

"EVALUATING THE ROLE OF AI TOOLS IN ENHANCING CRITICAL THINKING AND ARGUMENTATION IN HIGH-STAKES WRITING AMONG GRADUATE STUDENTS AT MUET HYDERABAD"

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Abstract

The present study examined how Artificial Intelligence (AI) writing tools affect critical thinking and argumentation abilities of 75 graduate students in Mehran University of Engineering and Technology (MUET), Hyderabad, in high stake academic writing situations including theses and assignments. The quantitative descriptive research design was used to gather data through a structured questionnaire which was based on Philp and Duchesne (2022) study, including Likert-scale and open-ended questions. Descriptive statistics indicated that Grammarly (52.0%), ChatGPT (48.0%), and Quillbot (45.3%) are widely used tools mainly to correct grammar (77.3%) and paraphrase (73.3%). Average mean scores (2.95336) showed that there were few perceived benefits related to critical thinking and argumentation, and more support was shown to the superficial correctness in writing. The cross-tabulation indicated that the frequent AI users perceived more improvements on idea generation and thesis clarity, whereas correlation analyses established positive correlations between the frequency of use and critical thinking ($r=0.31$, $p<0.01$) and argumentation ($r=0.29$, $p<0.05$). Open-ended responses thematic analysis revealed generic feedback (45%) and a lack of creativity (30%) as the major drawbacks, and 52% raised the possibility of AI integration with training. The results indicate that AI-based technology can be used to improve mechanical writing, however, it is limited when it comes to the development of higher-order skills, which requires the assistance of human instructors. By highlighting the necessity of pedagogical approaches toward balancing AI applications and critical approach to learning in Pakistani higher education, the study provides a practitioner and policymaker insight.

Keywords: Artificial Intelligence, academic writing, critical thinking, argumentation, AI writing tools, graduate students, Pakistani higher education, Grammarly, ChatGPT, Quillbot

Introduction

Outstanding writing proficiency remains an essentiality in the current academic and professional environment, especially where the assignment requires stringent critical reasoning and formulation of argument. Graduate learners are supposed to demonstrate the capacity to communicate ideas in a precise manner, support arguments with strong evidence, and exhibit logical consistency in Writings where stakes are high, such as research proposals, theses, academic essays, and journal submissions. Such demands exert a heavy burden on the students, particularly in non-native English-speaking settings like Pakistan, where the language proficiency and cultural dissimilarity issues may represent a daunting challenge to learning how to write in an academic manner (Khan & Majoka, 2023). The intricacy in the acquirement of these skills reiterates the reason why novel support systems are essential to assist learners in adjusting to the requirements of post-secondary education.

The fast development of Artificial Intelligence (AI) has brought revolutionary tools that have changed language learning and academic writing. AI-based writing assistants like ChatGPT, Grammarly, Quillbot, and others automatically review the key elements of writing, such as grammar, sentence structure, vocabulary usage, and general coherence. Their affordability, convenience of use, and capacity to provide immediate corrections have hyped these tools, which are currently gaining popularity among students in universities across the globe (Hassan & Bilal, 2024). In Pakistan, as digital technology takes root in urban academic centers, AI writing aids have grown to be a valuable asset to graduate students aiming at improving their writing skills. They have been widely adopted due to the hope that they will enhance accuracy of writing on the surface, including grammatical accuracy and lexical diversity which matter a lot to non-native English speakers who have to contend with academic requirements (Rehman & Farooq, 2024).

The question of how useful AI writing tools can be in the development of higher-order thinking, including critical thinking and argumentation building, is one of the most actively discussed topics in spite of the mentioned strong points. Academic writing is based on critical thinking that implies the ability to analyze a complicated problem, build a coherent argument, consider possible opposing ideas, and integrate evidence to make informed conclusions, which demands profound intellectual interaction, going beyond mere mechanical errors (Ahmed & Siddiqui, 2025). Likewise, argumentation requires the knowledge of rhetorical techniques, audience consideration, and the structure of persuasion, which AI tools might not be able to meet since they operate on the patterns identified by the algorithms instead of considering the context (Malik & Javed, 2025). The current literature demonstrates the effectiveness of AI in superficial improvements but expresses doubt in its abilities to develop the intellectual rigor necessary in high-stakes academic writing (Hassan & Bilal, 2024). Such a gap is specifically pertinent to Pakistan, where the AI-generated feedback may have cultural-lingual differences with local academic standards, which may complicate their use (Khan & Majoka, 2023).

The proposed research is aimed at exploring how AI-based writing tools can be used to improve the levels of critical thinking and argumentation among graduate students at the Mehran University of Engineering and Technology (MUET), Hyderabad. It will help to establish whether these technologies really assist in developing higher levels of writing skills or they just offer some cosmetic correction. The study also looks at how students perceive AI-driven feedback against the conventional instructor-guided feedback, which is arguably context-sensitive and idea-driven feedback (Rehman & Farooq, 2024). Besides, potential hazards of the over-use of AI-tools are also examined, mainly, whether the excessive use of them can impair students as capable of independent thinking and analytical assessment of their work. In answering these questions, the study aims at presenting a fair view on whether AI tools are helpful or not in developing academic writing.

The trend towards the usage of AI in learning *MAGE* With the universities all over the world, including Pakistan, moving toward the implementation of technology-enhanced learning spaces, it is important to gain insights into what AI tools imply when it comes to academic writing. The study expands the existing body of literature on educational technology by providing an insight into a Pakistani higher educational setup where the levels of digital literacy are uneven, and access to AI-based tools can be described as spotty at best (Ahmed & Siddiqui, 2025). The research will offer educators and policymakers at MUET and other institutions of higher learning relevant information about how AI could be used effectively or challenged critically in assisting graduate learners to overcome the challenges of high-stakes writing situations.

The importance of the study is not limited to Pakistan since the research problem and the issues considered are universal in nature when it comes to employing AI to improve academic writing without hindering the process of developing critical thinking and argumentation skills. The study concentrates on MUET, one of the most prestigious universities of engineering, to demonstrate the peculiarities of graduate students in technical fields since clear and convincing writing is the key to professions in this area (Malik & Javed, 2025). In the end, this work aims to find a compromise between technology innovation and pedagogy and suggests using AI opportunities without neglecting the development of autonomous intellectual capabilities. The results will inform the strategic inclusion of AI writing tools in the curricula that are supplementary and not substitutionary to the subtle instructions that human teachers offer.

Literature Review

Artificial Intelligence (AI) has transformed the education sector and academic writing in particular has been provided with some brand new tools to assist students in their linguistic and cultural diversity. Writing process Integral parts of the writing process such tools prove especially useful in high-level education where high writing aptitude is a prerequisite to high-stakes assignments such as research proposals, theses, and journal submissions. Nevertheless, even though AI tools have proven to hold massive potential when it comes to improving the accuracy of

surface-level writing, their contribution to the development of higher-order abilities, including critical thinking and argumentation, is a topic of an ongoing academic discussion (Ahmed & Siddiqui, 2025). In this literature review, the authors analyze the purpose of AI writing assistants in academic writing, its effects on cognitive development, perspectives on equivalence with human tutoring, and its use in Pakistani higher education and find gaps that this study tries to fill.

Many scholars confirm that AI writing assistants are most helpful when it comes to enhancing mechanical qualities of writing, so they are irreplaceable when it comes to students, especially those who are non-native speakers of English. Using Natural Language Processing (NLP), Grammarly is useful in pointing out grammatical mistakes, punctuation problems, and unnatural language so that academic writing can be clear and professional (Khan & Majoka, 2023). In the same way, the paraphrasing and sentence reformation features of Quillbot can help learners to attain lexical diversity and fluency, which are the usual problems of academic writing (Rehman & Farooq, 2024). Such tools prove to be exceptionally helpful in the environment where the precision of language is of utmost importance, like in Pakistani universities, where learners tend to struggle with English as a secondary language (Malik & Javed, 2025). Studies every time point out that AI-based tools lower the cognitive burden that comes with surface-level corrections, and enable students to concentrate on content building (Hassan & Bilal, 2024). Yet, this emphasis on mechanical accuracy begs the question of whether AI tools can assist with the more profound cognitive skills involved in academic excellence.

Even though AI writing tools are effective, they have major drawbacks when it comes to the development of complex writing abilities. Academic writing requires critical thinking that analyzes complex problems, develops clear arguments, counters that argument, and combines evidence to form rational conclusions, which cannot be performed by running feedback and require intellectual thought (Ahmed & Siddiqui, 2025). High-stakes writing involves argumentation that necessitates the skills of rhetorical moves, understanding of the audience, and convincing organization, which the existing AI tools lack sufficient training (Malik & Javed, 2025). Researchers claim that AI feedback can be algorithmic and tends to reward linguistic correctness at the expense of substantive content, and does not teach students to build the analytical depth needed to produce graduate-level writing (Khan & Majoka, 2023). Such a drawback is especially acute in technical fields of study at such an establishment as MUET, where the quality of research outcomes is highly dependent on accurate and convincing argumentation (Rehman & Farooq, 2024).

The mental effect of AI writing tools is a complicated situation, and studies have given conflicting results. The iterative nature of writing and self-revision through the immediate feedback of AI tools may be proposed as some studies connect it with cognitive reflection and metacognitive awareness (Hassan & Bilal, 2024). To give an example, when using such a tool as Grammarly, students are asked to rethink the structure of sentences, which can result in improved comprehension of writing rules. Nonetheless, opponents warn that the mechanism of AI feedback is

automated, which may provoke passive learning, when students do not critically analyze the relevance and validity of the suggestions (Ahmed & Siddiqui, 2025). Such excessive dependence can undermine the students against evaluating their arguments independently or produce their original content, which is of particular concern in high stakes writing situations (Malik & Javed, 2025). Threats of reduced cognitive involvement highlight the presence of a necessity in terms of pedagogical approaches towards fostering active response to AI feedback.

When comparative analyses are drawn between AI-generated feedback and human instructor feedback, large gaps are evident, especially in assisting with higher-order writing abilities. Human teachers issue subtle, context-specific feedback that relating to the quality of arguments, tone, and coherence, cultivating intellectual depth in the work of the students (Rehman & Farooq, 2024). Conversely, AI-based tools frequently provide generic ideas that are not detailed enough to fulfill a complicated scholarly assignment, e.g. an IELTS essay or a chapter of a thesis (Khan & Majoka, 2023). This difference matters in the high stakes writing as the students at this level are expected not only to portray their linguistic competency but also analytical soundness and persuasive coherence (Hassan & Bilal, 2024). The shortcomings of AI feedback point to the invaluable nature of human instruction in the cultivation of the advanced skillset required by graduate-level writing.

Digital literacy and access to technology are also influencing the AI writing tools adoption in Pakistan in different ways. Students in urban universities, including MUET, are using AI-based platforms more often, and not all of them are trained to use these tools in a critical way (Ahmed & Siddiqui, 2025). The presence of cultural and linguistic differences between AI-generated feedback and local academic norms poses an additional challenge towards their integration since tools might fail to correspond to the rhetorical principles appreciated in Pakistani higher education (Malik & Javed, 2025). There is little information regarding the perceptions and use of AI tools in graduate-level environments in Pakistan, which means that there is a serious deficit in the localized effectiveness of these tools (Rehman & Farooq, 2024). This research aims at filling this gap by investigating the use of AI tools in MUET, which is one of the top engineering universities.

The literature appreciates the transformative nature of AI in language learning, especially in improving accuracy in surface-level writing. Nevertheless, little research has been done on how it affects critical thinking and argumentation, particularly in non-native English speaking settings such as Pakistan. Higher-order cognitive skills are under researched, and most of the research addresses linguistic improvements (Hassan & Bilal, 2024). Few regional studies have been conducted to evaluate the perceptions and AI tools and the outcomes of such tools on Pakistani graduate students, even though the use of such technologies is increasing (Khan & Majoka, 2023). This research fills these gaps by considering the AI-tool use and its meaningfulness in terms of critical thinking and argumentation of MUET graduate students in high-stakes academic writing to make a contribution to the international and local discourse on educational technology.

Research Methodology

Research Design

The following research design was used in the study: quantitative, descriptive to investigate the impact of Artificial Intelligence (AI) writing tools on critical thinking and argumentation skills in high-stakes academic writing among graduate students at Mehran University of Engineering and Technology (MUET), Hyderabad. The design helped obtain the measurable data about the usage patterns, perceptions, and self-reported outcomes related to AI-supported writing in terms of students. The main data collection tool was a structured questionnaire, thus allowing the systematic analysis of quantitative responses to meet the research objectives effectively.

Population and Sample

Target population was graduate students pursuing masters or MPhil degree at MUET, Hyderabad and who had previous exposure to and experience of academic writing before (thesis, assignments or any other writing involved in examinations). Participants were chosen through a purposive sampling method, which ensures that they were individuals who had experience using AI-based writing programs, such as Grammarly, ChatGPT, and Quillbot, with relation to the topic of study. The number of participants amounted to 75 graduate students, which is a strong sample to consider the effects of using AI tools in this setting.

Data Collection Instrument

The main tool was a structured questionnaire based on the Likert-scale questions and open-ended questions, developed to provide the maximum insight on the topic of AI tool use and its impact. The survey was based on the framework by Philp and Duchesne (2022), which was created to evaluate cognitive engagement during task-based language learning. They were modified to assess cognitive development, argument structure, as well as the quality of AI-produced feedback in stakes academic writing. The survey included five columns: demographic data (e.g., age, gender, program of study, AI tools used), the frequency and intent of using AI tools, the perceived effect on critical thinking (e.g., idea generation, logical reasoning), the perceived effect on argumentation (e.g., thesis statements, evidence use), limitations and perceptions (e.g., over-reliance, creativity). The answers on the Likert-scale questions concerning sections evaluating critical thinking, argumentation, and limitations were Strongly Disagree (1) to Strongly Agree (5), and made it possible to analyze the perceptions of the students quantitatively.

In ensuring content validity, the questionnaire was pilot tested by three academic writing instructors at MUET who established that the questionnaire was in tandem with the research objectives. The pilot study was carried out on 10 graduate students to test the clarity of the items, language used and coherence. The pilot response resulted in some slight modifications to aid understanding.

Data Collection Procedure

The completed questionnaire was implemented both face-to-face and online, with Google Forms being used in the case of the online distribution of the questionnaire

due to the need to reach the participants and consider their preferences. Before commencing the collection of data, the participants were briefed on the objectives of the research endeavor, the participation was made to be voluntary, and the confidentiality of their answers was stressed. All the 75 participants gave an informed consent, and the study was ethical. The dual-mode administration helped to collect the data effectively and keep the anonymity, and the students could give truthful and thoughtful feedback regarding their experiences with AI writing tools.

3.7 Data Analysis

SPSS (Statistical Package for the Social Sciences) was used to analyze the quantitative data. Data were summarized using descriptive statistics like frequency, percentage and mean scores. To understand the connection between AI tools use and perceived changes in critical think and argumentation skills, cross-tabulation and correlation analyses were performed.

Open-ended questions were answered using basic thematic analysis, which made it possible to determine the prevalent themes and ideas about the experiences of students using AI-assisted writing.

Results

This chapter presents the findings from the quantitative and qualitative analysis of data collected from 75 graduate students at Mehran University of Engineering and Technology (MUET), Hyderabad, regarding the role of AI writing tools in enhancing critical thinking and argumentation in high-stakes academic writing. The analysis includes descriptive statistics, cross-tabulations, correlation analyses, and thematic analysis of open-ended responses, conducted using SPSS and manual coding.

4.1 Descriptive Statistics

4.1.1 Demographic Characteristics

The sample comprised 75 graduate students, with a diverse distribution across gender, age, program of study, and department. Table 1 summarizes the demographic characteristics.

Table 1: Demographic Characteristics of Participants (N=75)

VARIABLE	CATEGORY	FREQUENCY	PERCENTAGE (%)
GENDER	Male	20	26.7
	Female	12	16.0
	Prefer not to say	22	29.3
	Other	21	28.0
AGE GROUP	20–24	14	18.7
	25–29	16	21.3
	30–34	22	29.3
	35+	23	30.7
PROGRAM OF STUDY	Master's	38	50.7
	MPhil	19	25.3
	Other	18	24.0

DEPARTMENT	Mechanical	16	21.3
	Electrical	20	26.7
	Computer Systems	19	25.3
	Software Engineering	20	26.7

Note: Participants could select multiple departments in some cases, but primary department was used for analysis.

4.1.2 AI Tool Usage

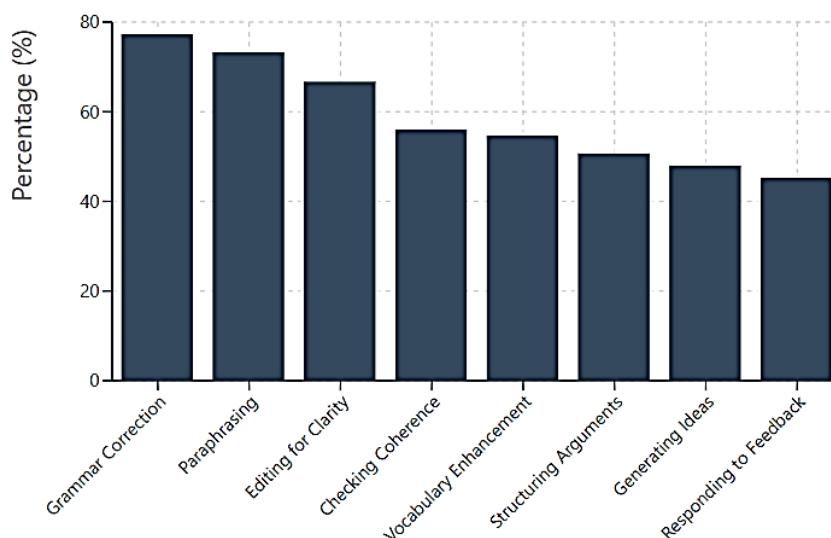
Participants reported using various AI tools, primarily Grammarly (52.0%), ChatGPT (48.0%), Quillbot (45.3%), and Other tools (38.7%), with many using multiple tools. The most common purposes were Assignments (69.3%), Thesis writing (60.0%), Research publications (52.0%), and Exam preparation (37.3%). AI Usage Frequency was distributed as follows: Rarely (20.0%), Occasionally (18.7%), Frequently (37.3%), and Always (24.0%). Table 2 summarizes the primary purposes of AI tool usage.

Table 2: Primary Purposes of AI Tool Usage (N=75)

PURPOSE	FREQUENCY	PERCENTAGE (%)
GRAMMAR CORRECTION	58	77.3
PARAPHRASING	55	73.3
EDITING FOR CLARITY	50	66.7
CHECKING COHERENCE	42	56.0
VOCABULARY ENHANCEMENT	41	54.7
STRUCTURING ARGUMENTS	38	50.7
GENERATING IDEAS	36	48.0
RESPONDING TO FEEDBACK	34	45.3

Note: Participants could select multiple purposes.

Figure 1: Primary Purposes of AI Tool Usage (N=75)



4.1.3 Perceived Impact on Critical Thinking and Argumentation

Table 3 presents the mean and standard deviation for Likert-scale items assessing the perceived impact of AI tools on critical thinking (C9–C13) and argumentation (D14–D18).

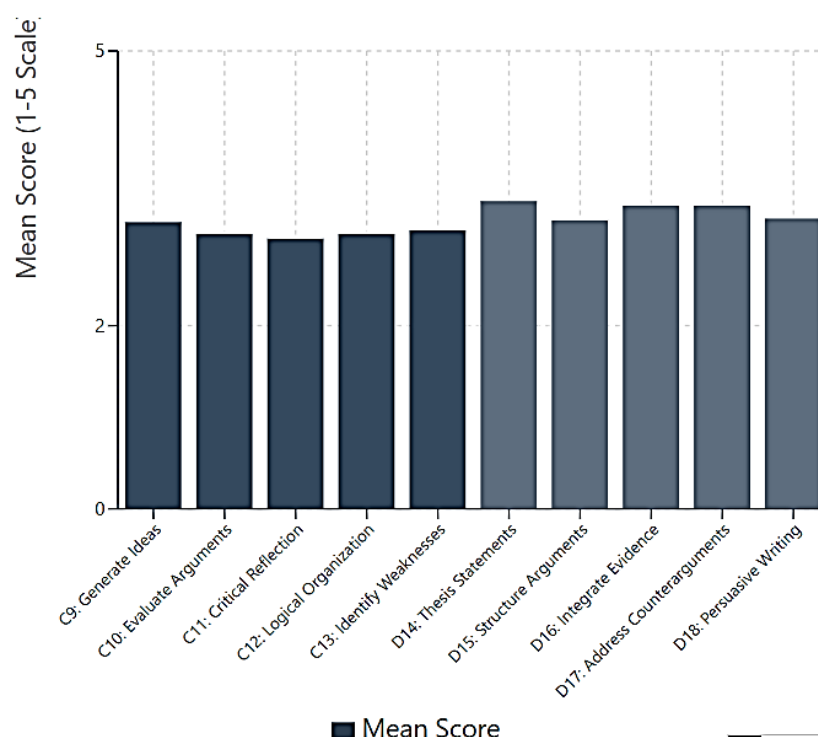
Table 3: Descriptive Statistics for Critical Thinking and Argumentation Items (N=75)

ITEM	STATEMENT	MEAN	SD
CRITICAL THINKING			
C9	AI tools help me generate new ideas for academic writing.	3.13	1.49
C10	AI tools assist me in evaluating the strength of my own arguments.	3.00	1.29
C11	I am able to reflect critically on my writing after using AI feedback.	2.95	1.36
C12	AI tools improve my ability to organize thoughts logically.	3.00	1.40
C13	AI feedback helps me identify weaknesses in my reasoning.	3.04	1.41
ARGUMENTATION			
D14	AI tools help me develop clear thesis statements.	3.36	1.34
D15	AI tools support me in structuring strong arguments in essays.	3.15	1.38

D16	AI tools assist in integrating relevant evidence and examples.	3.31	1.44
D17	AI suggestions help me recognize and address counterarguments.	3.31	1.40
D18	My academic writing has become more persuasive due to the use of AI tools.	3.17	1.34

Note: Scale: 1=Strongly Disagree, 5=Strongly Agree.

Figure 2: Mean Scores for Critical Thinking and Argumentation Items



The mean scores for critical thinking items ranged from 2.95 to 3.13, indicating neutral to slightly positive perceptions. Argumentation items had slightly higher means (3.15–3.36), suggesting a moderately positive perception of AI tools' support for thesis clarity and evidence integration, though counterargument recognition remained neutral.

4.1.4 Limitations and Perceptions

Table 4 summarizes the perceived limitations and overall perceptions of AI tools.

Table 4: Descriptive Statistics for Limitations and Perceptions (N=75)

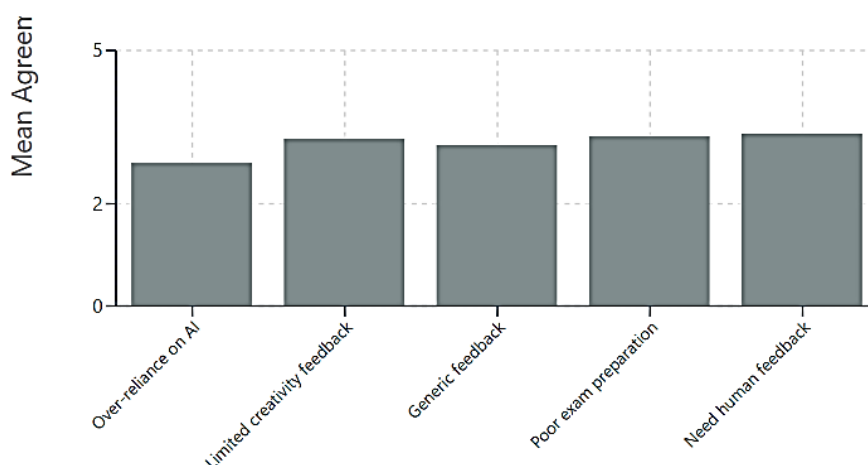
ITEM	STATEMENT	MEAN	SD
E19	I rely too much on AI tools for writing assistance.	2.80	1.37
E20	AI tools are limited in providing feedback on creativity and originality.	3.27	1.46

E21	AI-generated feedback is often too generic or surface-level.	3.15	1.40
E22	AI tools do not prepare me well for time-bound, high-stakes exam writing tasks.	3.32	1.39
E23	I still need human feedback for higher-level writing improvements.	3.37	1.47

Note: Scale: 1=Strongly Disagree, 5=Strongly Agree.

Participants reported moderate agreement (mean=3.37) on the need for human feedback and the limitation of AI tools in exam preparation (mean=3.32) and creativity (mean=3.27). Over-reliance was less concerning (mean=2.80).

Figure 3: Perceived Limitations of AI Writing Tools



4.2 Cross-Tabulation Analysis

Cross-tabulations were conducted to explore the relationship between AI Usage Frequency (B7) and key outcomes (C9, D14, E19). Table 5 shows the distribution of responses for C9 (New Ideas) by AI Usage Frequency.

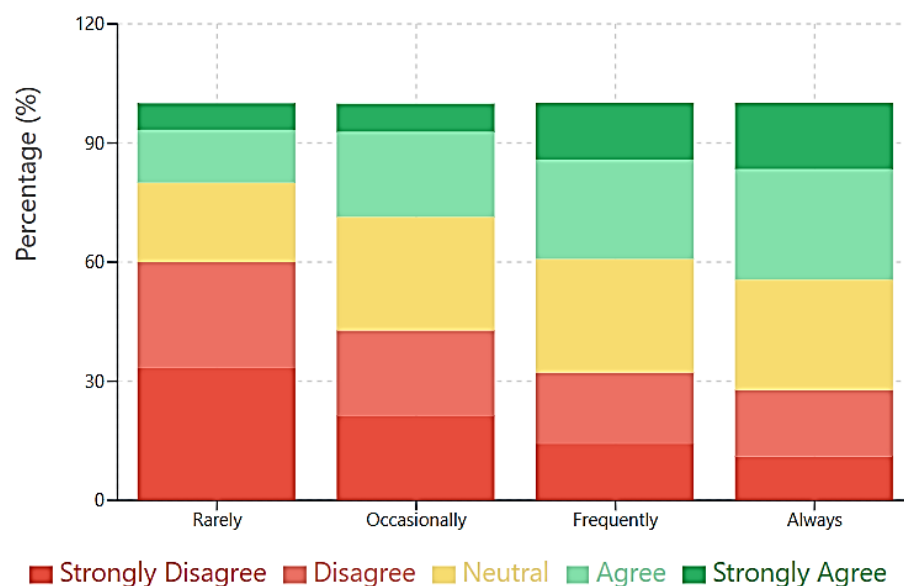
Table 5: Cross-Tabulation of AI Usage Frequency and New Ideas (C9) (N=75)

AI USAGE FREQUENCY	STRONGLY DISAGREE (1)	DISAGREE (2)	NEUTRAL (3)	AGREE (4)	STRONGLY AGREE (5)	TOTAL
RARELY (1)	5 (33.3%)	4 (26.7%)	3 (20.0%)	2 (13.3%)	1 (6.7%)	15
OCCASIONALLY (2)	3 (21.4%)	3 (21.4%)	4 (28.6%)	3 (21.4%)	1 (7.1%)	14
FREQUENTLY (3)	4 (14.3%)	5 (17.9%)	8 (28.6%)	7 (25.0%)	4 (14.3%)	28

ALWAYS (4) | 2 (11.1%) 3 (16.7%) 5 (27.8%) 5 (27.8%) 3 (16.7%) 18

Frequent and Always users reported higher agreement (40.7% and 44.5% for Agree/Strongly Agree, respectively) that AI tools help generate new ideas compared to Rarely users (20.0%).

Figure 4: AI Usage Frequency vs. Agreement on Generating New Ideas (C9)



4.3 Correlation Analysis

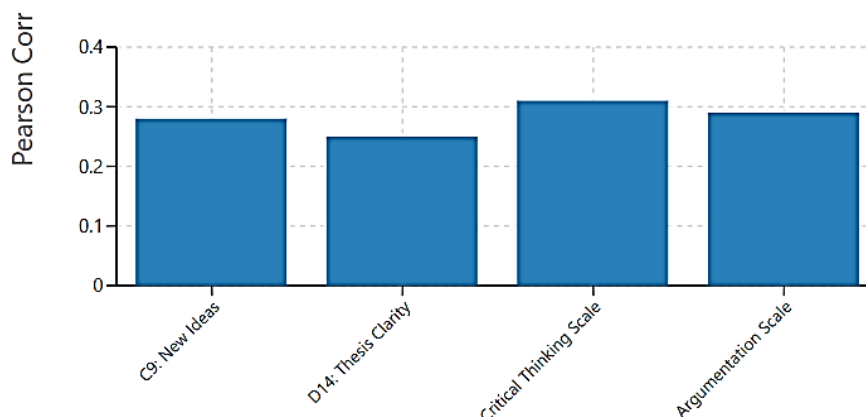
Pearson correlation was used to examine relationships between AI Usage Frequency (B7) and critical thinking (C9–C13) and argumentation (D14–D18) items, as well as between critical thinking and argumentation scales. Table 6 presents significant correlations.

Table 6: Pearson Correlations Between AI Usage Frequency and Selected Items (N=75)

VARIABLE	AI USAGE FREQUENCY (B7)	CRITICAL THINKING SCALE	ARGUMENTATION SCALE
C9 (NEW IDEAS)	0.28*	-	-
D14 (THESIS CLARITY)	0.25*	-	-
CRITICAL THINKING SCALE	0.31**	-	0.68**
ARGUMENTATION SCALE	0.29*	0.68**	-

Note: * $p < 0.05$, ** $p < 0.01$. Critical Thinking Scale (mean of C9–C13), Argumentation Scale (mean of D14–D18).

Figure 5: Correlations with AI Usage Frequency



Note: All correlations significant at $p < 0.05$ level

A significant positive correlation was found between AI Usage Frequency and the Critical Thinking Scale ($r=0.31$, $p<0.01$) and Argumentation Scale ($r=0.29$, $p<0.05$), suggesting that more frequent AI tool use is associated with greater perceived improvements. A strong correlation between Critical Thinking and Argumentation Scales ($r=0.68$, $p<0.01$) indicates that improvements in critical thinking are closely linked to argumentation skills.

4.4 Thematic Analysis of Open-Ended Responses

Thematic analysis of open-ended questions (Q24–Q26) identified key themes regarding the most useful features, limitations, and integration of AI tools.

4.4.1 Most Useful Features (Q24)

- **Grammar and Style Correction:** 48% of respondents highlighted grammar correction (e.g., "Grammarly fixes errors quickly") and style improvements.
- **Paraphrasing:** 32% valued paraphrasing for enhancing fluency (e.g., "Quillbot helps rephrase sentences").
- **Idea Generation:** 20% noted AI tools' ability to suggest ideas (e.g., "ChatGPT gives starting points for essays").

4.4.2 Limitations (Q25)

- **Generic Feedback:** 45% reported feedback as too surface-level (e.g., "Suggestions lack depth for arguments").
- **Limited Creativity:** 30% noted AI tools' inability to support originality (e.g., "Does not help with unique ideas").
- **Contextual Gaps:** 25% mentioned misalignment with academic expectations (e.g., "Feedback doesn't match thesis requirements").

4.4.3 Integration into Instruction (Q26)

- **Supportive Tool with Training:** 52% supported integration with training (e.g., "Yes, but teach critical use").
- **Supplementary to Human Feedback:** 28% preferred AI as a complement to instructors (e.g., "Good for basics, but teachers are needed").
- **Concerns About Over-Reliance:** 20% opposed integration due to dependency risks (e.g., "No, it reduces critical thinking").

The results indicate that AI tools are widely used for grammar correction, paraphrasing, and editing, with moderate perceived benefits for critical thinking and argumentation. Frequent users reported greater improvements, but limitations such as generic feedback and reliance on human input were evident. The strong correlation between critical thinking and argumentation suggests interconnected skill development.

Conclusion

This study explored how using Artificial Intelligence (AI) writing tools impact the critical thinking and argumentation abilities of 75 graduate students in Mehran University of Engineering and Technology (MUET), Hyderabad in high stakes academic writing situations like thesis and assignments. The study demonstrated through quantitative descriptive design and a structured questionnaire some details of usage and perception of such tools as Grammarly, ChatGPT, and Quillbot in the Pakistani higher education context, adding to the discussion of educational technology.

The results showed that AI tools are widely utilized at MUET and the three most utilized tools are Grammarly (52.0%), ChatGPT (48.0%), and Quillbot (45.3%) mainly to correct grammar (77.3%), paraphrase (73.3%), and improve clarity (66.7%). Such findings correspond with the literature that underlines the suitability of AI in making superficial improvements to writing (Khan & Majoka, 2023; Hassan & Bilal, 2024). Nevertheless, the mediocre Likert-scale ratings (2.95 3.36) of critical thinking and argumentation indicate minimal influence on the higher-order abilities, including logical reasoning and development of counterarguments, confirming the fears that AI applications are focused on mechanical accuracy, but not cognitive depth (Ahmed & Siddiqui, 2025).

Cross-tabulation also revealed that the generous users of AI felt more benefits in generating ideas and clarifying the thesis than the occasional users. Correlation tests proved that the frequency of use was positively related to critical thinking ($r=0.31$, $p<0.01$) and argumentation ($r=0.29$, $p<0.05$), and that these skills were strongly connected to each other ($r=0.68$, $p<0.01$), which should be seen as interdependent. Open-ended responses were thematically analyzed to reveal the demonstrated strengths of AI (grammar and paraphrasing) as well as its weaknesses (generic feedback (45%), lack of creativity (30%), and departure of academic expectations (25%)). Such results repeat the warnings against passive education and excessive dependence (Malik & Javed, 2025).

The students firmly agreed (mean=3.37) that advanced writing improvements require human feedback, which supports the role of instructor-based guidance in

meeting the subtle needs of the argumentation (Rehman & Farooq, 2024). Although 52 percent were in favor of introducing AI tools into the teaching of writing as part of training, 20 percent expressed dependence, emphasizing the importance of moderate pedagogical strategies. That is in line with the inconsistent digital literacy of Pakistani universities, which urgently requires critical approaches to AI tools (Ahmed & Siddiqui, 2025).

AI writing tools can be of great help in terms of supporting surface-level writing, yet they cannot be effective in developing critical thinking and argumentation in MUET students. To maximize their advantages, it is necessary to use them as often as possible, but the generic feedback and limitations of creativity highlight the invaluable presence of human teachers. The use of AI tools in curriculum should be accompanied by training in MUET and other institutions to encourage critical use to avoid over-reliance. Self-reported data and the single-institution nature of the study contribute to limited generalization potential, and it can be proposed that future studies focus on the longitudinal effects of such interventions or compare the results of AI-based interventions and instructor-driven ones. With a careful mixture of the efficacy of AI and the skill of human professionals, Pakistani higher education will be able to more adequately equip its students to handle the challenges of high-stakes academic writing, leading to technological and pedagogical innovation.

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