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Research Article

Experiences and Ethical Practices in Using AI-Powered Tools for Research Writing of MAEd-Mathematics Students: Basis for AI Ethical Guidelines

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Abstract
Integrating AI-powered tools in research writing offers significant benefits but also presents ethical challenges that may compromise academic integrity. This study examined MAEd Mathematics students' ethical practices in using AI-powered tools as the basis for developing institutional guidelines for responsible AI integration. Using a convergent parallel mixed-method design, data were gathered from 52 students through surveys and interviews with seven participants. Findings revealed extensive use of ChatGPT, QuillBot, Grammarly, and Turnitin, with stage-specific applications for idea generation, content refinement, editing, and plagiarism detection. Despite high accessibility, a digital divide persists in the depth of AI use, shaped by disparities in digital literacy and institutional support. While no formal AI-related policy exists, students practice ethical AI use as instructed by their instructors, highlighting the need for clear guidance. Based on the findings, a proposed AI ethical guideline for MAEd Mathematics researchers is established, emphasizing equitable access and standardized citation protocols to ensure responsible and academically sound AI use. Additionally, it is recommended for mathematics department to provide an established AI-use policy for research writing and other academic endeavors.
Keywords: AI in Higher Education, Research Writing, AI Literacy, AI Ethical Use, Research Integrity.

Introduction

The rapid advancement of Artificial Intelligence (AI) has brought transformative change across sectors, including educational research. Its integration in teaching and learning offers new opportunities to enhance instruction, increase engagement, and support data-driven decision-making-particularly in graduate programs such as mathematics education, where research writing is a core academic requirement. As a crucial component of Education 4.0, research writing cultivates critical, data-driven, and innovative thinking among future educators and researchers. Education 4.0-shaped by Industry 4.0 and Work 4.0-emphasizes digital and cognitive skill development supported by blended learning and self-regulated learning models. This transformation aligns with Sustainable Development Goal 4 by promoting equitable and inclusive quality education worldwide.

Among the emerging technologies within Education 4.0, Artificial Intelligence plays a central role in personalizing learning and reshaping educational practices. Some studies highlight how AI adapts content, pacing, and complexity to individual learners, while others notes that AI tools in Education 4.0 prepare students for a cyber-physical world by developing future-ready skills (Bazargani *et al.,* 2022; Joshi, 2022). According to the Stanford University Human-Centered Artificial Itelligence (2025), the 2025 AI Index further reveals that AI systems are advancing at unprecedented rates, becoming more efficient and accessible. As AI increasingly permeates research and education, the establishment of ethical and responsible use becomes more critical. AI's application in academic writing provides both advantages and challenges. It was found that AI accelerates the drafting process but often generates inaccurate citations-up to 70% in some cases-and raises plagiarism concerns due to high similarity indices (Kacena *et al.,* 2024). Meanwhile, it is also observed the need for constant human oversight to ensure the accuracy of AI-generated references (Khalifa and Albadawy, 2024). Globally, the rise of AI-powered tools has prompted educational reforms to protect academic integrity. In the UK, authorities are rethinking assessment systems to prevent cheating (Weale, 2025), while China has restricted AI-powered solvers in examinations (Schlott, 2025). Similarly, at Harvard, AI's capability to solve complex problems has driven curriculum redesign and raised ethical debates (Lu and Teichholtz, 2022; Boles, 2025).

In the Philippines, AI literacy and ethical competence among graduate students are vital to preparing educators who can responsibly integrate AI into instruction and research. Such digital readiness supports the goals of AmBisyon Natin 2040 by fostering innovation and competitiveness in a technology-driven economy. The University of the Philippines (n.d.) has already articulated AI principles emphasizing transparency, fairness, and human accountability, highlighting the need for inclusive and ethical AI use in education. However, specific institutional or national guidelines for using AI in academic writing have yet to be standardized across higher education. Given these developments, AI continues to reshape academic writing and research practices by streamlining idea generation, literature synthesis, and editing. Yet, the lack of clear ethical standards leave room for misuse and academic misconduct. Thus, this study seeks to understand and describe the ethical practices of MAEd-Math students in using AI tools for research writing, even in the absence of standardized institutional guidelines for AI use in academic research. Also, the study provided a proposed AI ethical guidelines that can be used as a foundation for developing policy in using AI-powered tools in research writing that promote responsible and integrity-driven AI integration in higher education.

Artificial Intelligence in Research Writing and Related Academic Writing

The integration of artificial intelligence in academic writing has emerged as a transformative force that fundamentally reshapes scholarly communication, with AI-powered tools like ChatGPT demonstrating unprecedented capacity to assist across various dimensions of research writing (Salvagno *et al.,* 2023). Meanwhile, Adams and Chuah (2022) asserts that contemporary research reveals that AI technologies have evolved into sophisticated assistants enhancing critical aspects of research writing including literature review processes, content coherence, and stylistic refinement, with systematic examination identifying six key beneficial domains: idea generation, content improvement, literature synthesis, data management, editing processes, and ethical compliance (Khalifa and Albadawy, 2024).

The transformative potential extends across the entire scholarly communication process, from initial study design to publication, enabling researchers to allocate cognitive resources to higher-order thinking while AI handles operational tasks (Fileti *et al.,* 2024). For non-native English speakers, AI tools like ChatGPT, Grammarly, and ResearchRabbit provide crucial assistance in overcoming linguistic barriers, significantly improving manuscript clarity and promoting global inclusivity in scholarly publishing (Giglio and Costa, 2023). In educational contexts, AI tools demonstrate substantial impact on academic writing instruction by supporting students and instructors across various writing stages (Leoste *et al.,* 2021; Kamalov *et al.,* 2023), with research indicating these tools are essential for addressing diverse learning challenges (Gardner *et al.,* 2021; Akgun and Greenhow, 2022; Fyfe, 2023) and helping students overcome cognitive barriers through tools like Wordtune and Google Translate (Dong, 2023; DuBose and Marshall, 2023).

Empirical evidence shows AI tools enhance writing capabilities and boost confidence through immediate feedback (Gayed *et al.,* 2022; Utami *et al.,* 2023) though significant concerns remain about maintaining human expertise, preventing plagiarism, and ensuring equitable access (Salvagno *et al.,* 2023). Dergaa *et al.,* (2023) assets that the evolving discourse emphasizes the necessity of maintaining authenticity while harnessing efficiency benefits, with scholars advocating for preservation of human oversight and accountability throughout the scientific process (Fileti *et al.,* 2024), while acknowledging a critical gap in systematic evaluations of real-world AI implementation that underscores the need for comprehensive frameworks, ethical guidelines, and equitable access across diverse academic communities (Adams and Chuah, 2022).

This shift is especially relevant in graduate education, where academic integrity and research skill development-such as among MAEd-Math students-are central, compelling a reevaluation of traditional understandings of intellectual labor and scholarly contribution (Narayanaswamy, 2023). AI-generated content, which can mimic human writing with increasing fluency, challenges existing standards for peer review, assessment, and authorship, thereby necessitating process-based evaluation, reflective transparency, and comprehensive disclosure statements (Misra and Chandwar, 2023). While ethical risks such as plagiarism, attribution errors, and diminished cognitive engagement are prominent-especially as AI may introduce inaccuracies and copyright issues-the responsible use of AI can offer substantial educational benefits, including personalized support and equity-promoting feedback for learners facing linguistic or academic barriers (Salvagno *et al.,* 2023). Ultimately, thoughtful policy frameworks and institutional guidance are essential to ensure that AI enhances, rather than undermines, human agency in scholarly inquiry, maintaining academic rigor and integrity as technology continues to evolve (Nazari *et al.,* 2021; Alston *et al.,* 2022; Narayanaswamy, 2023).

AI-Use Policy in Research Writing

As AI systems like ChatGPT become more sophisticated, graduate programs grapple with maintaining rigorous standards while leveraging the educational advantages of these tools (Dergaa *et al.,* 2023; Salvagno *et al.,* 2023). Scholars underscore the continued necessity of teacher supervision alongside AI use, ensuring that faculty mentorship remains central to fostering creativity and deeper cognitive engagement (Su *et al.,* 2022). Also, Chaudhry *et al.,* (2023), the intricate nature of AI-generated writing has also complicated academic integrity and plagiarism detection, necessitating clearer standards to distinguish appropriate use from misconduct. This challenge is amplified by the evolving ability of AI to produce human-like text, prompting calls for robust transparency standards and faculty training (Narayanaswamy, 2023; Misra and Chandwar, 2023). Policies, therefore, must clarify disclosure expectations, delineate forms of legitimate AI assistance, and address risk management concerns such as factual errors and data fabrication. Faculty development, revised assessment strategies, and institutional support are essential for effective policy implementation, with new evaluation criteria focusing on students' critical integration of AI-generated content.

International and national policy frameworks further inform ethical AI integration in education. The European Commission's "AI Act" establishes uniform, risk-based standards emphasizing transparency, human oversight, and alignment with European values, mandating that institutions prepare for phased compliance deadlines according to system risk levels. In the Philippines, the University of the Philippines system issued the "UP Principles for Responsible Intelligence," emphasizing human control, fairness, and accountability, while UPOU's guidelines highlight ethical AI integration in teaching, content creation, and assessment. De La Salle University's generative AI policy echoes these priorities by formalizing student disclosure requirements and instructor guidance on permissible AI use, complementing broader regulatory efforts (Su *et al.,* 2022; Chaudhry *et al.,* 2023; Narayanaswamy, 2023; Misra and Chandwar, 2023). Collectively, these policies aim to safeguard academic integrity, clarify the boundaries of AI assistance, and promote responsible, human-centered integration. Despite these efforts, gaps persist in evaluating the effectiveness and adaptability of AI policies, underscoring the need for continued research, empirical assessment, and responsive policy improvement as AI technologies evolve within diverse educational contexts.

Statement of the Problem

The absence of consistent policy across academic institutions contributes to confusion among students regarding the appropriate use of AI in scholarly work. There is a need to bridge this gap by developing clear and context-specific policies that guide students, faculty, and academic reviewers in making informed decisions. These policies must balance innovation with integrity, acknowledging both the utility and the risks of AI technologies in education.

The study explored the experiences and ethical practices of Master of Arts in Education, Major in Mathematics students in using AI-powered tools in writing a research paper. This further strengthens the supportive integration of AI in higher education responsibly.

Specifically, the study sought answers for the following research questions:

1. What is the demographic profile of the MAEd-Mathematics students in terms of:
1.1. Length of exposure in using AI-powered tools?
1.2. Common AI-powered tools used in stages of research writing?

2. What are the experiences of MAEd-Mathematics students in using AI tools for stages in research writing in terms of:
2.1. Access to AI tools?
2.2. Institutional policies and guidelines?
2.3. Exposure to using of AI tools?

3. What are the ethical practices of MAEd-Mathematics students in using AI-powered tools for research writing?

4. What policy guideline about using AI-powered tools in research writing among MAEd-Mathematics students can be developed based on the findings of the study?

Method

The study utilizes mixed method design specifically, convergent parallel study approach. The researcher collected both quantitative and qualitative data simultaneously in convergent parallel design and analyzes each data set independently (Cresswell, 2011). The collected findings were compared to point convergence and divergence among the data. The study was conducted in a selected State University and College (SUC) in Region VIII–Eastern Visayas which offers graduate programs specifically Master of Arts in Education, Major in Mathematics (MAEd-Math). Moreover, there are 52 MAEd-Math students enrolled from A.Y. 2024–2026 who were surveyed and seven of them were interviewed. All of these respondents were selected in full enumeration as they have the experience in writing research papers.

Due to its research design, two primary research instruments were developed: a researcher-made survey questionnaire for the quantitative strand and a semi-structured interview guide for the qualitative strand. For quantitative component, the study utilized a validated researcher-developed survey questionnaire aimed at identifying the ethical practices of MAEd-Math students in using AI-powered tools in research writing. It was composed of three main parts: (1) demographic profile, (2) AI-powered tool usage pattern, and (3) perceptions, experiences, and ethical practices which has five subsections namely accessibility to AI-powered tools, awareness of institutional policies and guidelines, ethical practices in using AI-powered tools in writing research, and their stand in developing institutional guidelines, particularly AI ethical guidelines in research writing. Same subsections were covered in interview of seven participants with varied experiences (beginning, developing, experienced, advanced) through in person and virtual gathering.

Quantitative responses from the survey questionnaire were analyzed using descriptive statistical techniques. The data was encoded, organized, and processed using statistical software. Meanwhile, the qualitative responses gathered from the participants wase analyzed using thematic analysis, a structured method well-suited for exploring lived experiences and uncovering meaningful insights (Cresswell, 2011). This method enables the researchers to identify recurring themes and deeply embedded patterns related to how graduate students interact with AI tools during the research writing process. The study adhered to trustworthiness of the study by following member checking, triangulation, reflexivity, peer debriefing, and audit trail accompanied with ethical considerations that includes participation details, informed consent forms, confidentiality and data privacy, disclosure of conflict of interest, and risks and benefits of the participants and respondents of the study.

Results and Discussion

Demographic Profile of MAEd-Mathematics Students

In terms of the demographic profile, particularly for familiarity based on length of exposure, the analysis reveals both convergence and divergence between the quantitative and qualitative findings on AI tool use in research writing (see Table 1). While 55.77% of participants reported using AI tools for over a year, they still primarily rely on basic functions like grammar checking and summarizing. This convergence indicates that long-term exposure to AI tools does not necessarily lead to more advanced usage, as students continue to depend on free versions for cost-saving reasons.

> "*I'm somewhat familiar with AI tools. I started using them mostly for grammar checking and generating ideas. I wouldn't say I'm an expert, but I know how to use the basic functions.*"– P1, Developing User (Interview Transcript)
>
> "*I'm very familiar with different AI tools. I use them regularly not just for school, but also for work, especially for checking grammar and summarizing information.*"–P2, Developing User (Interview Transcript)
>
> "*I'm not very familiar yet. I've only used a few AI tools for basic purposes like grammar checking. I know some of my classmates use more advanced ones, but I'm still exploring.*"– P3, Beginning User (Interview Transcript)

Despite greater familiarity with AI tools, most participants remain limited to basic functions due to financial constraints, underscoring that exposure does not automatically equate to deeper engagement with AI.

However, there is also a divergence in how students utilize these tools. Even experienced users, such as P2, who have been using AI for over a year, focus on simple features like grammar checking and summarizing, while some beginning users (e.g., P3) are more open to exploring other features but still rely on basic functions. This suggests that the lack of access to premium features and financial limitations significantly impact the depth of AI usage, regardless of exposure time. Therefore, while students are increasingly familiar with AI tools, their usage is still constrained by practical factors, particularly access to premium versions and institutional support.

Table 1. Convergent comparison on familiarity in using AI-powered tools.

User category	Quantitative finding	Qualitative finding	Meta-inference
New user	Less than 3 months (11.54%)	Users in this category primarily use basic functions such as grammar checking. They are still exploring AI-powered tools and are cautious in expanding their use due to limited exposure.	New users are still in the exploratory phase, focusing on basic, cost-free functions. More exposure could lead to exploring advanced features.
Beginning user	3–6 months (13.46%)	Participants in this group use basic functions (grammar checking, summarizing) and have started to explore other features but are still heavily reliant on free versions of AI tools.	Beginning users are open to exploration but continue to prioritize cost-saving options like free versions. Limited exposure may limit more sophisticated usage.
Developing user	7–12 months (19.23%)	Developing users exhibit familiarity with tools, but like others, they focus mainly on grammar checking and summarizing. They are familiar with basic functions but not necessarily advanced ones.	Developing users have more exposure, but financial constraints and access to free tools still limit their use of advanced AI features.
Experienced user	More than 1 year (55.77%)	Experienced users have been using AI for over a year, but like others, they still primarily use the basic functions such as grammar checking and summarizing, often due to free access.	Even with extensive exposure, cost remains a dominant factor influencing the use of only basic AI features. The role of free vs. paid versions limits further engagement.

Experiences and Ethical Practices of MAEd-Math Studens in Writing Research Using AI-Powered Tools

The mixed-method analysis reveals that MAEd-Math students predominantly use AI-powered tools like ChatGPT, QuillBot, and Grammarly across various stages of research writing (see Table 2). Quantitative results show that ChatGPT is the most utilized tool, especially for idea generation and research design (92.3%), aligning with qualitative insights where students report using it for brainstorming and summarizing. QuillBot (82.7%) and Grammarly (53.8%) are preferred for content refinement, emphasizing their role in improving clarity and coherence. However, AI use declines significantly in data management and analysis, with 71.2% of students not using any AI tools in this stage due to limited knowledge and perceived complexity. In editing and publishing, Grammarly and Trinka AI dominate (82.7%), suggesting strong trust in these tools for polishing outputs. Furthermore, ChatGPT (88.4%) and Claude.AI (42.3%) are frequently used for communication and ensuring ethical compliance. Overall, these findings highlight that while AI tools are widely integrated in conceptualization and writing, their adoption in technical and analytical stages remains limited.

On the other hand, Table 3 reveals a paradox between high quantitative satisfaction and qualitative concerns about equity in AI tool accessibility among MAEd-Mathematics students. Although students report strong overall access to AI tools (M = 3.68, SD = 0.56), qualitative findings show that this access is uneven, favoring those with stronger digital literacy and institutional support. High ratings for internet stability (M = 3.81) and device access (M = 3.77) mask a deeper "digital divide 2.0," where the disparity lies not in access itself but in the quality of AI tool utilization. Subscription costs (M = 3.62) further exacerbate inequality, as some students rely on free versions or shared accounts. Technical issues (M = 3.35) remain a tangible obstacle, but qualitative insights stress that true accessibility also depends on awareness and training. While students use multiple AI tools (M = 3.71), the absence of clear institutional guidance makes this diversity confusing rather than empowering. Overall, both data strands converge on the need for structured institutional interventions through policies, training, and resource support to ensure equitable and effective AI integration.

Table 2. Convergent comparison on commonly AI-powered tools used.

Stage/task	Quantitative result	Qualitative result	Meta-inferences
Idea generation and research design	92.3% use ChatGPT, 26.5% use Claude.AI, 1.9% use Perplexity AI	Participants report using ChatGPT for brainstorming and topic generation (P5, P6, P7). Most are casual users, but some experienced users rely on it for topic selection.	ChatGPT is the dominant tool for idea generation, but its role remains largely focused on basic functions, regardless of user experience.
Content improvement and structure	82.7% use QuillBot, 53.8% use Grammarly, 11.5% use ChatGPT	Participants highlight using Grammarly and QuillBot for paraphrasing, summarizing, and grammar checking (P7). Some use ChatGPT for content improvement.	QuillBot and Grammarly are the primary tools for refining academic writing, showing consistent preferences for tools that enhance clarity.
Literature review and synthesis	78.8% use QuillBot, 21.2% use Litmaps, 7.7% use ChatGPT, 5.8% use Elicit	QuillBot and Litmaps are favored by participants for literature review tasks, though ChatGPT is used in a supplementary manner (P5). Some prefer to manually synthesize ideas.	QuillBot's dominance in literature review highlights the preference for tools that assist in summarizing and connecting existing research.
Data management and analysis	7.7% use ChatGPT, 5.8% use IBM Watson, 5.8% use Google AutoML, 71.2% do not use AI tools	Participants express limited use of AI for data management, indicating unfamiliarity or reluctance to integrate AI into this phase of research (P6, P7).	Low adoption of AI tools in data analysis suggests a gap in awareness or confidence in using AI for technical tasks like data processing.
Editing and publishing	82.7% use Grammarly, 15.4% use Trinka AI, 7.7% use ProWritingAid, 3.8% use ChatGPT	Editing and grammar checking tools like Grammarly are used by almost all participants, with a few exploring tools like Trinka AI and ProWritingAid for refining academic writing.	Grammarly is heavily favored in editing, suggesting a high demand for AI tools that enhance writing quality and coherence in the final stages.

Table 3. Convergent comparison on accessibility to AI-powered tools.

Quantitative finding	Qualitative finding	Meta-inference
Strong agreement on general accessibility (M=3.68).	Increasing familiarity with ChatGPT, Grammarly, QuillBot.	AI tools have achieved baseline accessibility among MAEd-Math students, creating a foundation for integration into research writing practices.
Students have stable internet (M=3.81) and easy device access (M=3.77).	Students who are digitally literate navigate challenges better.	Technological infrastructure exists but its effectiveness depends on individual digital competence.
Access to free versions (M=3.69).	Reliance on free versions or shared accounts limits feature maximization.	Free-tier accessibility provides entry but creates a two-tiered experience based on financial capacity.
Subscription costs limit access (M=3.62).	Students use shared accounts to circumvent costs.	The "workaround culture" reveals that students are resourceful but this creates ethical ambiguities and inconsistent learning experiences.
Access to multiple AI tools (M=3.71).	Varied institutional policies on AI guidance.	Tool diversity exists but lack of institutional direction means students navigate this landscape without consistent support or best-practice frameworks.

In terms of institutional policies on AI use in research writing, quantitative data indicates moderate-to-strong agreement that such policies exist (M = 3.42–3.46), yet qualitative findings reveal they are vague and lack AI-specificity (Table 4). This mismatch suggests that students may confuse general academic integrity rules with actual AI guidelines or that policies exist only on paper without actionable frameworks. Both data strands highlight the urgent need for comprehensive and clear institutional guidance (M = 3.75). The low compliance rating (M = 3.31) aligns with qualitative evidence that unclear rules hinder adherence and lead to inconsistent practices. Moreover, moderate faculty explanation ratings (M = 3.44) conceal the reality that instructors themselves hold conflicting views about AI use. Ultimately, institutions appear to have formal policies but lack the specificity, communication, and faculty alignment necessary for effective implementation, creating a guidance vacuum that compromises academic integrity.

Table 4. Convergent comparison on institutional policies on AI use.

Quantitative finding	Qualitative finding	Meta-inference
Strong agreement that more institutional guidance is needed (M=3.75).	Policies remain vague or undeveloped; lack of specific AI guidelines.	Policy gap is universally recognized: both datasets confirm institutions are in early stages of AI policy development.
Awareness of guidelines exists (M=3.44) but implementation varies.	Students aware of general academic integrity rules but no AI-specific guidance.	Students possess surface awareness without actionable clarity-knowing policies exist doesn't equate to understanding how to apply them.
Lowest compliance rating: "I follow institutional rules" (M=3.31).	Students navigate AI use through personal judgment rather than institutional direction.	Policy ambiguity breeds non-compliance: absence of clear standards makes rule-following difficult, not just unwillingness.
Faculty explain guidelines (M=3.44).	Instructors have differing views on acceptable AI use.	Faculty explanations are inconsistent because instructors themselves lack institutional direction-the policy vacuum affects both students and educators.
Policies help with ethical use (M=3.38) and outline consequences (M=3.42).	Students either freely use AI or avoid it due to fear of sanctions.	Moderate ratings reflect polarized student behaviors: some interpret vague policies permissively while others self-censor, creating unequal learning experiences.

Additionally, MAEd-Mathematics students show broad but shallow exposure to AI tools across research stages (see Table 5), with the highest use in topic selection (M = 3.50) and idea generation (M = 3.44), mainly through ChatGPT. Both data strands agree on strong AI use during editing (M = 3.40), particularly with Grammarly, but reveal minimal engagement during data analysis (M = 2.83) due to limited confidence in AI's analytical reliability. While integration across stages (M = 3.42) appears widespread, qualitative findings clarify this as tool-switching rather than strategic use. Training application (M = 3.06) remains moderate, as most students rely on peer learning instead of institutional training. Overall exposure (M = 3.29) reflects frequency but not depth, as qualitative data depict surface-level, exploratory use that risks uncritical dependence on AI. These results suggest that while AI tools support early and final stages of research, they are underutilized in core analytical tasks, indicating a need for guided, skill-based training to ensure ethical and effective integration.

MAEd-Mathematics students exhibit strong ethical awareness in using AI for research writing reflected in Table 6, as both data strands confirm high integrity (M = 3.67) and conscious avoidance of over-reliance (M = 3.67). Qualitative accounts reveal that students double-check AI outputs and view AI as a support tool rather than a substitute for intellectual work, reflecting graduate-level maturity and prior research experience (M = 3.65). However, gaps appear in disclosure practices, with the lowest score on AI acknowledgement (M = 3.46) driven by uncertainty about proper citation and plagiarism boundaries, not by ethical neglect. Similarly, moderate ratings for seeking faculty guidance (M = 3.58) highlight ambiguous ethical frameworks that prevent students from seeking help confidently. The findings expose a value–practice gap, where students uphold ethical principles but lack procedural clarity for implementing them in practice. Overall, both datasets converge on the need for institutionalized, ethics-focused AI literacy policies that translate values into action through clear citation formats, disclosure protocols, and training on AI-integrated research ethics.

Table 5. Convergent comparison on exposure to AI-powered tools in research writing.

Quantitative finding	Qualitative finding	Meta-inference
High exposure in topic selection (M=3.50) and idea generation (M=3.44).	Students use ChatGPT for topic formulation and generating research questions.	Early-stage AI dominance: both datasets confirm AI tools are most deeply integrated at research inception, shaping foundational decisions.
Strong use in literature review (M=3.42) and editing/proofreading (M=3.40).	QuillBot used for paraphrasing during literature review; Grammarly for finalizing papers.	Beginning-to-end pattern: AI adoption concentrates at initiation and finalization stages, creating a "bookend effect" in research workflow.
Low exposure in data analysis (M=2.83-lowest rating).	Familiarity is experiential, based on self-learning and peer recommendations rather than formal training.	Self-directed adoption creates inequality: exposure levels depend on personal initiative and technical proficiency, not equitable institutional provision.
Integration across research stages (M=3.42).	AI tools embedded across workflow: topic → literature → drafting → editing.	Quantitative "integration" reflects sequential tool-switching rather than cohesive methodology-students use different tools per stage but lack holistic AI strategy.
Low training application (M=3.06).	There is no formal training but there are seminars conducted to facilitate AI literacy among students.	Students teach themselves AI use because formal training is absent-the low mean reflects institutional failure to provide structured learning opportunities.
Moderate formatting use (M=3.27) with high SD (0.86).	Students may still rely on "traditional software or manual techniques".	Polarized practices: tech-savvy students automate formatting while others resist, reflecting generational or skill-based divides in AI adoption.

Table 6. Convergent comparison on ethical practices in AI use.

Quantitative finding	Qualitative finding	Meta-inference
Strong agreement on maintaining honesty/integrity (M=3.67) and avoiding over-reliance (M=3.67).	Students acknowledge "AI tools should enhance, not replace" intellectual contributions; awareness that overreliance leads to plagiarism.	Ethical consciousness is high: both datasets confirm students possess strong normative values about AI use, recognizing the boundary between assistance and substitution.
Adherence to ethical guidelines (M=3.62).	Students adopt responsible practices: double-checking AI text, citing paraphrased content.	Intentional ethical behavior: agreement translates into concrete actions-students don't just endorse ethics abstractly but implement verification strategies.
Draw on prior research experience for ethical practices (M=3.65).	Many participants "agreed AI enhances efficiency while upholding academic honesty".	Experiential ethics: research maturity shapes responsible AI use-graduate students leverage scholarly training to navigate AI integration ethically.
Lower agreement on disclosing AI assistance (M=3.46-lowest rating).	"Degree of ethical awareness varies" among students; uncertainty about indirect AI involvement.	Students may not seek guidance because they're unsure what questions to ask-ambiguity about what constitutes problematic AI use prevents help-seeking.
Moderate variability (SD=0.57) across ethical practices.	Some students uncertain about proper citation; ethical awareness varies.	Heterogeneous ethical competency: variability reflects different levels of exposure to academic integrity training, not uniform ethical standards.

Policy development emerges as the strongest convergence point between quantitative and qualitative findings (Table 7), with MAEd-Mathematics students showing the highest support for explicit AI-use guidelines (M = 3.85). Both datasets reveal a rare consensus (SD = 0.41), as participants unanimously call for clear, practical, and evolving policies to guide ethical and effective AI integration. Students emphasize the need for balanced governance that clarifies benefits and risks (M = 3.79), promoting AI as a supportive aid rather than a substitute for learning. Faculty training (M = 3.77) is identified as essential to ensure consistent interpretation and application of policies across departments, while student consultation (M = 3.69) highlights the importance of addressing real accessibility challenges. Furthermore, the strong call for regular updates (M = 3.81) reflects students' awareness of AI's rapid evolution and the need for adaptive, not static, governance. Overall, these findings underscore students' sophisticated understanding that sustainable AI integration in research requires dynamic, inclusive, and well-communicated institutional policy frameworks.

Table 7. Convergent comparison on policy development in AI use for research writing.

Quantitative finding	Qualitative finding	Meta-inference
Strongest agreement: institutions should establish explicit AI guidelines (M=3.85-highest across all objectives).	Unanimous call for "clear, practical, and ethical policies"; "schools should make policies that guide us".	Across methodologies, policy development emerges as the most pressing need-students demand institutional action with rare unanimity.
Policies must outline ethical integration (M=3.79) and clarify benefits/risks (M=3.79).	Guidelines should "emphasize responsible use, transparency, and academic honesty".	Balanced governance expectation: students don't seek restriction or permission-they want ethical frameworks that acknowledge AI's dual nature as tool and risk.
Faculty should be trained to guide AI use (M=3.77).	"Teachers should be trained about AI tools"; faculty training ensures "consistent interpretation across departments".	Top-down capacity building required: policy success depends on educator preparedness-guidelines without trained implementers create enforcement gaps.
Students should be consulted in policy-making (M=3.69).	Participants believe policies should "consider accessibility issues" and student experiences.	Participatory governance: policy legitimacy requires end-user involvement-students as stakeholders, not just policy recipients.
Regular policy updates needed (M=3.81).	AI technology evolves rapidly, necessitating "forward-thinking approach".	Dynamic policy framework: static rules fail for rapidly evolving technology-both datasets recognize need for adaptive governance.
High agreement on ethical guidelines (M=3.79).	Policies should ensure "AI is used as an aid rather than replacement for learning and critical thinking".	Quantitative emphasis on "ethics" gains specificity: ethics means preserving pedagogical integrity-AI shouldn't erode critical thinking development.
Student consultation in policy-making (M=3.69).	Policies should address "accessibility issues" raised by students.	Student input isn't ceremonial-it provides ground-level intelligence about digital divides and implementation barriers invisible to administrators.
Very low standard deviation (SD=0.41-remarkably consistent).	"Unanimous" agreement; quotes span beginning to advanced users.	Rare cross-experience consensus: policy need transcends proficiency levels-novices and experts alike recognize governance gaps.

Development of Policy Guideline for AI-Use in Research Writing

The findings clearly underscore the need of having a clear and specific policy guideline on how to use AI-powered tools in research writing stages. Thus, the study formulated a proposed policy guideline specifically designed for Master of Arts in Education (MAEd)-Mathematics students to address ethical concerns in AI-assisted research writing across five critical stages: topic identification and literature review, research design and methodology, data analysis and interpretation, discussion and conclusion, and editing, paraphrasing, and referencing.

The policy emphasizes transparency through mandatory disclosure requirements, verification of AI-generated content, preservation of human decision-making in methodological choices, and the development of independent research and writing capabilities. In order to facilitate implementation, the guideline includes sample templates such as an AI Use Disclosure Form, Verification and Reflection Statement, and

Authorship Integrity Affirmation, ensuring that MAEd-Mathematics students can responsibly integrate AI tools while maintaining academic integrity and demonstrating genuine mathematical and pedagogical understanding in their research outputs. Table 8 shows the ethical issue found in each stage of research writing as well as the policy guideline implication. These ethical issues were drawn from the result of the findings of this study (scan the QR code found in the appendix).

Table 8. Ethical issue and its policy implication in stages of research writing.

Stage of research writing	Ethical issue identified	Policy guideline implication
Topic identification and literature review	Overreliance on AI summaries; absence of citation; possible plagiarism or misinformation.	Require AI citation and verification when using AI for literature synthesis. Ban direct copying of AI-generated content. Conduct AI literacy workshops on evaluating secondary sources.
Research design and methodology	Delegating methodological choices to AI; compromising research validity.	Specify that AI can assist for clarification only; decisions on design, variables, or analysis must be human-justified.
Data analysis and interpretation	Risk of misinterpretation; absence of analytic transparency; reduced researcher engagement.	Mandate explicit disclosure of AI-assisted analysis. Require student reflection on how AI interpretation was verified or corrected.
Discussion and conclusion	Authorship dilution; distortion of original interpretation.	Require disclosure of AI editing in acknowledgment or methodology section. Ensure students verify conceptual accuracy after AI revision.
Editing, paraphrasing, and referencing	AI-based paraphrasing may mask plagiarism; overreliance reduces writing development.	Require originality checking for AI-paraphrased text. Implement AI literacy training distinguishing helpful rewriting vs. plagiarized content.

Discussions

Recent research highlights widespread student adoption of AI-powered writing tools such as ChatGPT, Grammarly, and QuillBot, with usage strategically aligned to different phases of the academic writing process (Raad *et al.,* 2023; Mahapatra, 2024; Shubha *et al.,* 2025). Surveys and systematic reviews confirm that students employ ChatGPT for summarization and ideation, QuillBot for paraphrasing and revision, and Grammarly for editing, while evidence from diverse university contexts suggests these tools address both lower-order concerns-like grammar-and higher-order tasks such as literature synthesis and critical analysis (Mahapatra, 2024; Zhao *et al.,* 2024; Black and Tomlinson, 2025).

Within mathematics education, studies document discipline-specific benefits of AI (e.g., lesson planning), but also caution about mathematical accuracy and risks to student critical thinking (Pepin *et al.,* 2025). Despite increased accessibility, digital literacy and platform familiarity vary widely across student populations, with institutional support remaining inconsistent and reinforcing calls for policies that balance innovation, academic integrity, and equitable access (Raad *et al.,* 2023; Shubha *et al.,* 2025).

Quantitative surveys indicate high accessibility to AI tools, but financial barriers like subscription costs and technological infrastructure gaps create inequitable access patterns among students (Flaherty, 2025; Zhao *et al.,* 2025). Varsik and Vosberg, (2024) and Vesna *et al.,* (2025) underscore that cost, infrastructure, and digital literacy deficiencies can exacerbate the digital divide, especially as resource-rich institutions offer more robust AI experiences than underfunded counterparts.

Research with students with disabilities further confirms that subscription fees and technical barriers limit equitable tool adoption even among populations who could benefit most (Atcheson *et al.,* 2025; Flaherty, 2025). These realities demand targeted strategies to remove financial and technical obstacles to widespread, equitable AI use in educational settings. Institutional policy development emerges as a critical factor for facilitating ethical AI adoption and closing equity gaps. Student and faculty surveys globally reveal that awareness of institutional AI guidelines is low and existing policies are often unclear, inconsistently enforced, or poorly communicated (Trucano, 2023; Vesna *et al.,* 2025). Faculty commonly report confusion in handling AI-related plagiarism due to vague procedures and lack of formal reporting frameworks, while students express a desire for clearer, more accessible rules and support mechanisms (Flaherty, 2025; Haque and Hundhausen, 2025). The evidence suggests institutions must not only create policy frameworks but ensure their integration into daily academic practice through effective communication, enforcement, and ongoing monitoring.

Recent surveys document high exposure to AI among students, with the majority using these tools in preliminary and surface-level writing tasks (Dumitru *et al.,* 2025; Zhao *et al.,* 2025). However, data show that student engagement with advanced features like data analysis and methodological support remains limited, signaling an urgent need for comprehensive AI literacy training encompassing all stages of academic writing.

Training programs should empower students to utilize AI efficiently and ethically, moving beyond basic use to advanced academic support while safeguarding integrity and originality. Further, it highlights technical and financial barriers, reaffirming that privileged backgrounds correlate with more robust AI access-a gap institutions must address (Bowden, 2024; Sousa and Cardoso, 2025).

Ethical awareness and disclosure practices among students reflect ongoing gaps in institutional guidance and protocol. (Gonsalves, 2025) reports high rates of unreported AI use, with ambiguous guidelines, enforcement inconsistency, and fear of repercussions cited as core obstacles to ethical compliance. The absence of standardized disclosure frameworks and mentorship limits students' ability to responsibly declare AI assistance, exposing the need for transparent, enforceable institutional standards for ethical authorship and acknowledgment in academic work. Such standards must be actively taught, consistently modeled by faculty, and regularly revised in light of evolving AI technology and pedagogical realities.

All in all, empirical evidence reaffirms a growing demand for structured, dynamic institutional frameworks governing ethical AI use in academic writing (Ateeq *et al.,* 2024; Onufer, 2024; Jiang *et al.,* 2025; Lund *et al.,* 2025; Zhao *et al.,* 2025). Effective frameworks require stakeholder engagement, continuous policy evaluation, targeted training programs, and feedback mechanisms, operationalizing core pillars-transparency, integrity, skill development, equity, and adaptive governance. Only with coordinated action, ongoing monitoring, and responsive adaptation can institutions ensure AI integration supports academic excellence, maintains integrity, and narrows digital and equity gaps in higher education.

Conclusion

The study reveals that MAEd Mathematics students actively utilize AI-powered tools, mainly for idea generation, content organization, and editing, yet their engagement remains surface-level. This pattern reflects the Digital Divide Theory, which emphasizes that while access to digital tools is increasing, the depth and quality of usage remain uneven. Students with higher digital literacy and stronger institutional support can harness AI more effectively, whereas others are restricted to basic functions due to limited training or financial barriers.

The convergence of quantitative data showing widespread AI use and qualitative evidence of shallow engagement underscores a skill-based divide rather than one of access. Moreover, although students display strong ethical awareness, uncertainty persists regarding proper AI citation and plagiarism avoidance. Despite the absence of formal AI-related research policies, students attempt to uphold ethical standards guided by instructors. These findings highlight the urgent need for clear institutional policies and training programs to promote equitable, ethical, and meaningful integration of AI in research writing.

Based on the findings, it is recommended that institutions establish a comprehensive AI literacy framework within the MAEd Mathematics curriculum to promote equitable and ethical integration of AI in research writing. This framework should include structured training, seminars, and workshops focusing on tool functionality, ethical awareness, and critical application of AI across all research stages. Embedding AI instruction into coursework will empower students to choose and use tools effectively while reinforcing the principle that AI should complement, not replace, human intellectual effort.

Institutions should also provide support mechanisms such as access to licensed AI tools, mentoring programs, and research assistance to address disparities in competence and access. Moreover, clear institutional policies must be developed to define acceptable AI use, citation standards, and plagiarism boundaries, supported by faculty training to ensure consistent implementation. Finally, policies should remain adaptive and regularly updated to reflect technological progress, maintaining the institution's relevance and leadership in ethical AI integration in education and research.

Appendix

Proposed Guidelines for AI-Use in Research Writing

Declarations

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Author Contribution: Definition of intellectual content, literature survey, prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation, manuscript revision, and publication.

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Informed Consent Statement: The participation in this study involved a brief orientation (10 minutes) and completion of questionnaire and interview (30 minutes). Selected MAEd-Math students were invited to participate because their experiences are relevant and essential to this research. Moreover, the participation was entirely voluntary and was free from any form of coercion. It is understood that when a participant agreed to join, they will be asked to sign an informed consent form but may withdraw at any time without providing a reason. Should a participant withdraw before data collection is completed, all information related to them will be deleted (both softcopy and hardcopy).

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