

AI Impact of Power Tools from Academic to Social Value: Beyond Educational Outcomes Toward Social Significance

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Abstract. Artificial Intelligence (AI) has become an integral component of contemporary education, providing pre-service teachers with AI-powered applications that support learning activities and technology-enhanced academic experiences. As the adoption of these tools continues to expand, it is important to examine their influence not only on academic achievement and learner motivation but also on competencies that generate broader social value. This investigation employed an explanatory sequential mixed-methods design involving 148 first-year pre-service teachers from North Eastern Mindanao State University–Cantilan Campus. Quantitative data were collected from all 148 respondents using a validated instrument that assessed AI tool usage frequency, tool variety, perceived ease of use, and perceived usefulness. For the qualitative phase, 24 purposively selected participants from the 148 respondents provided in-depth responses to two open-ended questions, which were analyzed using thematic analysis to further explain and enrich the quantitative findings. The quantitative findings indicated that AI-powered tool utilization was significantly associated with perceived academic performance, particularly in terms of examination outcomes and assignment quality. Regarding motivation, the diversity of AI tools used showed significant relationships with perceived ease of use and perceived usefulness, whereas usage frequency alone was not significantly related to motivation. The qualitative findings further demonstrated that AI-supported learning promotes academic productivity, digital readiness, technological adaptability, responsible engagement with emerging technologies, and competencies that extend

beyond educational settings into broader social participation. Findings indicate that AI-powered tools contribute not only to improved academic development but also to the cultivation of capabilities that support meaningful participation within increasingly technology-driven educational and societal environments.

Keywords: Artificial Intelligence; AI-powered tools; pre-service teachers; academic performance; digital readiness; social value; technology acceptance

1. Introduction

Artificial Intelligence (AI) has rapidly emerged as a transformative force across numerous sectors, with higher education among the fields experiencing substantial change. The increasing availability of AI-powered applications—including intelligent tutoring systems, automated writing assistants, and generative content platforms—has altered the ways learners obtain information, accomplish academic tasks, and interact with instructional materials. Within teacher education, these technologies provide pre-service teachers with additional opportunities to improve learning efficiency, stimulate creativity, and enhance academic productivity. As AI becomes more deeply integrated into educational practice, understanding its implications for learning outcomes and student motivation has become an important concern for teacher education institutions.

For pre-service teachers, AI-powered technologies represent more than convenient digital resources because they support the development of academic competence while strengthening confidence in technology-enhanced learning environments. These applications assist learners in completing a wide range of academic activities, including brainstorming ideas, editing written work, paraphrasing texts, summarizing information, generating lesson concepts, and organizing study materials. Consequently, many future teachers increasingly incorporate AI into their academic routines to improve task completion and reduce cognitive demands. Despite these advantages, it remains necessary to determine whether frequent AI utilization actually contributes to measurable improvements in academic performance and whether learner motivation explains this relationship.

Emerging research presents mixed findings regarding the impact of AI-powered tools on learners. Some studies suggest that AI technologies enhance productivity, facilitate understanding, and increase engagement, while others highlight concerns related to overreliance, diminished critical thinking, and superficial learning. These contrasting findings underscore the need for localized empirical investigations, particularly among pre-service teachers who serve as both current learners and future educators. Understanding how they experience and utilize AI-powered tools is essential for promoting responsible, effective, and meaningful technology integration within teacher education.

Beyond academic performance and learner motivation, AI-powered tools have gained increasing relevance in shaping broader forms of social value (Chisom & Chloe, 2025). The integration of emerging technologies in learning environments has increasingly been associated with learners' capacity to adapt to digital demands, strengthen confidence in technology use, and develop competencies necessary for educational and professional participation. These outcomes suggest that technology-assisted learning extends beyond academic achievement and contributes to broader forms of personal and social

development (Diamante et al., 2025). Through continuous interaction with AI technologies, learners develop digital literacy, ethical awareness, information-evaluation skills, technological adaptability, and responsible technology-use practices that extend beyond classroom requirements. These competencies influence how individuals communicate, collaborate, participate in digital communities, and respond to the demands of an increasingly technology-driven society.

Despite growing scholarly attention to AI in education, existing literature remains largely focused on academic outcomes such as performance, efficiency, and motivation, providing limited understanding of how AI-powered tools contribute to broader social significance. Consequently, there remains a need to examine how AI utilization supports not only learning outcomes but also the development of digital readiness, responsible engagement, and competencies that contribute to future professional and societal participation.

To address these limitations in the existing literature, the present study explores the influence of AI-powered tools among pre-service teachers by considering both educational outcomes and broader social implications. The study focuses on how the use of AI technologies shapes learning experiences, academic performance, learner motivation, digital readiness, and competencies that remain valuable beyond formal educational environments. By generating empirical evidence within a teacher education setting, this study expands current scholarship on artificial intelligence in education and provides a clearer understanding of how AI-supported technologies foster social value through responsible technology use, informed decision-making, and meaningful participation in digitally connected communities.

The increasing presence of AI technologies in everyday learning activities further emphasizes their relevance to broader societal development. Regular engagement with AI-powered systems enables learners to strengthen digital literacy, technological adaptability, collaborative capabilities, and responsible information practices that are highly valued in contemporary society (Mariyono & Nur, 2025). Among pre-service teachers, these competencies extend beyond supporting academic success because they also prepare future educators to meet professional responsibilities and contribute responsibly within technology-rich communities. Accordingly, examining AI through both educational and social lenses provides a more holistic understanding of its contribution to individual growth and wider societal advancement.

Artificial Intelligence continues to reshape educational practice by providing flexible, personalized, and data-informed learning support. Applications such as adaptive learning systems, AI-assisted writing platforms, and generative AI technologies improve instructional processes while simplifying numerous academic activities (Salido, 2023). For pre-service teachers, these tools also serve as models of future classroom technologies, making AI literacy an essential component of teacher preparation programs. Existing evidence indicates that these technologies expand students' access to relevant information, minimize the time required for repetitive academic work, and strengthen self-regulated learning behaviors (Chen et al., 2022). Within teacher education, exposure to these technologies also prepares future educators to utilize digital innovations effectively in their own classrooms, making AI literacy an increasingly important component of professional preparation.

2. Literature Review

2.1. AI in Education and Its Emerging Role

Artificial Intelligence has increasingly shaped educational landscapes by providing flexible, personalized, and data-driven learning support. AI-powered systems such as adaptive learning platforms, writing assistants, and generative AI enhance instructional delivery and streamline academic tasks (Salido, 2023). Studies highlight that AI tools improve students' access to information, reduce time spent on repetitive tasks, and support self-regulated learning (Chen et al., 2022). For pre-service teachers, these tools also serve as models of future classroom technologies, making AI literacy an essential component of teacher preparation programs.

Beyond supporting academic learning, AI literacy also carries broader social relevance. As learners interact with AI-powered systems, they develop competencies related to digital communication, information evaluation, ethical technology use, and responsible participation in technology-mediated environments (Nur, 2021). These capabilities extend the value of AI beyond educational settings and contribute to the development of individuals who can effectively navigate the social and technological demands of contemporary society.

AI Learning Performance

Studies examining the relationship between AI-powered tools and academic performance have produced mixed findings. Some researchers reported that AI applications improve learning by supporting knowledge organization, generating feedback, enhancing writing quality, and increasing task accuracy (Sahiner & Sahiner, 2021). Tools such as ChatGPT, Grammarly, and AI-based tutoring systems also promote better comprehension and reflective learning. Conversely, other scholars argued that excessive dependence on AI may reduce critical thinking and encourage superficial learning, limiting authentic academic development (Koehler et al., 2023).

While academic performance remains a central indicator of educational outcomes, the influence of AI-powered tools may extend beyond measurable academic achievements. The ability to access, analyze, and utilize information efficiently can contribute to broader competencies that support workplace readiness, informed decision-making, and participation in knowledge-based communities. These outcomes suggest that AI technologies may generate forms of social value that complement their educational benefits.

AI Learning Motivation

Learner motivation influences the acceptance and continued use of educational technologies. According to the Technology Acceptance Model (TAM), perceived ease of use and perceived usefulness shape students' motivation and intention to adopt technology (Davis, 1989). Studies applying TAM to AI have shown that students who consider AI tools accessible and beneficial demonstrate stronger academic motivation and engagement (Mark & Nguyen, 2024). AI-generated feedback, content suggestions, and simplified learning tasks improve learning experiences, strengthen confidence, and lessen cognitive demands, encouraging greater participation in academic activities.

Among pre-service teachers, motivation supports openness toward technology integration in future teaching practice. Those with higher motivation are more willing to explore digital tools, strengthen their learning experiences, and implement innovative instructional approaches in technology-enhanced classrooms. Motivation toward AI utilization may also influence learners' engagement beyond academic contexts. Students

who are confident and motivated in using AI technologies are more likely to participate in collaborative digital environments, share knowledge resources, and engage in technology-supported communication. These forms of participation demonstrate how AI-assisted motivation can contribute to broader social engagement and meaningful interaction within increasingly digital communities.

Patterns of AI Tool Usage Among Pre-Service Teachers

Evidence shows that pre-service teachers increasingly incorporate AI tools into academic routines. Common tasks include brainstorming, drafting, editing, reference searching, summarizing, and generating lesson ideas (Ponce & Paglinawan, 2023). Students prefer tools that provide instant feedback, reduce effort, and help overcome academic challenges. However, patterns of use vary depending on students' digital literacy, course demands, and personal study habits. Some research suggests that high-frequency users tend to rely on AI for writing-intensive tasks, whereas others use it as a supplementary study aid. These variations underscore the need to understand how usage frequency and tool variety relate to student outcomes. Patterns of AI tool utilization may likewise reflect learners' capacity to adapt to rapidly evolving technological environments. AI applications can strengthen digital adaptability, technological confidence, and information-management skills that are increasingly valuable beyond academic settings. Exposure to technology-assisted learning environments has likewise been associated with improved learning engagement, particularly when learners actively interact with instructional innovations that encourage participation and knowledge construction (Legarde et al., 2025). Such competencies possess social significance because they enable individuals to participate more effectively in digital communities, respond to technological change, and engage productively within knowledge-driven societies.

Concerns and Ethical Considerations

Despite the educational benefits associated with AI, several concerns continue to receive attention in the literature. Reported issues include academic misconduct, reduced originality, data privacy concerns, and the possibility that students may complete academic requirements without fully engaging in the learning process (Dwivedi et al., 2023). Excessive dependence on AI may also weaken independent reasoning, critical thinking, and problem-solving abilities. Within teacher education, these concerns emphasize the need to promote responsible AI practices while preserving academic integrity. Similar findings indicate that educators continue to emphasize responsible AI utilization and academic integrity as essential considerations when integrating generative AI into higher education learning environments (Mundo et al., 2024). Understanding how pre-service teachers use and perceive AI can support the development of appropriate institutional guidelines for ethical technology use.

The ethical dimension of AI also extends beyond higher education. Responsible use of technology, information integrity, digital accountability, and equitable access to AI resources shape participation in contemporary digital communities. Therefore, evaluating AI-powered tools requires consideration of both their educational value and their capacity to encourage ethical behavior and responsible participation in technology-mediated environments.

Synthesis and Research Gap

Existing literature demonstrates that AI-powered tools contribute to learning efficiency and motivation, yet their direct impact on academic performance remains inconclusive.

Moreover, most prior studies focus on general university students, with limited attention to **pre-service teachers**, whose professional preparation requires both academic rigor and technological competence. Little is known about how the **frequency and variety of AI tool usage** relate to **motivation and academic performance** within teacher education contexts.

Thus, this study addresses a critical gap by examining these relationships among pre-service teachers, offering insights relevant for curriculum design, AI literacy development, and responsible integration of AI in teacher education programs. Although existing studies have extensively examined the relationship between AI-powered tools and educational outcomes such as academic performance, engagement, and motivation, considerably less attention has been given to their broader social value and social significance. Current evidence largely focuses on classroom-based outcomes, leaving limited understanding of how AI influences digital citizenship, responsible technology engagement, social participation, and competencies that extend beyond educational environments. Addressing these dimensions is essential for developing a more comprehensive understanding of AI impact that moves from academic outcomes toward broader contributions to individual and societal development.

2.2. Theoretical Framework of Technology Acceptance Model (TAM)

The present study is guided by the Technology Acceptance Model (TAM) introduced by Davis (1989), a theoretical framework that explains why individuals accept and continue using technological innovations. TAM proposes that users' acceptance of a technology is primarily influenced by two interrelated constructs: Perceived Ease of Use (PEOU) and Perceived Usefulness (PU). Perceived Ease of Use refers to an individual's belief that a technology can be used with minimal effort, whereas Perceived Usefulness reflects the belief that the technology enhances task accomplishment and improves overall performance.

Within educational settings, TAM has frequently been applied to explain students' acceptance of AI-powered technologies. Learners who perceive AI applications as accessible and beneficial are generally more willing to incorporate them into their academic activities, which may influence learning behaviors, engagement, and educational outcomes. In the context of this investigation, the model also provides a framework for understanding how acceptance of AI technologies may extend beyond academic performance. Positive perceptions of AI usefulness and ease of use may encourage responsible technology engagement, informed decision-making, digital readiness, and effective participation in technology-mediated environments. Accordingly, TAM supports the view that acceptance of AI-powered tools may contribute not only to academic development but also to competencies associated with broader social value and meaningful participation in contemporary society.

3. Methodology

3.1 Design

An explanatory sequential mixed-methods approach served as the research design for this study. The inquiry began with a quantitative component using a descriptive-correlational design to determine the associations among AI-powered tool utilization, academic performance, and learner motivation of pre-service teachers. The succeeding qualitative

component gathered participants' experiences and perceptions to clarify and enrich the interpretation of the quantitative results.

The descriptive phase documented the existing characteristics of the variables, whereas the correlational component examined their statistical associations. Integrating qualitative evidence after the quantitative analysis provided a more comprehensive explanation of AI-powered tool utilization and its relationship with academic performance, motivation, and learning outcomes among pre-service teachers.

3.2 Participants

The quantitative phase of the study involved 148 first-year pre-service teachers enrolled in the six programs under the Department of General Teachers Training at North Eastern Mindanao State University–Cantilan Campus during the Academic Year 2025–2026. These programs include the Bachelor of Secondary Education major in English, Filipino, Science, and Mathematics, the Bachelor of Technical Vocational and Livelihood Education, and the Bachelor of Science in Technology Education. The 148 respondents participated in the quantitative survey that examined AI-powered tool utilization, academic performance, and learner motivation. For the qualitative phase, 24 participants were purposively selected from the 148 respondents to provide more in-depth insights through the two open-ended questions. Their responses served as the basis for the thematic analysis used to further explain and enrich the quantitative findings.

3.3. Research Instrument

The study utilized an adopted questionnaire based on Impact of AI-Powered Learning Tools on Student Understanding and Academic Performance and Motivation by Veronica Salido. The questionnaire contains about AI for Students' that delves into student perspectives on artificial intelligence in education. Gain valuable insights and opinions on AI integration. The researcher asked permission from the owner of the instrument through email (Please see Appendix A.)

To complement the quantitative findings, two open-ended qualitative questions were included to gather participants' experiences, perceptions, and reflections regarding the influence of AI-powered tools on their learning activities, academic performance, technology-use practices, and professional development. Responses to these questions served as the basis for thematic analysis and qualitative theme generation.

- a. Q1. How do AI-powered tools influence your learning activities, technology use practices, and engagement within academic and digital environments?
- b. Q2. In what ways do AI-powered tools influence your academic performance, quality of work, and ability to contribute meaningfully to learning and professional development?

3.4 Data Collection and Analysis

Approval to conduct the investigation was obtained from the Department Chair of the College of General Teachers Training through the respective program coordinators before data collection commenced. After receiving authorization, the researcher personally

distributed the questionnaires to the participants and collected all completed instruments immediately after completion, resulting in a 100% response rate.

Quantitative data obtained from the 148 respondents were processed using the Weighted Mean and Standard Deviation to describe AI-powered tool utilization, perceived motivation, and academic performance. The Pearson Product-Moment Correlation Coefficient, evaluated at the 0.05 level of significance, was employed to determine the magnitude and direction of the relationships among AI-powered tool utilization, academic performance, and learner motivation. For the qualitative phase, the responses of the 24 purposively selected participants from the 148 participants to the two open-ended questions were analyzed using descriptive thematic analysis. The researcher repeatedly reviewed the responses to achieve familiarity with the dataset, identified meaningful statements and recurring ideas, assigned initial codes, grouped related codes into categories, and generated overarching themes that represented common patterns across participants' narratives. Representative participant excerpts were used to support each theme. Finally, the qualitative findings were integrated with the quantitative results to provide a more comprehensive and contextually grounded interpretation of the findings within the explanatory sequential mixed-methods design.

4. Results and Findings

Table 1. Students use of AI-Powered Tools

Usage Frequency	Weighted Mean	Verbal Description
1. I regularly use AI tools to support my academic work.	3.17	Agree
2. I use an AI-powered tool every day.	2.35	Disagree
3. I rely on AI-powered tools for the majority of my academic requirements.	2.15	Disagree
4. I consistently use AI tools during the entire academic semester.	2.35	Disagree
5. I usually use AI-powered tools whenever I have assignments or upcoming examinations.	2.65	Agree
6. I use AI-powered tools to organize my daily study activities.	2.18	Disagree
7. I use AI-powered tools even when completing minor academic tasks..	2.05	Disagree
8. I increase my use of AI-powered tools whenever I have several assignments to complete.	2.78	Agree
9. AI-powered tools are a regular part of my weekly study routine.	2.52	Agree
10. I usually access AI-powered tools before I begin studying.	2.13	Disagree
<i>Average Weighted Mean</i>	2.43	Disagree

Legend:

1:00 – 1.74 SD 1.75 – 2.49 D 2.50 – 3.24 A 3.25 – 4.00 SA

Tool Variety	Weighted Mean	Verbal Description
11. I regularly use different AI-powered tools for my academic work.	2.32	Disagree
12. I use different AI-powered tools depending on the subject or academic task.	2.72	Agree
13. I utilize AI tools for note-taking, creating flashcards, and reviewing lessons.	2.97	Agree
14. I switch between different AI-powered applications according to my academic needs.	2.95	Agree
15. AI-powered tools I use support various academic purposes, such as writing, studying, and organizing schoolwork.	2.90	Agree
16. I frequently try newly available AI-powered study applications.	2.87	Agree
17. I use specialized AI tools for complex subjects.	2.93	Agree
18. My academic requirements often require the use of multiple AI-powered tools.	2.37	Disagree
19. I adjust my choice of AI-powered applications according to the requirements of each subject.	3.02	Agree
20. I am comfortable using multiple types of AI tools that match various learning preferences.	2.80	Agree
<i>Average Weighted Mean</i>	2.78	Agree

Table 1 summarizes respondents' utilization of AI-powered learning tools. The overall weighted mean of 2.43, interpreted as "Disagree," indicates that AI applications are not extensively incorporated into the participants' academic routines. Among the usage-frequency indicators, the statement "I frequently use AI-powered tools (e.g., ChatGPT, Grammarly) to assist with my studies" recorded the highest weighted mean (3.17; Agree), suggesting that respondents utilize these technologies primarily when academic support is needed. In contrast, the statement "I use AI-powered tools even for small academic tasks" obtained the lowest weighted mean (2.05; Disagree), implying that AI applications are generally reserved for more demanding or cognitively intensive academic requirements. These findings suggest that although respondents are acquainted with AI-powered applications such as ChatGPT and Grammarly, their overall level of utilization remains moderate. Rather than incorporating these technologies into routine learning activities, students appear to engage with them selectively, particularly when confronted with more complex academic demands. The immediate assistance provided through AI-generated responses may explain this pattern, as learners perceive these applications as effective resources for addressing academic concerns and facilitating task completion (Anders, 2023).

Regarding Tool Variety, the overall weighted mean of 2.78, interpreted as "Agree," reflects favorable perceptions toward the diversity of AI-powered applications used for learning. The statement "I adapt my tool usage depending on the subject's requirements" obtained the highest weighted mean (3.02; Agree), indicating that respondents demonstrate flexibility in selecting AI applications according to specific academic requirements. Conversely, "I use a variety of AI-powered study tools regularly" yielded the lowest weighted mean (2.32; Disagree), suggesting that respondents tend to depend on a relatively limited range of AI applications despite recognizing the value of selecting tools

that correspond with different learning tasks. It indicate that respondents demonstrate adaptive technology-use practices but have not yet fully diversified their utilization of available AI applications. Expanding familiarity with a broader range of AI-powered tools may enhance learning efficiency and optimize their educational benefits. This interpretation aligns with Zhao et al. (2025), who emphasized that technology adoption is influenced not only by efficiency but also by users' willingness to explore, develop familiarity with different applications, and select technologies that correspond with specific academic tasks.

Question 1. How do AI-powered tools influence your learning activities, technology use practices, and engagement within academic and digital environments?

The quantitative findings revealed that respondents generally reported moderate usage of AI-powered tools (WM = 2.43) while demonstrating positive perceptions regarding tool variety (WM = 2.78). To provide deeper insight into these findings, 24 purposively selected participants from the 148 respondents were asked how AI-powered tools influence their learning activities, technology-use practices, and engagement within academic and digital environments. The qualitative responses revealed that AI technologies function as academic support resources while simultaneously fostering digital readiness and broader forms of social value.

AI as an Academic Support Companion

Sixteen (16) out of the 24 participants described AI-powered tools as academic support companions that assisted them in completing assignments and understanding difficult lessons. Although the overall frequency of use was moderate, many participants acknowledged utilizing AI technologies when faced with challenging learning tasks. The findings suggest that AI functions as a supplementary learning companion that enhances efficiency and supports academic productivity.

"I frequently use AI-powered tools (e.g., ChatGPT, Grammarly) to assist with my studies, especially when I need help understanding difficult topics or improving my assignments."

"I tend to increase my use of AI tools when I have multiple assignments because they help me organize my work and finish tasks more efficiently."

Building Digital Readiness and Social Value

The table 1 further indicated that students utilized different AI tools depending on academic requirements and expressed comfort in using multiple AI applications. These findings were reflected by eighteen (18) out of the 24 participants' narratives, which emphasized how exposure to technologies strengthened digital confidence, adaptability, and responsible engagement within technology-mediated environments. Such experiences demonstrate that the influence of AI extends beyond academic support toward the development of competencies associated with social value and digital participation.

"I am comfortable using multiple types of AI tools for different learning styles, which helps me become more confident in using technology."

"Exploring new AI-powered study tools allows me to improve my digital skills and adapt to new technologies that may also be useful outside the classroom."

Table 2. Students perceive their motivation towards AI

Ease of Use	Weighted Mean	Verbal Description
1. I find AI-powered tools easy to operate.	3.25	Strongly Agree
2. I feel capable of using AI-powered tools for my educational activities.	2.73	Agree
3. I quickly become familiar with newly introduced AI-powered tools for learning.	3.02	Agree
4. AI tools are straightforward and easy for me to comprehend.	3.20	Agree
5. I seldom require assistance when using AI-powered tools.	2.70	Agree
6. I experience very few difficulties while using AI-powered tools for academic purposes.	3.00	Agree
7. I consider AI-powered tools dependable for completing academic requirements.	2.75	Agree
8. I have confidence in the information generated by AI-powered tools.	2.52	Agree
9. AI-powered tools are convenient for completing tasks quickly	3.12	Agree
10. Using AI-powered tools for my studies is generally hassle-free for me.	3.05	Agree
<i>Average Weighted Mean</i>	2.93	Agree
Usefulness	Weighted Mean	Verbal Description
11. AI-powered tools effectively support my understanding of difficult concepts.	3.30	Strongly Agree
12. I believe AI-powered tools contribute to my overall academic performance.	3.03	Agree
13. AI-powered tools enhance the overall quality of my academic outputs.	3.78	Strongly Agree
14. AI-powered tools help me retain information better	2.92	Agree
15. I consider AI-powered tools valuable for completing academic tasks efficiently.	3.02	Agree
16. AI-powered tools make it easier to meet deadlines	3.00	Agree
17. I believe AI-powered tools improve my performance during examinations.	2.63	Agree
18. AI-powered tools assist me in organizing my study materials efficiently.	2.87	Agree
19. AI tools help me stay focused by making academic tasks more manageable.	2.72	Agree
20. AI-powered tools make a meaningful contribution to my academic success.	3.03	Agree

<i>Average Weighted Mean</i>	3.03	Agree
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The findings presented in Table 2 indicate that respondents expressed favorable perceptions of AI in terms of Ease of Use, reflected in an overall weighted mean of 2.94, interpreted as “Agree.” Among the indicators, “AI-powered tools are easy to use” registered the highest weighted mean (3.25; Strongly Agree), demonstrating that respondents generally perceived these technologies as intuitive and readily navigable. In contrast, “I trust the information provided by AI-powered tools” obtained the lowest weighted mean (2.52; Agree). Although participants recognized the accessibility and practicality of AI applications, their confidence in the precision and dependability of AI-generated information remained comparatively restrained. This pattern suggests the importance of strengthening digital literacy and evaluative judgment so that learners can critically appraise AI-generated content before incorporating it into academic work. These findings correspond with Llego (2023), who emphasized that maximizing the educational potential of artificial intelligence requires collaborative engagement among educators, institutional leaders, and policymakers. Such collaboration encourages the responsible integration of AI while complementing human capabilities and advancing the delivery of quality education.

With respect to Usefulness, respondents likewise demonstrated favorable perceptions, as reflected in an overall weighted mean of 3.03, interpreted as “Agree.” The indicator “AI-powered tools improve the quality of my assignments” recorded the highest weighted mean (3.78; Strongly Agree), indicating that respondents perceived AI applications as valuable resources for enhancing the quality and presentation of academic outputs. Conversely, “I feel that AI helps me perform better on exams” yielded the lowest weighted mean (2.63; Agree), suggesting comparatively lower confidence in the contribution of AI to examination performance. These findings imply that respondents primarily associated AI with improving coursework, assignment completion, and learning productivity rather than directly strengthening assessment performance. This interpretation is consistent with Fosner (2024), who reported that although most students perceived AI tools as enhancing their effectiveness as learners, relatively few attributed improvements in academic grades or language proficiency to AI utilization. The same investigation further noted that learners more frequently relied on AI for summarizing, paraphrasing, translating, and grammar refinement than for examination preparation or idea generation.

AI for Meaningful Learning Engagement

Seventeen (17) out of the 24 participants described AI-powered tools as accessible and user-friendly technologies that support learning activities and encourage active engagement in academic tasks. The ease of using AI applications enabled participants to navigate digital resources more confidently and complete learning requirements with less difficulty. These experiences suggest that accessible AI technologies not only enhance learning engagement but also encourage greater participation in technology-mediated environments.

“AI-powered tools are easy to use and help me complete academic tasks without spending too much time learning how the system works.”

"I rarely encounter difficulties when using AI-powered tools because they are user-friendly and easy to understand."

AI-Enabled Learning Productivity and Social Contribution

Twelve (12) out of the 24 participants emphasized that AI-powered tools improve learning efficiency by helping them understand complex topics, complete assignments, and manage academic responsibilities more effectively. The usefulness of these technologies motivated learners to maximize available resources and improve the quality of their outputs. Beyond academic productivity, participants recognized that efficient use of AI can support knowledge sharing, collaboration, and responsible participation in learning communities, demonstrating broader forms of social value.

"AI-powered tools help me understand difficult lessons and improve the quality of my assignments."

"I find AI tools useful because they help me organize study materials and complete academic requirements more efficiently."

Table 3. Students perceive their academic performance

Exam Scores	Weighted Mean	Verbal Description
1. Using AI-powered learning tools, my academic grades have improved.	2.75	Agree
2. I feel more prepared for exams due to AI-powered tools.	2.63	Agree
3. AI tools strengthen my ability to remember information needed for examinations.	2.75	Agree
4. AI-powered tools enhance the quality of my academic assignments.	2.93	Agree
5. AI-assisted learning resources increase my confidence when taking examinations.	2.63	Agree
6. I rely on AI-powered tools to review and reinforce topics covered in examinations.	2.52	Agree
7. AI tools help me develop a deeper understanding of examination-related topics.	2.87	Agree
8. AI-powered tools assist me in identifying the topics that require further review before examinations.	2.72	Agree
9. I tend to obtain better examination results when I study with AI-powered tools.	2.57	Agree
10. AI-powered tools make it easier for me to retrieve information during examinations.	2.70	Agree
<i>Average Weighted Mean</i>	2.71	Agree
Assignment Quality	Weighted Mean	Verbal Description

11. AI-powered tools enhance the overall quality of my assignments.	3.00	Agree
12. AI assistance enables me to complete assignments with greater accuracy.	2.92	Agree
13. AI-powered tools help me prepare assignments that are more organized.	2.85	Agree
14. My problem-solving ability has improved through the use of AI-powered tools.	2.78	Agree
15. AI tools improve the clarity and logical flow of my written outputs.	2.95	Agree
16. I am able to meet deadlines more easily with AI-powered tools.	2.98	Agree
17. The use of AI-powered tools reduces errors in my assignments.	2.93	Agree
18. AI tools assist me in generating ideas and developing content for assignments.	2.98	Agree
19. AI-powered tools improve my ability to locate credible sources for academic work.	2.92	Agree
20. AI-powered tools help ensure that my assignments satisfy academic requirements.	2.98	Agree
<i>Average Weighted Mean</i>	2.93	Agree

Table 3 presents respondents' perceived academic performance across the dimensions of Exam Scores and Assignment Quality. For Exam Scores, the overall weighted mean reached 2.71, corresponding to the verbal interpretation "Agree." Among the measured indicators, "AI-powered tools have improved the quality of my assignments" registered the highest weighted mean (2.93; Agree), suggesting that respondents perceived AI applications as beneficial in refining the quality and organization of their academic outputs. Conversely, the indicator "I rely on AI-powered tools to review and reinforce exam content" obtained the lowest weighted mean (2.52; Agree). This pattern indicates that although respondents acknowledged the academic value of AI applications, they were comparatively less inclined to depend on these technologies during examination preparation. Such responses may indicate continued reliance on conventional review strategies or a more reserved level of confidence in AI-assisted support for examination-related learning.

Comparable observations were reported by Wecks et al. (2024), who found that students using generative AI obtained lower examination scores, on average, than non-users, suggesting that learners may exercise greater caution when depending on AI technologies for examination performance. Regarding Assignment Quality, respondents likewise expressed favorable perceptions, reflected in an overall weighted mean of 2.98, interpreted as "Agree." The statement "AI-powered tools have improved the quality of my assignment" achieved the highest weighted mean (3.00; Agree), whereas "My problem-solving skills have improved due to using AI-powered tools" recorded the lowest weighted mean (2.78; Agree).

Respondents regarded AI-powered applications as valuable resources for producing more organized, accurate, and well-developed academic outputs. Nevertheless, the comparatively lower evaluation assigned to problem-solving skills

suggests that although AI enhances the presentation and quality of written work, its contribution to higher-order cognitive processes remains less evident. Consequently, respondents appear to utilize AI primarily as an academic support resource rather than as a mechanism for strengthening independent analytical reasoning and cognitive problem-solving abilities.

Question 2. In what ways do AI-powered tools influence your academic performance, quality of work, and ability to contribute meaningfully to learning and professional development?

The quantitative findings showed that respondents perceived AI-powered tools as easy to use (WM = 2.93), useful (WM = 3.03), and beneficial for improving academic performance, particularly assignment quality (WM = 2.93). To further explain these results, 24 purposively selected participants from the 148 respondents were asked how AI-powered tools influence their academic performance, quality of work, and ability to contribute meaningfully to learning and professional development. The qualitative findings revealed that AI-supported learning promotes both quality-oriented academic outputs and competencies that extend toward future professional and societal contributions.

Strengthening Quality-Oriented Learning Outputs

Sixteen (16) out of the 24 participants shared that AI-powered tools contributed to the improvement of their academic outputs by assisting them in organizing ideas, refining written work, and enhancing the overall quality of assignments. The availability of immediate feedback and content support enabled learners to produce outputs that were more structured, accurate, and aligned with academic expectations. These experiences suggest that AI technologies serve as valuable resources for promoting quality-oriented learning practices among pre-service teachers.

“AI-powered tools have improved the quality of my assignments by helping me organize my ideas and improve the clarity of my work.”

“Using AI tools allows me to produce more accurate and well-structured outputs that meet academic requirements.”

Academic Growth Toward Social Contribution

The positive perceptions reflected in the quantitative findings were further supported by seventeen (17) out of the 24 participants' experiences regarding the broader benefits of AI-powered tools. Beyond improving academic outputs, participants emphasized how AI-assisted learning enhanced communication skills, information management, technological adaptability, and preparedness for future professional responsibilities. These findings suggest that AI contributes not only to academic growth but also to the development of competencies that hold broader social significance.

“AI-powered tools help me become more prepared for future professional responsibilities by improving how I learn and manage information.”

“The skills I gain from using AI technologies can be applied not only in school but also in helping others and contributing to my future profession.”

Table 4. AI-powered study tools on academic performance

AI powered tools (Usage Frequency) and	r-value	p-value	Decision	Interpretation
Exam Scores	0.334	0.009	Reject H_0	Significant
Assignment Quality	0.272	0.036	Reject H_0	Significant
AI powered tools (Tool Variety) and	r-value	p-value	Decision	Interpretation
Exam Scores	0.476	0.000	Reject H_0	Significant
Assignment Quality	0.399	0.002	Reject H_0	Significant

Table 4 presents the correlation analysis examining the association between AI-powered tool utilization and the academic performance of pre-service teachers. The findings indicate that usage frequency demonstrated a statistically significant association with exam scores ($r = 0.334$, $p = 0.009$), resulting in the rejection of the null hypothesis. Likewise, the relationship between AI-powered tool utilization and assignment quality was statistically significant ($r = 0.272$, $p = 0.036$), likewise warranting the rejection of the null hypothesis. These findings indicate that greater engagement with AI-powered applications corresponds with improved academic performance, particularly in relation to examination outcomes and assignment quality. Regular utilization of AI technologies appears to facilitate stronger comprehension of learning content while supporting the production of higher-quality academic outputs. The findings further suggest that AI-powered platforms function as complementary learning resources that reinforce effective study practices, deepen conceptual understanding, and enhance overall academic attainment.

Beyond measurable educational outcomes, sustained engagement with AI technologies may also cultivate competencies associated with information management, adaptive learning, digital proficiency, and technology-mediated decision-making. Such capabilities possess relevance not only within academic settings but also in future professional practice. Consequently, pre-service teachers who demonstrate effective utilization of AI-powered tools may be better equipped to function within digitally enriched educational environments and to contribute more effectively to educational advancement and broader societal development.

Table 5. AI-powered study tools on student motivation

AI powered tools (Usage Frequency) and	r-value	p-value	Decision	Interpretation
Ease of Use	0.229	0.079	Failed to Reject H_0	Not Significant
Usefulness	0.216	0.097	Failed to Reject H_0	Not Significant
AI powered tools (Tool Variety) and	r-value	p-value	Decision	Interpretation
Ease of Use	0.351	0.006	Reject H_0	Significant
Usefulness	0.280	0.030	Reject H_0	Significant

Table 5 delineates the correlation between AI-powered study tools and students' motivation. The statistical evidence revealed that usage frequency did not demonstrate a statistically significant association with Ease of Use ($r = 0.229$, $p = 0.079$), as the obtained probability value exceeded the 0.05 criterion. Consequently, the null hypothesis was not rejected, signifying that the frequency of AI-powered tool utilization was not statistically associated with students' motivational disposition. Likewise, the relationship involving Usefulness generated an r -value of 0.216 and a p -value of 0.097, which likewise surpassed the prescribed significance threshold. Accordingly, the null hypothesis remained not rejected, indicating that respondents' perceived usefulness of AI-powered applications was not statistically associated with their level of motivation.

The findings suggest that while students generally perceive AI-powered tools as accessible and useful, these characteristics alone may not be sufficient to significantly influence their motivation. As Delgado and Moreno (2020) argue, technology can contribute to student motivation, but "the use of information and communication technologies (ICT) does not guarantee success and student motivation unless paired with effective pedagogy and learner-centered design. Motivation appears to be shaped by a combination of factors, including instructional support, learning experiences, personal interests, and academic goals. This indicates that technology should not be viewed as an independent driver of motivation but rather as one component within a broader learning environment. The results further imply that the effectiveness of AI-powered tools depends not only on their availability but also on how learners meaningfully engage with them within educational contexts.

Furthermore, the significant relationship observed between tool variety and both ease of use and usefulness suggests that exposure to diverse AI-powered applications may enhance students' appreciation of technology-assisted learning. Students who utilize different AI tools are more likely to recognize the practical benefits and functions of these technologies in supporting learning activities. Beyond motivation, familiarity with a variety of AI-powered tools may encourage technological adaptability, responsible digital engagement, and greater confidence in navigating technology-rich environments. For pre-service teachers, these experiences are valuable because they contribute to their readiness to function effectively within increasingly digital educational and professional settings.

5. Discussion

The findings substantiate a statistically significant association between AI-powered tools and the academic performance of pre-service teachers. In relation to learner motivation, the empirical evidence revealed a comparatively multifaceted pattern, wherein exposure to a broader repertoire of AI-powered applications exhibited a significant association with perceived ease of use and perceived usefulness, whereas the frequency of AI utilization, in isolation, did not demonstrate a statistically meaningful relationship. As teacher education programs progressively institutionalize digital innovation within instructional practice, AI-driven technologies including intelligent tutoring systems, automated feedback engines, adaptive learning environments, and AI-assisted content generation platforms have become integral components of contemporary academic experiences among pre-service teachers. The integration of AI into learning also creates opportunities

for learners to develop competencies that extend beyond classroom achievement and contribute to broader forms of social value through responsible technology use (Vieriu & Petrea, 2025). Beyond their educational function, AI-powered tools appear to influence how pre-service teachers engage with digital environments and technology-mediated learning experiences. The findings from the qualitative component indicate that students increasingly view AI not merely as an academic resource but also as a means of strengthening digital adaptability, information-management practices, and responsible technology utilization. The development of digital competence through AI-assisted learning also strengthens learners' capacity to participate effectively in technology-enhanced educational environments (Niyazova et al., 2026).

The result revealed that pre-service teachers who demonstrated more frequent utilization of AI-powered applications likewise reported more favorable academic performance. This observed pattern may be attributable to the capacity of AI-driven technologies to furnish immediate instructional feedback, elucidate intricate concepts, and deliver individualized academic assistance responsive to diverse learning requirements. Through functionalities such as automated practice assessments, intelligent corrective recommendations, and systematically organized learning resources, pre-service teachers are afforded opportunities to engage with academic content in a more efficient and purposeful manner. These technological resources lessen the demands associated with routine academic activities, thereby enabling learners to devote greater cognitive engagement to conceptual comprehension and the application of higher-order thinking competencies. These competencies enable learners to participate more effectively in digitally connected communities where responsible information sharing and technology-mediated collaboration have increasing social significance (Duki et al., 2025). Apart from measurable academic outcomes, the findings further suggest that AI-supported learning experiences are associated with broader educational gains. Participants described becoming more self-assured in retrieving information, critically appraising digital resources, and navigating diverse technology-enabled platforms. Such experiences facilitate the cultivation of digital competencies that are increasingly indispensable within knowledge-intensive societies, where individuals are expected to exercise informed judgment, technological adaptability, and responsible engagement with emerging digital innovations. The ability to navigate multiple digital platforms responsibly reflects competencies that are increasingly recognized as socially valuable in contemporary knowledge-based environments (Naeem et al., 2025).

With regard to learner motivation, the findings indicate that AI-powered tools may foster learners' engagement and confidence when purposefully incorporated into academic activities. Purposefully integrated AI applications can create more engaging learning experiences by providing timely feedback, personalized academic support, and opportunities for active interaction during learning activities (Lin & Chen, 2024). Although the frequency of AI-powered tool utilization did not exhibit a statistically significant association with motivation, exposure to a broader repertoire of AI-powered applications demonstrated significant associations with perceived ease of use and perceived usefulness. Exposure to multiple AI applications allows learners to recognize different instructional functions and select technologies that best address specific academic tasks, thereby strengthening perceptions of usability and practical value (Zhou & Peng, 2025). Participants described how AI technologies made academic tasks easier, more interactive, and more manageable, contributing to positive learning experiences and

greater engagement with technology-supported activities. The availability of on-demand assistance may reduce frustration and promote a sense of autonomy and competence. AI also encourages creativity and active participation, especially when used for lesson planning, content development, or collaborative digital activities. Students highlighted how AI-powered tools facilitated collaboration, information sharing, and engagement with technology-supported environments. These experiences suggest that AI adoption may contribute to positive learning experiences and encourage active participation within increasingly interconnected educational spaces.

The study underscores that AI-powered tools are not only technological enhancements but also valuable pedagogical partners. Their strategic use can support pre-service teachers in meeting academic expectations while strengthening self-regulation, digital competence, and preparedness for future professional tasks. The findings highlight the need for teacher education institutions to promote responsible, ethical, and meaningful use of AI, ensuring that pre-service teachers develop both digital competence and critical awareness as future educators. More importantly, the evidence suggests that the influence of AI-powered tools extends beyond immediate educational outcomes toward broader contributions associated with digital citizenship, informed decision-making, technological adaptability, collaborative engagement, and professional readiness. As future educators, pre-service teachers are expected not only to utilize technology effectively but also to guide future learners in navigating increasingly complex digital environments. Consequently, AI-powered tools may serve as important mechanisms for preparing individuals who can contribute responsibly and productively within contemporary society.

6. Conclusion

The study concludes that AI-powered technologies constitute a valuable educational resource that enhances the academic experiences of pre-service teachers. The empirical evidence indicates that purposeful engagement with AI applications facilitates information acquisition, improves the quality of academic outputs, strengthens learning organization, and contributes to greater academic productivity. These outcomes affirm the capacity of AI-supported technologies to enrich learning processes and reinforce educational achievement within teacher education programs.

Regarding learner motivation, the findings revealed a differentiated pattern. Although the frequency of AI utilization did not exhibit a statistically significant relationship with motivational dimensions, exposure to a broader range of AI-powered applications showed significant associations with perceived ease of use and perceived usefulness. These findings suggest that familiarity with diverse AI technologies encourages greater technological acceptance and supports more favorable learning experiences by accommodating varying academic demands and individual learning preferences.

More importantly, the investigation extends the discourse beyond conventional educational outcomes by demonstrating that AI-powered technologies generate broader social significance. The qualitative evidence indicates that sustained interaction with AI applications cultivates digital readiness, technological adaptability, ethical technology engagement, responsible information management, and collaborative participation within digitally mediated environments. These competencies transcend classroom

performance by preparing future educators to navigate technological change, contribute responsibly to knowledge-based communities, and respond effectively to the evolving expectations of contemporary society.

Findings substantiate that the impact of AI-powered tools extends from academic advancement toward social value. Rather than functioning solely as instruments for improving educational performance, AI technologies facilitate the development of competencies that support lifelong learning, professional preparedness, responsible digital citizenship, and meaningful societal participation. Consequently, teacher education institutions should promote ethically grounded and pedagogically purposeful AI integration to cultivate future educators who are academically competent, technologically resilient, and capable of generating positive social contributions within an increasingly AI-driven world.

Conflict of Interest

I hereby declare that I have no conflict of interest in the conduct of the research titled **“The Impact of AI-Powered Tools on the Academic Performance and the Motivation of Pre-service Teachers.”**

There are no financial, institutional, or personal relationships that could have influenced the design, implementation, analysis, or reporting of this study. The research was carried out independently, and all findings were presented objectively and without bias.

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