



Research Article

Artificial Intelligence Dependency as a Predictor of Perceived Reading Comprehension Barriers Among Senior High School Students in the Philippines

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Abstract. This study examined the relationship between artificial intelligence (AI) dependency and perceived reading comprehension barriers among senior high school students in the Philippines. Although AI tools are increasingly used for academic tasks, empirical evidence on whether dependency is associated with students' perceived reading-related difficulties remains limited, particularly in the Philippine senior high school context. This study used a quantitative, non-experimental correlational-predictive design with 319 students. Data were analyzed using mean, standard deviation, Pearson's r , and simple linear regression. AI dependency in reading, writing, and numeracy was moderate ($M = 3.20$, $SD = 0.66$). Perceived reading comprehension barriers were also moderate ($M = 3.16$, $SD = 0.78$). AI dependency was positively and significantly associated with perceived reading comprehension barriers, $r = .58$, $p < .001$. Regression analysis showed that AI dependency significantly predicted perceived barriers, $B = 0.68$, $\beta = .58$, $t(317) = 12.68$, $p < .001$, $R^2 = .34$, indicating that AI dependency accounted for 33.6% of the variance in the outcome. The finding should not be interpreted causally and does not indicate improved reading performance because no objective comprehension test was administered. The results highlight the need for guided AI use, explicit reading-strategy instruction, and further research using objective comprehension measures and longitudinal or experimental designs.

Keywords: Artificial intelligence dependency; Perceived reading comprehension barriers; Senior high school students; Philippines; SDG 4.

Reading comprehension is an active and multidimensional process through which learners construct meaning from written texts by integrating linguistic knowledge, background knowledge, cognitive processes, and engagement with reading. Difficulties may arise when learners struggle with vocabulary, grammar, discourse processing, background knowledge, motivation, or other factors that support meaning-making (Cain & Oakhill, 2021; Duke et al., 2021). Recent research likewise shows that reading comprehension difficulties vary across learners and are shaped by interacting cognitive and linguistic factors (De Oliveira et al., 2023; Wang & Hung, 2025). These findings support examining reading difficulties not only as a single skill deficit but also as a multidimensional learner experience.

The multidimensional nature of reading difficulties is also evident in studies of secondary and senior high school learners. Kandisa et al. (2025) reported difficulties involving vocabulary, identifying main ideas, making



inferences, and understanding detailed information among senior high school students. Wang and Hung (2025) similarly found that content-area knowledge, vocabulary, and reading fluency were associated with different profiles of reading comprehension difficulty among adolescents. Such evidence suggests that students may encounter different combinations of barriers depending on their linguistic knowledge, prior experiences, cognitive resources, and engagement with reading.

In the Philippine context, the concern is particularly important. PISA 2022 results continued to show that Filipino 15-year-old students performed below the OECD average in reading, indicating persistent challenges in reading literacy (Organization for Economic Co-operation and Development [OECD], 2023). National literacy evidence also shows continuing gaps: the Philippine Statistics Authority (2025a) reported that while basic literacy remained high, functional literacy was lower, indicating that the ability to use literacy skills effectively remains a concern. In Davao Region, the Philippine Statistics Authority (2025b) likewise reported a gap between basic and functional literacy among residents aged 10–64. These data provide a relevant context for examining factors associated with students' perceived reading difficulties in the Philippine setting.

Researchers have traditionally examined the continuing challenge of reading comprehension through vocabulary, fluency, grammar, background knowledge, reading motivation, and related cognitive and affective factors (Li et al., 2022; Kandisa et al., 2025). At the same time, the rapid development of digital technologies has introduced new factors that may shape how students access, process, and construct knowledge. Artificial intelligence (AI) tools such as chatbots, text summarizers, writing assistants, and intelligent tutoring systems can provide explanations, translations, summaries, examples, and feedback. However, their increasing use also raises concerns about over-reliance when students use AI as a substitute for independent reading, analysis, and evaluation (Zhai et al., 2024; Tian & Zhang, 2025).

The present study is informed by Vygotsky's Sociocultural Theory, which views learning and cognitive development as processes mediated by social interaction, language, and cultural tools (Vygotsky, 1978). In this study, AI is treated as a contemporary mediating tool that may provide explanations, feedback, and other forms of assistance during academic work. AI dependency is operationally defined as the extent to which students rely on AI tools when performing academic tasks in the domains of reading, writing, and numeracy, based on the adapted instrument of Capinding (2024). This operational definition focuses on reported reliance on AI rather than the time spent using AI or the quality of AI outputs.

The same theoretical perspective also permits a more cautious interpretation of excessive dependence. Mediating tools may provide support, but heavy reliance may reduce opportunities for students to practice the cognitive processes needed to construct meaning independently. Recent evidence illustrates this concern. Zhai et al. (2024) found that overreliance on AI dialogue systems may be associated with adverse cognitive outcomes, while Bastani et al. (2025) reported that unrestricted generative AI access can undermine learning under certain conditions. Tian and Zhang (2025) likewise identified mechanisms through which AI dependence may relate to fatigue and critical-thinking processes. These findings counter studies reporting beneficial effects of structured AI interventions and underscore the importance of examining how AI dependency relates to perceived reading barriers, rather than if AI use necessarily improves comprehension.

This issue is particularly important among senior high school students because they are expected to demonstrate increasingly advanced literacy, analytical, and critical-thinking skills. AI may support learning when it is used as a scaffold, but dependence may also coexist with greater difficulty when students turn to AI for tasks they would otherwise perform independently. Experimental and review evidence shows that structured AI interventions can produce learning benefits, but such findings do not establish that greater self-reported dependency improves comprehension (Deng et al., 2025; Zheng, 2024). Therefore, the present study focuses on the statistical association between AI dependency and perceived reading comprehension barriers.

The research gap is more specific than the general absence of AI-and-reading research. Pondang et al. (2025) examined AI application dependency and comprehension skills among Philippine HUMSS students, while Capinding (2024) developed and validated the 3R's AI dependency questionnaire, which serves as the basis for the present predictor measure. The present study adds evidence from a broader senior high school population in a private school in Davao City and focuses on perceived reading comprehension barriers as the measured

outcome. It also examines whether the observed association remains significant in a predictive model. At the same time, the study acknowledges counter-evidence on AI over-reliance (Bastani et al., 2025; Zhai et al., 2024), allowing the present result to be interpreted as an association rather than evidence that AI improves reading ability.

Thus, this study examines whether AI dependency is significantly associated with and statistically predicts perceived reading comprehension barriers among senior high school students. AI dependency is examined in terms of reading, writing, and numeracy, while the outcome is operationalized using perceived barriers and factors related to reading comprehension: vocabulary barriers, grammar barriers, discourse barriers, cultural background barriers, psychological barriers, and reading-interest factors. The study is aligned with Sustainable Development Goal 4 (SDG 4), which calls for inclusive and equitable quality education and opportunities for lifelong learning (United Nations, 2015). Understanding the relationship between AI dependency and perceived reading comprehension barriers may help teachers and schools design responsible AI-use guidance, strengthen independent reading strategies, and identify areas where students may need additional support. The study therefore contributes contextual evidence for educational decision-making while avoiding causal claims that cannot be supported by the cross-sectional design.

Methodology

Research Design

This study employed a quantitative, non-experimental correlational-predictive design. The correlational component was used to determine whether a significant relationship existed between AI dependency and perceived reading comprehension barriers. The predictive component was used to determine whether AI dependency statistically predicted variation in the perceived-barriers outcome. No variable was manipulated, and no intervention was administered; therefore, the design does not support causal conclusions. AI dependency served as the predictor variable, while perceived reading comprehension barriers served as the outcome variable. AI dependency refers to students' reported reliance on AI tools for academic activities in reading, writing, and numeracy, based on the adapted Capinding (2024) measure. The outcome refers to students' self-reported barriers and related factors associated with reading comprehension based on the adapted Tambis et al. (2023) instrument. Because the outcome is self-reported, the study does not claim to measure objective reading-comprehension performance. The design was appropriate because the study sought to describe existing conditions and estimate statistical associations without altering the respondents' learning environment or controlling their use of AI. The analysis was therefore interpreted in terms of association and statistical prediction, not influence, effect, or improvement.

Research Locale

The study was conducted in a private sectarian senior high school in Davao City, Philippines. The school offers Senior High School education through day and evening classes and includes Academic Track strands (ABM, HUMSS, and STEM) and Technical-Vocational-Livelihood strands (HE and ICT). The locale was selected because it provided access to students from multiple strands and class schedules relevant to the study objectives. The previously included description of Davao City's barangays and political boundaries was removed because it was not necessary to establish the research context. The research setting included Grade 11 and Grade 12 students enrolled in the participating senior high school during Academic Year 2025–2026. Students came from the available strands and class schedules represented in the school population. The setting provided an appropriate context for examining students' reported AI dependency and perceived reading comprehension barriers across different senior high school learning contexts.

Population and Sample

The respondents consisted of 319 Senior High School students enrolled in the selected private academic institution in Davao City during Academic Year 2025–2026. The respondents included students from both day and evening classes and represented the participating strands under the Academic and Technical-Vocational-Livelihood tracks. The inclusion criteria were: (a) currently enrolled Grade 11 or Grade 12 students in the selected school during the data-collection period; (b) belonging to one of the participating Senior High School strands; (c) willing to participate voluntarily; and (d) having the required parental/legal guardian consent and student assent when applicable. Students who did not meet these criteria or who declined participation were excluded.

Simple random sampling was employed. The researchers obtained the eligible-student list from the school and assigned a unique number to each eligible student. Selection was conducted through simple random sampling, giving eligible Senior High School students an equal chance of being selected. The final sample consisted of 319 students.

Research Instruments

The study utilized two adapted survey questionnaires. The first questionnaire measured AI dependency and was adapted from Capinding (2024), covering reading, writing, and numeracy. The second questionnaire was adapted from Tambis et al. (2023) and was used to measure perceived reading comprehension barriers and related factors. The AI dependency questionnaire contained 45 items (15 each for reading, writing, and numeracy), while the reading-comprehension questionnaire contained 21 items across six dimensions: vocabulary (4), grammar (3), discourse (3), cultural background (3), psychological factors (4), and reading interest (4). Both instruments used a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). The interpretation ranges were 4.20–5.00 = Very High; 3.40–4.19 = High; 2.60–3.39 = Moderate; 1.80–2.59 = Low; and 1.00–1.79 = Very Low. The Reading Interest Factors items in the administered questionnaire were negatively worded (e.g., lack of interest and reading only for tasks) and were scored as written; no reverse-scoring was applied. Higher scores therefore indicate greater endorsement of the reported reading-related difficulty/factor items. The outcome is treated as self-reported reading-comprehension-related experiences rather than an objective measure of reading performance.

Both instruments used a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree) response format. The interpretation ranges were 4.20–5.00 = Very High; 3.40–4.19 = High; 2.60–3.39 = Moderate; 1.80–2.59 = Low; and 1.00–1.79 = Very Low. The reading-comprehension instrument consisted of 21 items across six dimensions: vocabulary = 4; grammar = 3; discourse = 3; cultural background = 3; psychological = 4; and reading interest = 4. The outcome is treated as self-reported reading-comprehension-related experiences rather than an objective measure of reading performance.

Data Collection Procedure

The researchers first addressed a formal letter to the Senior High School Coordinator and the Principal of the selected school in Davao City to seek permission to conduct the study. Upon approval, the adapted survey questionnaires on Artificial Intelligence Dependency and Reading Comprehension were submitted to the research adviser for review. After incorporating the adviser's suggestions, the revised instruments were forwarded to a panel of experts for content validation. Following the validation process, pilot testing was conducted among thirty (30) non-participating Senior High School students to determine the reliability of the research instruments. The responses were encoded and submitted to the statistician for the computation of Cronbach's alpha to measure the internal consistency of the questionnaires. Once the instruments were confirmed to be reliable, the researchers personally distributed the printed questionnaires to the target Grade 11 and Grade 12 student respondents. The purpose of the study was clearly explained, and informed consent was obtained. The participants were assured that participation was voluntary and that responses would remain anonymous and confidential. No personal identifiers were collected. Sufficient time was given to the respondents to complete the questionnaires. After completion, the researchers collected the questionnaires and submitted them to the statistician for data coding and statistical analysis. The researchers distributed the questionnaires on December 2, 2025, and collected them on December 6, 2025, from respondents in each classroom.

Before administration, the research adviser and a panel of experts reviewed the adapted questionnaires. The content-validation process evaluated clarity, relevance, appropriateness, and alignment with the study objectives. Revisions made in response to validator comments were incorporated before pilot testing. Pilot testing was conducted among 30 Senior High School students who were not included in the actual sample. Cronbach's alpha was computed for the full scales and each subscale to assess the internal consistency of the questionnaires. After finalizing the instruments, the researchers administered the printed questionnaires to qualified Grade 11 and Grade 12 respondents. Before administration, the researchers explained the study purpose, procedures, the voluntary nature of participation, and participants' rights. For minors, parental or legal guardian consent and student assent were obtained before participation.

Participation was voluntary, and respondents could decline or withdraw without academic or personal

consequences. The researchers maintained confidentiality and limited access to the collected data. No identifying information was disclosed in the manuscript. Completed questionnaires were checked for completeness, encoded, and submitted for statistical analysis. Data files were stored using appropriate security measures, and access was limited to authorized members of the research team.

Statistical Treatment

The mean and standard deviation described the level and variability of AI dependency and perceived reading comprehension barriers. Pearson's product-moment correlation coefficient tested the relationship between the predictor and outcome. Simple linear regression was used to determine whether AI dependency statistically predicted perceived reading comprehension barriers. The study used mean, standard deviation, Pearson's product-moment correlation coefficient, and simple linear regression. Mean and standard deviation described the level and variability of AI dependency and perceived reading comprehension barriers. Pearson's r was used to determine the direction, strength, and statistical significance of the relationship between AI dependency and perceived reading comprehension barriers. Simple linear regression was used to estimate the extent to which AI dependency statistically predicted perceived reading comprehension barriers. Because the model includes a single predictor, the analysis focused on overall AI dependency and overall perceived reading comprehension barrier scores. Pearson's r was used to determine the direction, strength, and statistical significance of the relationship between AI dependency and perceived reading comprehension barriers. A positive coefficient indicates that higher AI dependency is associated with higher reported barriers; it does not indicate better reading comprehension. Simple linear regression was used to estimate how well AI dependency statistically predicted perceived reading comprehension barriers. The model was evaluated using the regression coefficient, standardized coefficient, t statistic, F statistic, coefficient of determination, standard error, and 95% confidence interval for the unstandardized coefficient. The level of significance was set at $\alpha = .05$. Statistical significance was determined using two-tailed tests. Results are reported using APA/JIP statistical conventions, including italicized statistical symbols, appropriate decimal precision, degrees of freedom, and $p < .001$ when the exact probability value is below .001.

Ethical Considerations

The researchers observed ethical principles throughout the study to protect the rights, dignity, privacy, safety, and welfare of the Senior High School participants. The researchers followed voluntary participation, informed consent, assent, confidentiality, privacy, justice, and respect for participants, consistent with the National Ethical Guidelines for Health and Health-Related Research (Philippine Health Research Ethics Board [PHREB], 2017) and the Publication Manual of the American Psychological Association (American Psychological Association, 2020). Data privacy was addressed in accordance with Republic Act No. 10173, the Data Privacy Act of 2012, including appropriate safeguards for the collection, storage, access, and reporting of participant information. The study observed voluntary participation, informed consent, assent, confidentiality, privacy, justice, and respect for participants, consistent with the National Ethical Guidelines for Health and Health-Related Research (Philippine Health Research Ethics Board [PHREB], 2017) and the Publication Manual of the American Psychological Association (American Psychological Association, 2020). Data privacy was addressed in accordance with Republic Act No. 10173, the Data Privacy Act of 2012, including appropriate safeguards for collection, storage, access, and reporting of participant information. The researchers ensured that ethical requirements were addressed before, during, and after data collection. Participants were informed of their rights, and the research team maintained confidentiality and data security throughout analysis and reporting.

Results and Discussion

The level of Artificial Intelligence Dependency

Table 1 presents the level of AI dependency among Senior High School students in terms of reading, writing, and numeracy. The overall mean score of 3.20 ($SD = 0.66$) indicates a moderate level of reported AI dependency. Writing obtained the highest mean ($M = 3.22$, $SD = 0.68$), followed by reading ($M = 3.21$, $SD = 0.94$) and numeracy ($M = 3.17$, $SD = 0.93$). These results indicate that respondents reported a similar, moderate degree of reliance on AI across the three academic domains. The findings should be interpreted as self-reported dependency, not as evidence that AI use is inherently beneficial or harmful. The pattern is consistent with the growing use of AI for academic assistance, particularly in tasks involving text generation and revision. However, the present result should not be interpreted as evidence that students' AI use replaces or improves independent learning. Research on AI in education emphasizes both opportunities and risks, including the importance of human oversight and

responsible use (Holmes & Tuomi, 2022; UNESCO, 2023). The moderate level observed in the present sample therefore provides a basis for examining whether reported dependency is associated with students' perceived reading difficulties.

Table 1. *The Level of Artificial Intelligence Dependency among Senior High School Students*

Indicator	Mean	SD	Descriptive Level
Reading	3.21	0.94	Moderate
Writing	3.22	0.68	Moderate
Numeracy	3.17	0.93	Moderate
Overall	3.20	0.66	Moderate

Level of Perceived Reading Comprehension Barriers

Table 2 presents the level of perceived reading comprehension barriers and related factors among Senior High School students. The overall mean score of 3.16 ($SD = 0.78$) was interpreted as moderate under the study's scoring scheme. Because the outcome is based on self-reported barriers and related factors rather than an objective reading test, the result indicates that respondents reported a moderate level of perceived difficulty-related experiences; it does not establish their actual reading-comprehension performance.

Table 2. *The Level of Perceived Reading Comprehension Barriers among Senior High School Students*

Indicator	Mean	SD	Descriptive Level
Vocabulary Barriers	3.14	0.96	Moderate
Grammar Barriers	3.14	1.06	Moderate
Discourse Barriers	3.03	1.10	Moderate
Cultural Background Barriers	3.21	1.06	Moderate
Psychological Barriers	3.22	1.07	Moderate
Reading Interest Factors	3.27	1.16	Moderate
Overall	3.16	0.78	Moderate

The subscale means also show variation in respondents' reported experiences. Reading-interest factors obtained the highest mean ($M = 3.27$, $SD = 1.16$), followed by psychological barriers ($M = 3.22$, $SD = 1.07$) and cultural background barriers ($M = 3.21$, $SD = 1.06$), while discourse barriers had the lowest mean ($M = 3.03$, $SD = 1.10$). Because the Reading Interest Factors items were negatively worded and not reverse-scored, the higher mean reflects greater endorsement of reading-related difficulty or low interest rather than stronger reading interest. The findings therefore describe reported reading-related experiences and do not establish actual reading-comprehension performance.

This multidimensional pattern aligns with research showing that reading comprehension depends on linguistic, cognitive, and affective factors (Li et al., 2022; Kandisa et al., 2025). Vocabulary, grammar, background knowledge, reading motivation, and related factors may shape how students understand texts. The present findings therefore support a multidimensional view of perceived reading difficulty, but they do not permit conclusions about which specific barrier is caused by AI dependency because the present study did not conduct subscale-level association tests.

Relationship Between AI Dependency and Perceived Reading Comprehension Barriers

Table 3. The correlation analysis showed a statistically significant moderate positive relationship between AI dependency and perceived reading comprehension barriers, $r = .58$, $p < .001$. The null hypothesis of no relationship was rejected. Because higher scores on the outcome represent greater perceived barriers under the current interpretation of the instrument, the positive association indicates that students reporting higher AI dependency also tended to report higher levels of perceived reading-related barriers. This direction is the opposite of an interpretation that AI dependency improves reading comprehension and must be understood accordingly.

Table 3. *Relationship and Regression of AI Dependency with Perceived Reading Comprehension Barriers*

Predictor	r	B	SE	β	t	p
AI Dependency	.58	0.68	0.05	.58	12.68	< .001
Model		95% CI for B [0.58, 0.79]		$R^2 = .34$	$F(1, 317) = 160.70$	$p < .001$

Note. N = 319. SE = standard error; CI = confidence interval. The regression model contains one predictor. Statistical values are rounded for reporting; calculations are based on the unrounded analysis output.

The positive association should not be interpreted as evidence that AI dependency causes reading difficulties. Several explanations are possible, including reverse or reciprocal processes, such as students who experience more difficulty turning to AI more often for assistance. Common-method bias is also possible because both variables were measured through self-report questionnaires collected at the same time. The results should therefore be interpreted as an association between reported AI dependency and perceived barriers.

This finding should also be considered alongside mixed evidence on AI use. Structured AI interventions may improve some learning outcomes under guided conditions (Deng et al., 2025), and chatbot-supported reading research has explored potential benefits and limitations (Zheng, 2024). In contrast, research on over-reliance reports possible cognitive and learning risks (Bastani et al., 2025; Zhai et al., 2024; Tian & Zhang, 2025). This positive association is therefore plausible in a literature that does not show a uniform direction. Importantly, the current study cannot determine whether dependency produces barriers, whether barriers lead to greater dependency, or whether a third factor contributes to both.

Predictive Association of AI Dependency with Perceived Reading Comprehension Barriers

The regression analysis showed that AI dependency significantly predicted perceived reading comprehension barriers, $B = 0.68$, $\beta = .58$, $t(317) = 12.68$, $p < .001$. The model was significant, $F(1, 317) = 160.70$, $p < .001$, with $R^2 = .34$. Thus, AI dependency accounted for approximately 33.6% of the variance in the perceived-barriers outcome. The unstandardized coefficient had an estimated standard error of 0.05 and a 95% confidence interval of approximately [0.58, 0.79]. These results indicate statistical prediction, not causal influence or improvement in reading performance.

The positive regression coefficient is consistent with the positive correlation: higher reported AI dependency was associated with higher perceived reading comprehension barriers. One possible explanation is that students who have trouble with reading may rely more heavily on AI for explanations, summaries, translations, or answers. Another possibility is that frequent reliance on AI may reduce opportunities for independent processing in some learning conditions. The cross-sectional design cannot distinguish between these possibilities. Experimental evidence on AI interventions suggests that structured use can produce learning benefits, but those findings cannot be directly generalized to self-reported dependency (Deng et al., 2025; Zheng, 2024).

The model also leaves about 66.4% of the variance unexplained, suggesting that other factors may matter. Reading comprehension is influenced by vocabulary, background knowledge, fluency, motivation, self-regulation, and other learner and instructional variables (Li et al., 2022; Wang & Hung, 2025). The results therefore support the need for further research using objective comprehension tests, domain-level analyses, additional predictors, and designs that can clarify temporal or causal relationships.

Conclusion

Based on the findings, the following conclusions were drawn: First, Senior High School students reported a moderate level of AI dependency across reading, writing, and numeracy. The three domains showed relatively similar mean levels, indicating that AI reliance was present across different academic tasks. Second, students reported a moderate level of perceived reading comprehension barriers and related factors. The findings describe students' perceptions of difficulty-related experiences and should not be treated as objective measures of reading performance. Third, AI dependency had a moderate, positive, and statistically significant relationship with perceived reading comprehension barriers. Thus, higher reported AI dependency was associated with higher reported barriers. No claim can be made that AI dependency improves comprehension, and no domain-level significant relationships were tested in the present analysis. Fourth, AI dependency significantly predicted perceived reading comprehension barriers, accounting for 33.6% of the variance. The result does not establish causality. For teachers, the finding supports guided AI practices that require students to explain, evaluate, summarize, and independently verify what they read rather than simply obtain answers. For schools, AI-literacy guidance and reading-support programs may help students use AI as a scaffold without replacing independent cognitive work. Future studies should use objective reading-comprehension tests, longitudinal or experimental designs, larger and more diverse samples, and domain-level or multiple regression analyses to determine how AI use and reading difficulties may interact over time.

Contributions of Authors

- Author 1:** He helped check the statistical outputs, verify the analyzed results, and ensure consistency between the data and the reported findings. He also helped identify and review literature supporting the study's theoretical and conceptual foundations, edited the manuscript, monitored the paper's overall flow, and participated in final proofreading and review before submission.
- Author 2:** Managed major activities related to data gathering. She facilitated the distribution and retrieval of the research instruments, coordinated with the respondents, and helped ensure that the data collection procedures adhered to ethical standards. She also helped locate and review literature relevant to the research topic.
- Author 3:** Assisted in the collection, organization, and preliminary examination of the research data. She reviewed the presentation of statistical results, helped verify the accuracy and consistency of the outputs, and contributed to interpreting key findings. She also supported the review of related literature relevant to the study.
- Author 4:** Contributed to the final preparation and refinement of the manuscript. She helped review the paper's completeness and consistency, checked alignment between sections and the research objectives, and improved the presentation of the findings.
- Author 5:** Took primary responsibility for reviewing and improving the manuscript. She examined the paper's organization, coherence, and academic presentation and provided detailed comments on grammar, clarity, and scholarly tone. Her contributions strengthened the manuscript's overall structure and readability.
- Author 6:** Provided academic guidance throughout the study and helped refine the research framework, methodology, findings, and manuscript.
- Author 7:** Contributed substantially to the formulation and refinement of the study's theoretical framework. He conducted and interpreted the statistical analysis and provided academic guidance on presenting the findings. He also contributed to developing the discussion and conclusion sections and helped ensure the study remained aligned with its objectives.

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Conflict of Interests

A research conflict of interest occurs when an investigator's personal, financial, or professional interests may potentially influence, or appear to influence, the impartiality, integrity, and validity of a study. Such conflicts may compromise the objectivity of the research process, particularly in the design, implementation, analysis, or reporting of findings, thereby affecting the credibility of the results. Transparent disclosure of any potential conflicts of interest, along with strict adherence to established ethical guidelines, is essential to safeguard the integrity of the research and maintain public trust in the study and the researchers involved.

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