

Examining the Relationship between Writing Habits, Digital Literacy, and Students' Perceptions in AI Writing Feedback and Critical Writing Skills among Senior High School Students

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Abstract

This study examined how writing habits mediate the relationship between digital literacy, students' perceptions of AI writing feedback, and critical writing skills among senior high school students. Anchored in the sociocognitive theory of writing, the research explored the interaction of cognitive, behavioral, and technological factors in writing development. A descriptive correlational design was employed involving 167 Grade 11 Humanities and Social Sciences students from a private Catholic institution. Data were collected using validated Likert-scale questionnaires and a rubric-based writing task, and analyzed through descriptive statistics, multiple regression, and structural equation modeling (SEM). Findings revealed that students demonstrated high perceptions of AI writing tools in terms of usefulness and ease of use, but only moderate trust. Writing habits and digital literacy were rated high to very high, while critical writing skills were at an approaching proficient level across clarity, reasoning, analysis, and reflection. Results further showed that digital literacy and perceptions of AI significantly influence writing habits; however, these variables do not directly predict critical writing skills. The best-fitting structural model indicated that critical writing development is primarily associated with higher-order cognitive processes rather than routine writing practices alone. The study concludes that while AI tools and digital competence enhance writing engagement, the development of critical writing skills requires deliberate cognitive and instructional support. It recommends strengthening explicit instruction in higher-order thinking, integrating AI tools critically, and designing curricula that emphasize reasoning and reflection. The study aligns with SDG 4 (Quality Education) by promoting inclusive and effective digital learning practices. It contributes to sustainability by supporting responsible AI integration, strengthening institutional teaching practices, and developing critical competencies essential for academic success and future employability.

Keywords: Artificial intelligence writing feedback, Critical writing skills, Digital literacy, Senior high school students, Structural equation modeling, Writing habits

1. Introduction

This study examines how writing habits mediate the relationship between digital literacy, students' perceptions of AI writing feedback, and critical writing skills among senior high school students. With the growing integration of Artificial Intelligence (AI) in education, particularly in writing instruction, there is a need to understand how technological, cognitive, and behavioral factors interact to influence higher-order writing competencies. While AI tools improve efficiency and technical accuracy, concerns remain regarding their impact on critical thinking, autonomy, and deep learning. This research addresses these concerns by investigating the interplay of these variables within the Philippine senior high school context.

1.1 Background of Senior High School Students' Critical Writing Skills in the Context of AI Writing Feedback, Digital Literacy, and Writing Habits

The integration of Artificial Intelligence (AI) in education has transformed writing instruction by providing immediate feedback, vocabulary suggestions, and structural improvements. These advancements aim to enhance academic performance through efficiency and innovation. However, disparities in access, digital skills, and teacher familiarity with AI tools exist among Filipino senior high school students. Writing habits such as planning, revising, and consistent practice remain essential for developing clarity, reasoning, and analytical thinking (Graham, 2020; Shen & Teng, 2024). While AI feedback can improve writing mechanics, excessive reliance may reduce higher-order thinking skills (Octoberlina et al., 2024). Digital literacy plays a critical role in enabling students to evaluate and apply AI-generated feedback effectively (Celik, 2023). Students' perceptions of AI—particularly usefulness, ease of use, and trust—also influence their engagement and dependence on such tools (Campos, 2025). Although AI enhances organization and accuracy, it may limit independent thinking if overused (Shen & Teng, 2024). Despite growing adoption, limited empirical studies examine how writing habits, digital literacy, and AI perceptions collectively influence critical writing skills, especially in the Philippine senior high school context (Kasneci et al., 2023; Zhai & Wibowo, 2023).

1.2 Themes on Writing Habits, Digital Literacy, AI Writing Feedback Perceptions, and Critical Writing Skills

Literature consistently highlights that AI writing tools improve clarity, organization, and argumentation depth (Minh, 2024). However, their contribution to deep analytical thinking remains limited, with overreliance potentially reducing originality and critical engagement (Pervaiz et al., 2025; Ziar, 2025). Critical writing skills include clarity of expression, evidence-based reasoning, logical reasoning, analysis and evaluation, and reflective thinking. AI tools support clarity and structure (Sangadji et al., 2025; Mohammed & Mohammed, 2025) but are less effective in fostering higher-order reasoning. Evidence-based reasoning requires evaluating and integrating credible sources (List & Alexander, 2020), while digital literacy supports critical evaluation of AI-generated content (Kim & Lee, 2023). Logical reasoning and argumentation benefit from AI-supported structuring but may weaken if students rely passively on suggestions (Rusdin et al., 2023). Analysis and evaluation improve when AI feedback encourages reflection rather than direct answers (Zhai, 2022). Reflective thinking develops when students actively engage with feedback and apply metacognitive strategies (Shen & Teng, 2024; Gonsalves, 2024). Writing habits—writing frequency, revision practices, and planning—are critical in translating feedback into improved writing outcomes (Teng & Yue, 2023). AI tools enhance these habits by providing immediate feedback and supporting iterative writing processes (Nasution et al., 2025; Guo et al., 2024). Digital literacy, including technical proficiency and adaptability, enables students to effectively use AI tools (Tinmaz, 2023; Celik, 2023). Students with higher digital literacy demonstrate better critical evaluation and engagement with feedback (Dharmayanti et al., 2024). Students' perceptions of AI—usefulness, ease of use, and trust—strongly influence technology adoption and engagement (Davis, 1989; Zhang & Hyland, 2023). Positive perceptions enhance motivation and writing improvement, while skepticism promotes critical evaluation of feedback (Venkatesh et al., 2020).

1.3 Local, National, and Global Context of AI Writing Feedback, Digital Literacy, and Writing Habits among Senior High School Students

Globally, AI tools such as ChatGPT, Grammarly, and QuillBot are widely used to support writing development, improving grammar, coherence, and organization (Minh, 2024; Sangadji et al., 2025). However, studies across different countries highlight concerns about reduced critical engagement and overdependence on AI (Pervaiz et al., 2025; Rusdin et al., 2023). Nationally, Philippine education faces challenges in equitable access to technology and varying levels of digital literacy. Locally, studies show that Filipino students benefit from AI tools in improving proofreading and writing efficiency but may become overly reliant on automated corrections (Francisco, 2024). These contexts emphasize the need to balance AI integration with critical thinking development, particularly in developing countries where access and digital competencies vary significantly.

1.4 Theoretical Basis of Writing Habits as a Mediator between Digital Literacy, AI Writing Feedback Perceptions, and Critical Writing Skills

This study is anchored in the Socio-Cognitive Theory of Writing (Flower & Hayes, 1981), which conceptualizes writing as a recursive cognitive process involving planning, translating, and reviewing. The theory explains how writing habits mediate the relationship between digital literacy, AI perceptions, and critical writing skills. Supporting theories include the Technology Acceptance Model (Davis, 1989), which explains technology adoption based on perceived usefulness and ease of use; Self-Efficacy Theory (Bandura, 1978), which highlights the role of confidence in learning engagement; and Expectancy Value Theory (Wigfield & Eccles, 2000), which explains motivation based on perceived success and task value. Together, these frameworks explain how cognitive processes, motivation, and technological engagement interact to shape writing development.

1.5 Research Gaps on the Interrelationship of Writing Habits, Digital Literacy, AI Writing Feedback Perceptions, and Critical Writing Skills

Existing studies often examine AI feedback, digital literacy, and writing skills independently, with limited research on their combined effects, particularly in senior high school contexts and developing countries (Kasnezi et al., 2023; Zhai & Wibowo, 2023). There is also insufficient understanding of how writing habits function as a mediating mechanism linking technological and cognitive factors to critical writing outcomes. Additionally, most studies focus on higher education, leaving gaps in secondary education research. This study addresses these gaps by examining the integrated relationships among writing habits, digital literacy, AI perceptions, and critical writing skills within the Philippine senior high school context.

1.6 Alignment of the Study on AI Writing Feedback, Digital Literacy, and Critical Writing Skills with SDG 4 (Quality Education)

This study aligns with SDG 4 – Quality Education, which aims to ensure inclusive and equitable education and promote lifelong learning (UN DESA, 2020). By exploring how AI tools can enhance writing skills while maintaining critical thinking, the study contributes to improving educational quality and digital learning practices.

1.7 Importance of the Study on AI Writing Feedback, Digital Literacy, Writing Habits, and Critical Writing Skills to Multidisciplinary Sustainability

This research contributes to educational sustainability by promoting effective integration of AI in learning without compromising critical thinking. It supports technological and digital sustainability by encouraging responsible and critical use of AI tools. Additionally, it contributes to socio-economic sustainability by enhancing students' competencies in critical writing, which are essential for academic success and future employability. The study also supports innovation and digital sustainability by providing evidence-based recommendations for integrating AI in education while fostering independent learning and cognitive development.

2. Material and methods

2.1 Research Design

This study employed a descriptive correlational design to examine the relationships among senior high school students' writing habits, digital literacy, perceptions of AI writing feedback, and critical writing skills. This design was appropriate because it investigates naturally occurring relationships without manipulation of variables. It enables the observation of real educational contexts and the identification of patterns reflecting actual learning experiences. As noted by Capinding (2023), this approach systematically measures associations among variables as they exist in authentic settings. It also allows the generation of insights into how behavioral, technological, and perceptual factors interact in shaping writing performance.

2.2 Locale of the Study

The study was conducted in a private Catholic institution located in Cagayan de Oro City. The setting provided a technology-integrated learning environment where senior high school students are regularly exposed to AI-assisted writing tools and digital platforms, making it appropriate for examining the variables under investigation.

2.3 Respondents of the Study

The respondents consisted of Grade 11 Senior High School students under the Humanities and Social Sciences (HUMSS) strand enrolled during the academic year 2025–2026. These students were selected because they are actively engaged in writing tasks and utilize digital tools for academic purposes, providing a relevant population for analyzing the relationship between writing habits, digital literacy, AI feedback perceptions, and critical writing skills.

2.4 Sample and Sampling Procedure

The study utilized stratified sampling to ensure proportional representation across relevant subgroups such as academic strand, gender, and writing proficiency levels. Within each stratum, participants were randomly selected to minimize bias and ensure fairness. The sample size was determined using standard statistical formulas to achieve adequate representation and reliability of results. This procedure ensured that the collected data reflected a balanced and accurate representation of the target population, allowing for meaningful analysis of relationships among variables.

2.5 Research Instrument

The study used modified Likert-scale questionnaires to measure writing habits, digital literacy, students' perceptions of AI writing feedback, and critical writing skills. The instrument for critical writing skills was adapted from Zhang (2025) and supported by established frameworks focusing on clarity of expression, evidence-based reasoning, logical reasoning, analysis and evaluation, and reflective thinking. Writing habits were measured using items adapted from Pathan (2025), covering writing frequency, planning and outlining, and revision practices. Digital literacy items were adapted from Afandi et al. (2024), assessing technical proficiency and adaptation to new technology. Students' perceptions of AI writing feedback were measured using a modified version of the Marquette University Office of International Education (2008) ESLP 82 Questionnaire, focusing on perceived usefulness, ease of use, and trust in feedback. All instruments underwent expert validation and pilot testing with 30 non-participant students to ensure clarity, relevance, and reliability. Reliability testing using Cronbach's alpha yielded a value of 0.77, indicating acceptable internal consistency (Bujang et al., 2024).

2.6 Data Gathering Procedure

The study followed ethical standards and obtained approval from the Research Ethics Committee of the institution. Permission was secured from the school administration prior to data collection. Participation was voluntary, and informed consent was obtained in accordance with the Belmont Report principles of Respect for Persons, Beneficence, and Justice (National Commission, 1979). Data were collected through face-to-face administration of standardized questionnaires within the school premises. The researcher explained the purpose, procedures, and participants' rights before distribution to ensure accurate and informed responses. Questionnaires were completed independently in a supervised setting and collected immediately after completion. Confidentiality and data privacy were strictly maintained in compliance with the Data Privacy Act of 2012. Responses were anonymized, securely stored, and accessible only to authorized individuals. No identifying information was collected, and all data were used solely for academic purposes.

2.7 Data Analysis Techniques

Descriptive statistics, including mean and standard deviation, were used to summarize participants' writing habits, digital literacy, perceptions of AI writing feedback, and critical writing skills. These measures provided an overview of trends and distributions within the dataset. Inferential analysis was conducted to examine relationships among variables. Multiple regression analysis was used to determine the predictive effects of writing habits, digital literacy, and AI feedback perceptions on critical writing skills. Structural Equation Modeling (SEM) was then employed to assess both direct and indirect relationships and to identify the best-fitting model. Model fit was evaluated using indices such as RMSEA, CFI, TLI, and NFI. All statistical analyses were conducted at a significance level of $p < 0.05$.

3. Results and Discussion

3.1 Perceptions of AI Writing Tools

3.1.1 Perceived Usefulness

The results show that students demonstrated a high level of perceived usefulness of AI writing tools ($M = 3.87$, $SD = 0.63$). Most participants rated usefulness as high to very high, indicating that AI tools support revision, clarity, and efficiency in writing tasks. The highest-rated aspects include encouraging thorough revision, improving task completion speed, and enhancing clarity of ideas, while relatively lower ratings were observed in confidence, long-term improvement, and academic performance. These findings suggest that students value AI tools primarily for process-oriented benefits rather than long-term developmental outcomes. This aligns with Holmes et al. (2022), who emphasized that AI tools enhance learning through immediate and adaptive feedback. Similarly, Graham (2020) highlighted the importance of feedback in strengthening revision practices, while Ranieri (2021) noted that technology often influences procedural aspects more than affective outcomes.

3.1.2 Ease of Use

Students reported a high level of ease of use ($M = 3.90$, $SD = 0.60$), indicating that AI writing tools are accessible, user-friendly, and manageable. Most participants experienced minimal technical difficulty, particularly in system simplicity, navigation, and clarity of feedback, although minor concerns were noted regarding system responsiveness and independence in use. This suggests that usability plays a crucial role in technology adoption. Crompton and Burke (2023) emphasized that intuitive systems increase user engagement, while Grassini (2023) explained that user-friendly design promotes acceptance of AI tools. The findings also support Tlili et al. (2023), who noted that system stability and transparency influence sustained use of educational technologies.

3.1.3 Trust in Feedback

The findings indicate a moderate level of trust in AI feedback ($M = 3.43$, $SD = 0.51$), with most students cautiously relying on AI suggestions. While students recognize the credibility and usefulness of AI during revision, concerns remain regarding consistency and reliability. This pattern reflects a balanced perspective where students value AI but still critically evaluate its outputs. Sun et al. (2021) emphasized that trust affects the extent to which learners use AI feedback, while Chen et al. (2022) noted that students still prioritize human judgment. This cautious stance aligns with technoskepticism, as explained by Venkatesh et al. (2020), where users acknowledge benefits but remain critical of automated systems.

3.1.4 Overall Perception of AI Writing Tools

Overall, students demonstrated a high perception of AI writing tools ($M = 3.74$), with strong ratings for usefulness and ease of use but moderate trust. This indicates that while AI tools are widely accepted and valued for efficiency and accessibility, trust remains a limiting factor. Zhao et al. (2021) and Deng and Yuen (2021) support the usefulness of AI in improving writing, while Holstein et al. (2020) and Heil and Poyas (2023) highlight that trust depends on reliability and transparency.

3.2 Writing Habits

3.2.1 Writing Frequency

Students demonstrated a high level of writing frequency ($M = 3.87$, $SD = 0.52$), indicating regular engagement in writing across academic and everyday contexts, particularly in functional writing such as emails, notes, and social media communication. This suggests that frequent writing supports language development and engagement. Alharthi (2021) emphasized that regular writing enhances proficiency, while Pathan (2025) linked frequent writing to improved performance. However, lower engagement in reflective writing aligns with Aksakalli and Daşer (2025), who found that students prefer functional over expressive writing.

3.2.2 Revision Practices

Students showed strong engagement in revision practices ($M = 4.16$, $SD = 0.49$), particularly in improving clarity, correcting errors, and refining sentence structure. However, slightly lower engagement was observed in multi-draft revision and AI-assisted editing. This indicates that students actively revise but may not fully utilize iterative revision or digital tools. Li and Graves (2020) emphasized the role of revision in writing development, while Tian et al. (2022) highlighted its contribution to self-regulated learning.

3.2.3 Planning and Outlining

Planning and outlining were also rated high ($M = 3.91$, $SD = 0.58$), with strong emphasis on brainstorming, organizing ideas, and structuring compositions, but lower use of structured techniques such as goal-setting and graphic organizers. This suggests that students engage in informal planning more than structured strategies. Fan (2024) and Abdelaty et al. (2025) emphasized that planning improves organization and coherence, while Tian et al. (2022) noted that structured planning enhances writing performance.

3.2.4 Overall Writing Habits

Overall writing habits were rated high ($M = 3.98$), with revision practices as the strongest component. This indicates a balanced writing process combining planning, drafting, and revision. Research confirms that integrated writing habits contribute to writing proficiency and self-regulated learning (Abdelaty et al., 2025; Fan, 2024; Li & Graves, 2020; Tian et al., 2022).

3.3 Digital Literacy

3.3.1 Technical Proficiency

Students demonstrated a very high level of technical proficiency ($M = 4.70$, $SD = 0.39$), indicating strong competence in operating digital devices and applications. This reflects familiarity with digital environments and foundational digital skills. Son et al. (2020) and Yuan et al. (2025) emphasized that technical proficiency supports engagement in digital learning, although Getenet et al. (2024) noted that security-related skills are often less developed.

3.3.2 Adaptation to New Technology

Students also showed high adaptability ($M = 4.42$, $SD = 0.50$), indicating the ability to learn new tools, collaborate digitally, and practice responsible technology use. This suggests readiness for evolving digital environments. Chen (2025) emphasized the importance of adaptability, while Yuan et al. (2025) linked it to engagement and performance.

3.3.3 Overall Digital Literacy

Overall digital literacy was very high ($M = 4.56$), reflecting strong technical and adaptive competencies. This indicates that students are well-equipped to engage in technology-supported learning. Research confirms that digital literacy enhances academic outcomes and digital self-efficacy (Yuan et al., 2025; Fu et al., 2025).

3.4 Critical Writing Skills

3.4.1 Clarity of Expression

Students demonstrated an approaching proficiency level ($M = 3.39$), with many able to express ideas but still facing challenges in organization and precision. This reflects typical second-language writing development. Nunan and Choi (2023) and Prilutskaya and Knoph (2020) emphasized challenges in clarity due to linguistic and structural limitations.

3.4.2 Evidence-Based Reasoning

Evidence-based reasoning was also at an approaching proficiency level ($M = 3.22$), indicating difficulty in supporting claims with credible evidence. This suggests the need for stronger instruction in argument development. Liu and Stapleton (2020) and Noroozi et al. (2020) emphasized the importance of integrating evidence effectively.

3.4.3 Logical Reasoning

Logical reasoning showed approaching proficiency ($M = 3.32$), with challenges in maintaining coherent arguments. This aligns with findings by Peng and Bao (2023) and Cheong et al. (2021), who highlighted difficulties in structuring arguments in second-language contexts.

3.4.4 Analysis and Evaluation

Students demonstrated moderate ability in analysis and evaluation ($M = 3.24$), indicating developing higher-order thinking skills. Yang (2025) and Teng & Yue (2022) emphasized that analytical writing requires metacognitive strategies and structured instruction.

3.4.5 Reflective Thinking

Reflective thinking was also at an approaching proficiency level ($M = 3.23$), with many students still developing deeper reflection skills. Chen et al. (2026) and Pereles et al. (2024) highlighted the role of reflection and metacognition in strengthening critical writing.

3.4.6 Overall Critical Writing Skills

Overall, critical writing skills were at an approaching proficiency level ($M = 3.28$), indicating developing but not yet fully mastered competencies. This reflects the need for instructional support focusing on metacognition, argumentation, and critical thinking (Qin et al., 2022; Khosravi et al., 2023; Abrami et al., 2015).

3.5 Structural Model of Critical Writing Skills

The results showed that preliminary analyses revealed no significant direct relationships among variables. However, structural equation modeling demonstrated that Model 1 achieved acceptable fit, while Model 2 showed superior fit across all indices. These findings indicate that critical writing skills are influenced by complex, mediated relationships rather than direct effects. Model 2 showed that perception of AI writing tools and digital literacy significantly influence writing habits, but writing habits do not directly predict critical writing skills. This supports sociocognitive theory, which explains that learning outcomes result from interactions among cognitive, behavioral, and environmental factors. Brown (2022) and Sathyanarayana & Mohanasundaram (2024) emphasized the importance of multiple fit indices in validating models. The findings further show that writing habits function as a mediating variable, linking technological perceptions and digital competence to writing engagement. However, higher-order writing skills require deeper cognitive processes such as reasoning, evaluation, and reflection (List & Alexander, 2020). Regression results confirm that perception of AI writing tools and digital literacy significantly influence writing habits, while writing habits do not significantly predict critical writing skills. This indicates that engagement alone is insufficient without cognitive and instructional support (Escalante, Pack, & Barrett, 2023; Bećirović, Polz, & Tinkel, 2025; Anggraeni et al., 2025). Overall, Model 2 best explains the relationships among variables, rejecting the null hypothesis and confirming that critical writing development follows an indirect, behaviorally mediated pathway. This highlights the importance of combining technology use, digital literacy, and structured instructional strategies to enhance higher-order writing skills.

4. Conclusion & Recommendations

The study found that senior high school students demonstrated high perceptions of AI writing tools in terms of usefulness and ease of use, but only moderate trust, indicating cautious reliance on automated feedback. Students also exhibited high writing habits and very high digital literacy, reflecting strong engagement in writing activities and competence in using digital technologies. However, their critical writing skills remained at an approaching proficient level across clarity of expression, evidence-based reasoning, logical reasoning, analysis and evaluation, and reflective thinking, suggesting that higher-order writing competencies are still developing. The findings further revealed that while perception in AI writing and digital literacy significantly influence writing habits, they do not directly predict critical writing skills. Instead, Model 2 emerged as the best-fitting model, confirming that critical writing development is primarily associated with higher-order cognitive processes rather than routine writing practices alone, supporting the Sociocognitive Theory of Writing.

The study recommends that English teachers strengthen explicit instruction in higher-order writing skills such as analysis, evaluation, logical reasoning, and reflective thinking, while integrating AI tools in a structured manner that promotes critical evaluation rather than passive use. Schools should support professional development and establish policies that ensure ethical and effective use of AI in writing instruction, while curriculum developers should design materials and assessments that emphasize argument development, evidence integration, and reflective writing. Additionally, future researchers are encouraged to explore other variables influencing critical writing skills and to conduct experimental studies examining the effectiveness of structured interventions and AI-assisted writing programs.

The study was limited to Grade 11 HUMSS students from a single private Catholic institution in Cagayan de Oro City, which may restrict the generalizability of the findings to other contexts. The use of a descriptive correlational design also limits the ability to establish causal relationships among variables. Furthermore, while writing habits, digital literacy, and perceptions of AI writing were examined, other potential factors influencing critical writing skills, such as instructional strategies, motivation, and feedback quality, were not included and may require further investigation.

Compliance with ethical standards

This study adhered to established ethical standards in the conduct of research involving human participants. Ethical approval was obtained from the Research Ethics Committee of the institution, and permission was secured from the school administration prior to data collection. Participation was voluntary, and informed consent was obtained in accordance with the Belmont Report principles of Respect for Persons, Beneficence, and Justice (National Commission, 1979). Confidentiality and data privacy were strictly maintained through anonymization, secure data storage, and restricted access, in compliance with the Data Privacy Act of 2012.

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