



ChatGPT as a Contemporary Learning Tool in the Digital Era: Enhancing Digital Literacy in Students' Scientific Writing

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Abstract. The presence of ChatGPT has led to a new trend in education, especially in student scientific writing. ChatGPT has the potential to significantly improve digital literacy and scientific writing skills, making it an interesting subject to research. This article aims to provide a quantitative description of student perceptions of using ChatGPT to enhance digital literacy in scientific writing. Data were collected through a Likert-scale questionnaire containing statements representing several indicators to gauge student perceptions. The results indicate that students perceive ChatGPT positively in enhancing overall digital literacy, improving information verification skills, increasing critical understanding, boosting confidence, and driving innovation and technology used in scientific writing. The study shows that using ChatGPT in scientific writing education not only aids in improving digital literacy skills but also makes learning methods in the digital era more effective. Integrating ChatGPT in education as a modern learning tool can create new opportunities and enhance the efficiency of scientific writing.

Keywords: Digital Literacy, Scientific Writing, ChatGPT, Student Perceptions

1 Introduction

Contemporary education in the 21st century is undergoing significant changes that alter how the educational process is viewed and implemented. These changes emphasize the importance of various aspects of education, such as increasing creativity and mastering computerised technology. Education today is not only limited to providing knowledge to learners but also teaching them to be creative and develop advanced literacy that is increasingly needed to deal with various cultural phenomena that dominate daily life [1].

The digital era is rapidly developing; technology has revolutionized human communication and learning [2]. In recent years, artificial intelligence (AI), specifically ChatGPT, has played an essential role in driving revolutionary changes in various industries and human culture globally. ChatGPT's interactive platform allows students to engage with advanced technology, encouraging personalized learning experiences and facilitating in-depth discussions. Unlike conventional learning, which is often static and unidirectional, ChatGPT offers a dynamic learning environment. Learners can ask questions, develop ideas, and receive informative and contextually relevant responses [3].

ChatGPT has transformed human communication and interaction, especially in the context of writing. During the learning process, ChatGPT promotes critical thinking by encouraging students to ask impactful questions and assess the accuracy and significance of answers. Natural language processing allows ChatGPT to simulate human-like conversations, offering an engaging and practical way to enhance the educational experience [4,5]. The emergence of ChatGPT signals a new phase in human-AI interaction, underscoring the importance of digital literacy skills. Digital literacy is essential today as it empowers individuals to engage with information through technology [6].

In the context of Indonesian language learning in higher education, ChatGPT represents a cultural revolution that enriches digital literacy and transforms learning methods, particularly in scientific writing. ChatGPT facilitates the generation of ideas for writing, the organization of articles, and quick access and verification of information. It improves access to essential sources and references. It helps people find reliable information and avoid inaccurate or biased sources. It also emphasizes the importance of critically evaluating online information [7,8]. This revolution creates new opportunities and combines modern technology with academic traditions, thus improving the efficiency of students' scientific writing process. It enhances their understanding of multiple perspectives and improves their digital literacy skills [9].

The root of literacy is *literate*, which means marked with letters, literate, or educated [10,11]. Literacy has evolved into the ability to understand and communicate in various ways. Literacy includes the ability of language users to use language well, including reading, writing, listening, and speaking. In addition, understanding, engaging, using, analyzing, and transforming texts is called literacy [12,13]. This confirms that literacy can cover a broader range of processes, including reading and writing, speaking, listening, imagining, and seeing [14].

Digital literacy encompasses various skills and practices essential for engaging in digital environments, including utilizing multiple technological tools and linguistic resources to interact and communicate [15,16]. Digital literacy goes beyond traditional skills such as reading, writing, composing, and interacting in digital environments. The Partnership for 21st Century Skills in the United States, for example, an organization that promotes the inclusion of skills in education, prepares students for life in the 21st century; these skills include information, media, and technology skills, also known as digital literacy [17]. Digital literacy, the ability to search, understand, evaluate, and create information using various digital technologies, has become an essential skill everyone must master. This condition is relevant to students adapting to an ever-changing learning environment. ChatGPT improves digital literacy and opens the door to understanding new cultures. This makes it more than just a tool; it becomes a dynamic learning companion [18].

A study comparing ChatGPT content with public educational resources shows that ChatGPT can improve digital literacy about health by making health information more accessible to read and access [19]. The results of another study mentioned that ChatGPT's performance in GIS exams illustrates its abilities and limitations in certain areas. This emphasizes that educators and practitioners must understand and overcome the difficulties in teaching spatial concepts for AI models. Based on this, the effect of ChatGPT on moral judgment emphasizes how vital digital literacy training is to reduce its negative impact on users' decision-making process [20,21].

ChatGPT helps improve college students' digital literacy from these various perspectives while maintaining the potential that requires responsible use.

Pegrum mentioned four skills in digital literacy: language, information, connection, and (re-)design [17]. These four digital literacy skills are translated into four indicators that describe students' perceptions of using ChatGPT to improve digital literacy in scientific writing. 1) Language-based literacy includes understanding and using online text, which relates to cognitive aspects because it involves understanding digital information. 2) Information-based literacy, which includes the skills of searching, evaluating, and managing information, corresponds to the critical aspect as it involves analyzing and evaluating information. 3) Connection-based literacy includes digital identity management and participation in online networks, reflecting the emotional aspect involving attitudes and feelings toward technology use. 4) (re-)design-based literacy includes creativity in creating and modifying digital content, corresponding to the innovative use aspect of technology. Thus, Pegrum's theory provides a strong basis for understanding and measuring students' perceptions of the use of ChatGPT in improving digital literacy. The novelty of this research is that this research has yet to examine these four factors of digital literacy. Overall, digital literacy encompasses critical, cognitive, and emotional aspects and is multifaceted in driving innovation and technology use [17, 22]. Thus, digital literacy is essential for success in the digital age.

2 Methods

This research falls into the quantitative research approach. The quantitative approach was chosen because it allows systematic data collection and objective statistical analysis. The research design used is a descriptive survey. Quantitative descriptive research is a method used to describe the phenomenon under study through numerical data collection with statistical analysis [23]. The population of this study was VI semester students in the Informatics Engineering Study Program, Indraprastha PGRI University Jakarta, who took Scientific Writing courses in the even semester of the 2023/2024 academic year. The sample selection technique with purposive sampling technique obtained a sample of 160 students who used ChatGPT in their scientific writing process, especially in the process of writing background problems.

The research instrument used was an indicator-based questionnaire to identify and describe students' perceptions of using ChatGPT to improve digital literacy in learning scientific writing. Four indicators were created based on Pegrum's four digital literacy skills. The survey was conducted by distributing questionnaires consisting of statements rated using a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Less Agree, 4 = Agree, 5 = Strongly Agree). The questionnaire used has been empirically tested through validity and reliability tests.

Table 1. Indicators of Student Perceptions of the Use of ChatGPT to Improve Digital Literacy in Scientific Writing.

Aspects of Digital Literacy	Number of questions
Cognitive aspects	5

Critical aspects	4
Emotional aspect	3
Aspects of innovative use of technology	3

3 Results

3.1 Results of the Validity and Reliability Test of the Student Perception Questionnaire on the Use of ChatGPT to Improve Digital Literacy in Scientific Writing

Validity Test. Research validity is defined as how well the measurement tool or tool used in research can precisely measure the intended variable or idea. The validity test is carried out to evaluate the ability of the measuring instrument to calculate the expected value. Ghozali [24] states that instrument validity is not always absolute but always relative, depending on the context and research population. A questionnaire is considered valid if it can explain the purpose of the questionnaire. To test the validity of this research, the *r* product moment is used to get the *r* count. If *r* count > *r* table, the questionnaire instrument is declared valid.

Table 2. Validity Test

Item	<i>r</i> count <i>product moment</i>	<i>r</i> table 5%	Description
P1	0,827493	0,1552	valid
P2	0,869393	0,1552	valid
P3	0,852667	0,1552	valid
P4	0,801632	0,1552	valid
P5	0,781362	0,1552	valid
P6	0,797523	0,1552	valid
P7	0,771321	0,1552	valid
P8	0,779917	0,1552	valid
P9	0,764535	0,1552	valid
P10	0,776048	0,1552	valid
P11	0,776048	0,1552	valid
P12	0,791099	0,1552	valid
P13	0,794266	0,1552	valid
P14	0,840603	0,1552	valid
P15	0,822818	0,1552	valid

Table 2 presents the results of the item validity test using the Pearson Product Moment correlation coefficient. This validity test aims to determine whether each item has sufficient validity. The calculated *r* value of each item is compared with the *r* table value at the 5% significance level ($\alpha = 0.05$). With a sample of respondents (*n* = 160) and degrees of freedom (*df* *n*-2) in the *r* product moment table with a

significance level of 5%, the r table value is 0.1552. According to Indrawan and Yaniawati, the item is declared valid if $r \text{ count} \geq r \text{ table}$ [25]. Table 2 above shows that the calculated r value is greater than the r table value at the 5% significance level for each statement in the questionnaire. Therefore, the statements listed on this research instrument are entirely valid. This shows that each item in the questionnaire can be used to measure the intended variable correctly so that the measurement results can be trusted. This high validity ensures that the data obtained accurately represents students' perceptions regarding using ChatGPT to improve digital literacy in scientific writing.

Reliability Test. Meanwhile, reliability is evidence that a measurement tool produces the same and stable results under the same conditions each time it is used. If a measuring instrument is considered reliable, the results will be uniform even if performed at different times or by others. In research, reliability refers to the extent to which an instrument or test produces consistent and reliable results when reused on the same subject or sample under the same conditions. Reliability is critical because reliable research will deliver consistent and dependable results. For reliability tests, a value close to one indicates high reliability, and if the value is more than 0.700, it is usually considered sufficient. The reliability coefficient value indicates empirically high or low reliability [26]. This research tool was tested for reliability using Cronbach's Alpha formula. Alpha values of more than 0.90 indicate perfect reliability; values between 0.70 and 0.90 indicate high reliability; values between 0.50 and 0.70 indicate moderate reliability; and values less than 0.50 indicate low reliability [27].

Table 3. Reliability Test

Item	<i>Cronbach's Alpha</i>	Description
P1	0,958	Reliable
P2	0,957	Reliable
P3	0,957	Reliable
P4	0,958	Reliable
P5	0,959	Reliable
P6	0,958	Reliable
P7	0,959	Reliable
P8	0,959	Reliable
P9	0,959	Reliable
P10	0,959	Reliable
P11	0,958	Reliable
P12	0,958	Reliable
P13	0,957	Reliable
P14	0,958	Reliable
P15	0,958	Reliable

Based on the results in Table 3, it can be stated that all research instruments are in the high or strong reliability category because the alpha value is > 0.90 . The research

instrument for student perceptions of the use of ChatGPT is valid and reliable. The high reliability provides confidence that this questionnaire will provide stable and consistent data for research on student perceptions of using ChatGPT to improve digital literacy in scientific writing.

3.2 Quantitative Descriptive Results of Student Perceptions of the Use of ChatGPT to Improve Digital Literacy in Scientific Writing

Table 4. Descriptive Statistics of Student Perceptions

Item	Mean	Median	Mode	Std. Deviation	N
P1	3,81	4,00	4	0,805	160
P2	3,85	4,00	4	0,818	160
P3	3,83	4,00	4	0,821	160
P4	3,96	4,00	4	0,827	160
P5	3,84	4,00	4	0,781	160
P6	3,68	4,00	4	0,894	160
P7	3,74	4,00	4	0,872	160
P8	3,70	4,00	4	0,823	160
P9	3,70	4,00	4	0,896	160
P10	3,73	4,00	4	0,859	160
P11	3,68	4,00	4	0,797	160
P12	3,66	4,00	4	0,831	160
P13	3,79	4,00	4	0,796	160
P14	4,01	4,00	4	0,813	160
P15	3,76	4,00	4	0,830	160

Table 4 presents descriptive statistics of students' perceptions of using ChatGPT to improve digital literacy for scientific writing. The data included mean, median, mode, standard deviation, and sample size (N=160) for the 15 perception indicators (P1 to P15), which were measured using a Likert scale. P1-P5 for indicators of cognitive aspects, P6-P9 for indicators of critical aspects, P10-P12 for indicators of emotional aspects, and P13-P15 for aspects of innovative use of technology. The cognitive aspect has a mean average of 3.86, indicating that students agree that ChatGPT helps in cognitive aspects such as understanding and using digital information. The critical aspect had a mean average of 3.71, indicating students' positive perceptions of ChatGPT's ability to help them analyze and evaluate information. Next, with a mean score of 3.69 for the emotional component, students feel at ease and confident when using ChatGPT. Then, the aspect of innovative use of technology has a mean average of 3.85, indicating that students consider ChatGPT to be helpful in the innovative use of technology in scientific writing.

Students' average score of above 3.5 across every aspect indicates that they generally perceive ChatGPT's utility for enhancing digital literacy. Higher Likert categories reflect more favourable impressions. Therefore, an average score above the midpoint—above three on a 5-point scale—can be interpreted as indicative of a positive perception [28]. It indicates that students consider ChatGPT a valuable tool for improving their digital literacy in scientific writing.

Based on the low standard deviation results (all below 1), it can be concluded that the respondents' responses are very consistent. This indicates that most students' perceptions of using ChatGPT to improve their digital literacy are almost the same. This consistency shows that the data collected is valid and indicates that the study results are reliable.

4 Discussion

Contemporary teaching techniques, such as technology-based learning and online learning environments, have significantly improved access to education worldwide. These strategies aim to make education more valuable and applicable so that students are better equipped to take advantage of the opportunities and overcome the challenges of the digital age. In addition, an essential component of digital literacy is using digital tools for tasks such as brainstorming, drafting and revising scientific papers. Digital literacy highlights the need to develop and master digital capabilities in the context of a digital society to participate critically and actively in the contemporary world. Students must possess digital literacy to effectively engage in an increasingly digitized academic and professional community.

Digital literacy is a comprehensive set of competencies that help one understand and utilize digital information effectively. In a higher education setting, this requires students to have the ability to access, assess and manage digital information wisely and ethically. The results of this study show that, in the cognitive aspect, students accept well ChatGPT as a learning tool that can improve their digital literacy through scientific writing. This indicates agreement that ChatGPT helps understand and utilize digital information. This is in line with the results of several studies that emphasize the cognitive benefits of ChatGPT in an educational context. The results of another study found that undergraduate students at the University of Jordan had good cognitive attitudes towards ChatGPT. They also recognized that ChatGPT can help with learning [29]. In addition, Kusworo et al. emphasized that ChatGPT is a valuable digital learning tool that allows students to complete cognitive tasks and increase their learning activities [30].

Furthermore, it also requires the ability to critically analyze the credibility and relevance of digital sources, utilize digital tools for research and communication, and understand ethical considerations surrounding digital information and technology. The results of this study show a positive perception from students towards ChatGPT's ability in the critical aspect. ChatGPT can help students analyze and evaluate digital information. The integration of ChatGPT into the field of education has shown promising results in improving students' critical digital literacy. This literacy includes students' ability to utilize digital tools for research and communication, understand ethical considerations about digital technologies and information, and identify the credibility and relevance of digital sources. For example, a study involving language learners and teachers found that ChatGPT can improve students' critical thinking and digital literacy, helping them find their way around digital information more easily [31]. Other research results mentioned ChatGPT as a valuable tool for saving time and improving the efficiency of the writing process. However, the study also emphasized that students should learn to compare, contrast, and synthesize data from multiple sources to overcome concerns about the quality and credibility of the data

ChatGPT provides [32]. Furthermore, a study confirmed that higher levels of digital literacy significantly improved how students search for information. This suggests that it is done to critically evaluate multiple sources and improve the quality of students' research [33].

Furthermore, the results of this study also show that students generally feel comfortable and confident when using ChatGPT. This result is in line with the results of several previous studies. Rhee et al. found that students were delighted when using ChatGPT. The study results mentioned that students would use ChatGPT more often in the future [34]. This research is supported by other studies which show that perceived usefulness and ease of use significantly influence students' behavioural intention to continue using ChatGPT. This indicates a positive emotional response to this artificial intelligence technology [35].

The last aspect examined in this study was innovative use of technology. The average score for this aspect indicator of 3.85 indicates that students positively perceive the use of ChatGPT as an innovative use of technology that helps them, especially in scientific writing. The study's results mentioned that ChatGPT was positively received. In general, the study underscored the transformative potential of ChatGPT in improving education, reflecting the aspect of innovative use of technology [36].

The results showed positive perceptions from students that ChatGPT helps improve digital literacy in various aspects, such as cognitive, critical, emotional, and innovative. The integration of ChatGPT into the educational context helps understand and utilise digital information and encourages critical analysis and creative application of digital tools. Improving digital literacy in these various aspects is crucial to preparing students to thrive in an increasingly digitized environment in the academic and professional world. Students had favourable perceptions and experiences with ChatGPT, suggesting that ChatGPT is a transformative educational tool that can significantly improve learning outcomes if used correctly. Therefore, wise and innovative use of technology such as ChatGPT is essential as digital literacy becomes increasingly important in the modern world.

5 Conclusion

ChatGPT has a vital role in facilitating the development of students' digital literacy, particularly in scientific writing. As an advanced artificial intelligence technology, ChatGPT increases the amount of information available to students and improves how they process, understand and apply that information ethically and critically within an academic framework. It significantly enhances students' digital literacy by assisting with writing structure and idea generation, providing easy access to relevant information, and improving the ability to assess and verify data. ChatGPT has been associated with improved academic collaboration and learning quality, encouraging a more creative and student-centred approach to teaching [37]. The integration of ChatGPT in learning scientific writing at the higher education level enriches digital literacy and changes how students interact with information to develop their scientific work. This promotes a modern cultural revolution in higher education that combines advanced technology with academic tradition.

Furthermore, incorporating ChatGPT into the teaching and learning process introduces a new dimension to student-centred education, making it more flexible and responsive to contemporary needs and challenges. The integration of ChatGPT into education represents an evolution in teaching methods, with this AI technology becoming a pivotal element in pedagogical development [38]. ChatGPT enhances critical and creative skills through dynamic and contextualized interactions, shifting the traditional educational paradigm towards greater interactivity and integration of modern technology. Consequently, ChatGPT serves as a tool and an essential component of a contemporary learning culture, equipping students to succeed in a world increasingly dependent on digital capabilities. This suggests that the strategic use of ChatGPT in higher education is vital for enhancing students' digital literacy and preparing them to navigate an ever-evolving world.

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