, and the coefficient of determination (R^2) to assess the extent of the independent variables' contribution to the dependent variable.

Findings and Discussion

Findings

Respondent Profile and Variable Description

This study involved 234 respondents who were students in the Office Administration Education Program at State University of Surabaya during the 2022 and 2023 academic years. The characteristics of the respondents by academic year are presented in Table 1.

Table 1. Respondent Profile by Academic Year (Source: Authors' calculations)

No.	Academic Year	Frequency	Percentage
1.	2022	80	34.19%
2.	2023	154	65.81%
	Total	234	100%

Based on Table 1, the composition of respondents in this study is dominated by students from the 2023 academic year, accounting for 65.81%, while respondents from the 2022 academic year constitute 34.19% of the total research sample.

The results of the descriptive analysis indicate that the level of ChatGPT usage (X1) falls into the high category with a percentage of 75.21%. Furthermore, student engagement (X2) falls into the strong category with a value of 68.94%, while creativity in writing scientific articles (Y) falls into the good category with a percentage of 71.97%. Before hypothesis testing, the research data first underwent classical assumption tests, including tests for normality, multicollinearity, heteroscedasticity, and autocorrelation. Based on these test results, the regression model used in this study met all classical assumption criteria. Thus, the regression model is deemed suitable for analyzing and predicting the dependent variable.

Hypothesis Testing

The results of the multiple linear regression analysis indicate that the variables of ChatGPT usage and student engagement have a significant influence on scientific article writing creativity, both partially and simultaneously. A summary of the hypothesis testing results is presented in Table 2.

Table 2. Hypothesis Testing Results: Partial and Simultaneous (Source: Authors' calculations)

No.	Variable	t-value	F-value	Sig.	Notes
1.	X1 on Y	4.924	-	0.000	H1 Accepted
2.	X2 on Y	10.179	-	0.000	H2 Accepted
	X1 and X2 on Y	-	277.088	-	H3 Accepted

The acceptance of the hypotheses in this study is evidenced by the significance values for all variables reaching 0.000, which is far below the probability threshold of 0.05. The variables ChatGPT usage (X1) and student engagement (X2) have a significant partial effect on writing creativity (Y). Simultaneously, both independent variables demonstrated a significant effect on writing creativity, as indicated by the calculated F-value of 277.088. The coefficient of determination (R-squared) of 0.706 indicates that 70.6% of the variation in scientific article writing creativity can be explained by the variables of ChatGPT usage and student engagement. Meanwhile, the remaining 29.4% is influenced by other factors not included in this research model.

The coefficient of determination value of 70.6% indicates that the regression model developed in this study has strong explanatory power in describing students' creativity in scientific article writing. This finding demonstrates that the integration of technological and psychopedagogical variables simultaneously contributes substantially to the development of academic creativity among university students. In quantitative research, an R-squared value above 0.50 generally reflects a relatively strong model in explaining the dependent variable. Therefore, the findings of this study confirm that the combination of ChatGPT usage and student engagement forms a relevant predictive model in understanding the dynamics of scientific writing creativity in higher education contexts.

In addition, the relatively high contribution of student engagement compared to ChatGPT usage indicates that internal learning participation remains the primary

determinant of academic creativity. Although AI technology provides assistance in generating ideas and structuring academic writing, the active involvement of students in reviewing, reflecting, and developing arguments still plays a central role in producing original scientific work. This finding suggests that technology-based learning should not merely emphasize the use of AI tools, but also encourage active cognitive and emotional participation among students during the learning process.

The descriptive findings also reveal that most students tend to utilize ChatGPT as a supporting academic tool rather than as a substitute for independent thinking. This can be observed from the high percentage of agreement on indicators related to brainstorming, drafting article outlines, and revising writing structures. Such findings indicate that students continue to play an active role as decision-makers in the writing process, while ChatGPT functions as a facilitator that accelerates idea exploration and writing efficiency.

Regression Model

In this study, the relationships among the variables were analyzed using a multiple linear regression model. To further explain the relationships among variables, the regression equation is presented as follows:

$$Y = 5.164 + 0.314X_1 + 0.772X_2 \quad (1)$$

Notes:

Y = Creativity in writing scientific articles

X₁ = Use of ChatGPT

X₂ = Student engagement

The regression equation indicates that a one-unit increase in ChatGPT usage predicts a 0.314 increase in students' scientific writing creativity, assuming other variables remain constant. Meanwhile, each one-unit increase in student engagement contributes to a 0.772 increase in writing creativity. Compared to ChatGPT usage, student engagement has been shown to make the strongest contribution to writing creativity.

These findings indicate that student engagement contributes more strongly to scientific writing creativity than the use of ChatGPT. Although AI technology provides significant assistance during the writing process, students' active involvement in analyzing, evaluating, and developing ideas remains the primary factor influencing creative academic performance. This pattern suggests that technology functions more effectively when accompanied by strong cognitive and behavioral participation from students.

The regression coefficients further indicate that student engagement contributes more strongly to students' academic creativity than ChatGPT usage. This finding suggests that although AI technology can facilitate academic writing processes, students' active participation, motivation, and cognitive involvement remain the most influential factors in developing scientific writing creativity. Therefore, the effectiveness of AI-assisted learning environments largely depends on the extent to which students remain actively engaged in the learning process. Overall, these findings indicate that the integration of AI-assisted learning tools and active student engagement can jointly support the development of students' scientific writing creativity in higher education contexts.

Discussion

The Effect of ChatGPT Use on Creativity in Scientific Article Writing

Based on the results of the analysis of the first hypothesis (H1), the use of ChatGPT was found to have a positive and significant effect on students' creativity in writing scientific articles. This is reflected in the regression coefficient value of 0.314 with a significance level below 0.05. The partial coefficient of determination of 28.7% also indicates that the use of ChatGPT plays a role in enhancing students' creative abilities in composing scientific papers. In practice, ChatGPT can be utilized as an academic support tool that assists students in the process of developing ideas, paraphrasing, systematically structuring their writing, and improving linguistic aspects more effectively. These research findings are also consistent with previous studies showing that the use of ChatGPT can help students better understand the structure of scientific writing while boosting their confidence in producing academic papers (Harapan & Suwanda, 2025).

ChatGPT's role as a productivity assistant in this study reinforces previous findings that AI significantly enhances student productivity in higher education (Fauzi et al., 2023). This technology's ability to spark ideas also aligns with previous research revealing that the use of ChatGPT can overcome writing barriers by providing instant creative ideas (Nasution et al., 2024). Furthermore, the integration of technology into this creative process is supported by studies indicating that the application of technology can stimulate students' writing creativity (Amelia & Solikhah, 2024). However, previous studies indicate that while AI is highly beneficial, its use still carries risks of information bias and plagiarism if not accompanied by responsible use and human validation (Kim, 2023; Wahid & Hasbi, 2024).

The findings of this study can also be explained through the Augmented Creativity perspective, which states that digital technology can enhance human creative processes through collaborative interaction between users and the technological system. In this context, ChatGPT does not function as a substitute for students' thinking abilities but as a cognitive tool that helps expand idea exploration, facilitates the brainstorming process, and accelerates the development of scientific writing structures (Zünd et al., 2015). Thus, AI technology acts as a catalyst supporting students' creative processes in producing more innovative scientific works.

These findings indicate that the role of ChatGPT in academic writing extends beyond merely functioning as a text generator. In the context of higher education, ChatGPT can serve as a cognitive scaffolding tool that facilitates students in organizing ideas, exploring alternative perspectives, and reducing psychological barriers during the writing process. Students often experience difficulties when initiating academic writing due to limited confidence, lack of vocabulary, or uncertainty in structuring arguments. The presence of AI-based assistance allows students to overcome these initial obstacles more efficiently, enabling them to focus more deeply on content development and critical reflection. This condition demonstrates that AI technology may contribute positively to the development of creative academic behavior when utilized responsibly and reflectively.

The Effect of Student Engagement on Creativity in Writing Scientific Articles

The results of the second hypothesis (H2) test indicate that student engagement has a positive and significant effect on creativity in writing scientific articles. With a contribution of 59.4%, this variable is the most dominant factor in enhancing students' writing creativity.

Scientifically, this finding confirms that writing creativity is not solely determined by technological sophistication but is highly dependent on students' cognitive, affective, and

behavioral engagement in processing and reflecting on ideas. This can be observed in the magnitude of the contribution of the student engagement variable, which reached 59.4%, a figure that is significantly more dominant compared to the contribution of ChatGPT usage, which was only 28.7%. This dominance is reinforced by a regression coefficient of 0.772 with a significance level (Sig. < 0.05), indicating that student engagement exerts the strongest partial influence in the regression model. This finding aligns with theories stating that depth of understanding (cognitive effort) and positive emotional responses form the foundation of educational outcomes (Appleton et al., 2006; Fredricks et al., 2004).

This finding also reinforces previous research emphasizing that active engagement is strongly correlated with critical thinking skills as the primary foundation of scientific creativity (Hardjito et al., 2025). This relationship between cognitive engagement and academic achievement is also supported by findings showing a significant influence of cognitive engagement on student learning success (Manoppo, 2020). In the context of writing, creativity in scientific article writing is considered the culmination of skills requiring systematic analysis and interpretation of information, where students' active participation becomes a key factor (Setyorini, 2020). These findings are also indirectly supported by studies demonstrating that interactive technology can enhance motivation and learning responses, ultimately fostering deeper engagement (Reza et al., 2025).

When examining the distribution of indicators across the student engagement variable, it is evident that the indicator with the highest level of agreement is found in the activity of reviewing and revising writing based on ChatGPT's suggestions, with a total percentage of "agree" and "strongly agree" responses of 76.49%. This finding indicates that students do not merely passively receive information generated by AI but are actively engaged in evaluating and refining those results. When examined from the distribution of indicators on the variable of creativity in writing scientific articles, several indicators showed a relatively higher level of agreement compared to other indicators. The indicator with the highest score pertains to students' ability to generate new ideas or concepts in scientific article writing, which received a 78.63% agreement rate from respondents. This indicates that ChatGPT is most frequently utilized by students as a tool for idea exploration and brainstorming in the scientific writing process. The availability of AI technology enables students to access various alternative ideas that can be further developed independently in their scientific writings.

Additionally, the indicator regarding the ability to structure paragraphs logically and systematically also showed a high score with a 77.78% approval rate. This finding indicates that ChatGPT helps students organize their ideas so that the flow of writing becomes more coherent and easier to understand. In the context of academic writing, the ability to structure paragraphs systematically is a crucial aspect as it relates to the clarity of the author's arguments and the structure of their thinking. Another indicator showing a high score is the ability to connect ideas with references or scientific literature, with an agreement rate of 77.35%. These results demonstrate that ChatGPT serves not only as a tool for generating initial writing ideas but also as a means to help students develop their arguments more systematically with the support of relevant scientific sources. These findings show that the use of AI technology in the scientific writing process can function as a supportive tool that enriches the exploration of ideas while simultaneously enhancing the quality of students' academic arguments.

The dominance of student engagement in this study also suggests that internal learning factors remain central in determining academic creativity despite rapid technological advancement. Although AI technology can accelerate access to information and idea generation, the ability to critically evaluate, revise, and reconstruct information still depends on students' active participation in the learning process. This finding confirms that creativity in scientific writing is fundamentally a reflective and cognitive activity requiring intellectual involvement rather than mere technological dependence. Therefore, educational institutions should not only encourage the integration of AI into learning activities but also strengthen pedagogical approaches that promote critical thinking, reflective learning, and active academic participation among students.

The Simultaneous Effect of ChatGPT Use and Student Engagement

The results of the analysis of the third hypothesis (H3) indicate that the simultaneous use of ChatGPT and student engagement has a positive and significant effect on students' creativity in writing scientific articles. The magnitude of the simultaneous contribution, reaching 70.6%, indicates that these two variables together account for the majority of the variation in students' writing creativity. This finding is further supported by the F-test results, which show a significance level of less than 0.05; thus, it can be concluded that the simultaneous use of ChatGPT and student engagement has a significant effect on creativity in writing scientific articles. Additionally, the coefficient of determination (R^2) value of 0.706 indicates that 70.6% of the variation in students' writing creativity can be explained by the two independent variables used in the regression model.

Simultaneously, the research results show that technological ease will produce innovative written works only if balanced by critical reflection from its users. This can be observed in the simultaneous contribution value of 70.6%, which is greater than the partial effects of each variable, indicating that an increase in writing creativity occurs optimally when the use of ChatGPT is combined with student engagement simultaneously, rather than when either variable stands alone. This finding is strongly supported by previous studies revealing that intensive use of ChatGPT, coupled with high academic initiative, can produce more productive and high-quality scientific works (Sudrajat et al., 2024). This synergy also aligns with perspectives emphasizing the importance of integrating AI into scientific writing while balancing it with active student engagement to maintain students' scientific reasoning (Yasmine & Hikmawan, 2025).

The digital transformation occurring in this research reflects a global phenomenon in which AI technology has become an integral part of modern education to support productivity (Darwin et al., 2025; Farman et al., 2024). However, concerns remain that students may simply copy AI outputs without engaging in critical thinking (Romaniuk & Łukasiewicz-Wieleba, 2024). Therefore, the implications of these findings urge educational institutions to integrate AI technology ethically, potentially through adaptive AI-based feedback systems designed to strengthen rather than replace students' critical thinking processes in producing original and high-quality scientific articles (Alawad, 2025).

Upon further examination of the distribution of indicators across each variable, it is evident that several indicators show very high levels of agreement, thereby reinforcing the simultaneous influence of both variables on writing creativity. Regarding the ChatGPT usage

variable, the indicator for using ChatGPT to create summaries or study materials received the highest level of agreement, with a total of 80.34% of respondents stating they agreed or strongly agreed. Additionally, the indicator regarding the use of ChatGPT when facing difficulties starting the writing process also showed a high value of 79.92%, as well as the indicator that ChatGPT helps find ideas for scientific articles with a percentage of 78.20%. These findings indicate that one of ChatGPT's primary functions for students is to accelerate the process of exploring ideas and finding initial writing concepts more efficiently. This acceleration of the ideation process indirectly impacts the increase in students' productivity when writing scientific articles. With ChatGPT's assistance in generating alternative ideas, summarizing information, and structuring the initial outline of the text, students can save time during the early stages of writing, thereby having a greater opportunity to develop arguments, engage in critical reflection, and refine the article's content.

Meanwhile, regarding the student engagement variable, the indicator with the highest level of agreement was found in the activity of reviewing and revising writing based on ChatGPT's suggestions, with a total of 76.49% of respondents stating they agreed or strongly agreed. This indicates that students not only use ChatGPT as a tool for generating text but are also actively involved in evaluating, verifying the accuracy of information, and refining the structure of the generated text. Another indicator that also showed a high value was the use of ChatGPT to draft article outlines at 74.36%, indicating student engagement in the systematic planning and organization of ideas. These findings demonstrate that students' writing creativity is not solely generated by AI technology, but emerges from the interaction between the technology's ability to accelerate the ideation process and students' active engagement in examining, verifying, and developing those ideas. In other words, ChatGPT functions as a catalyst that accelerates the process of exploring ideas, while student engagement ensures that the resulting ideas still undergo a process of critical reflection and in-depth academic development.

From a broader educational perspective, the synergy between AI technology and student engagement reflects the emerging paradigm of human-centered artificial intelligence in higher education. In this paradigm, AI is not positioned as a replacement for human intellectual capacity but rather as a collaborative partner that supports learning effectiveness and academic productivity. The findings of this study imply that the successful implementation of AI in education depends not only on technological accessibility but also on students' readiness to engage critically and ethically with AI-generated information. Consequently, universities need to design adaptive learning environments that integrate AI literacy, academic ethics, and critical reasoning skills to ensure that technological innovation contributes positively to students' academic development and originality in scientific writing.

Conclusion

This study concludes that the use of ChatGPT has a positive and significant effect on students' creativity in writing scientific articles, with a contribution of 28.7%. ChatGPT serves as an academic facilitator that assists in idea development, paraphrasing, and drafting initial drafts. Additionally, student engagement also has a positive and significant effect and is the most dominant factor, contributing 59.4%. Engagement encompassing cognitive, affective, and behavioral aspects has been shown to foster the creation of more reflective, systematic,

and original writing. Simultaneously, the use of ChatGPT and student engagement exert a significant influence on writing creativity, contributing 70.6%. These findings confirm that the integration of AI technology, balanced with active student engagement, is a key factor in improving the quality of academic writing.

This study has limitations because it only examined direct effects between variables. Therefore, future research is recommended to develop more complex models, for example, by positioning student engagement as a mediating variable. Additionally, other variables such as digital literacy, self-regulated learning, and critical thinking can be considered to enrich future research models.

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