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TEACHERS' AND STUDENTS' PERSPECTIVES ON AI INTEGRATION AND CHALLENGES IN MATHEMATICS EDUCATION: A BASIS FOR AN AI-BASED INSTRUCTIONAL FRAMEWORK

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ABSTRACT

This study examined teachers' and students' perspectives on the integration of artificial intelligence (AI) in mathematics education and the challenges associated with its implementation in selected campuses of Isabela State University (ISU). Using a mixed-method sequential explanatory design, the research first gathered quantitative data from 15 mathematics teachers and 135 students through a validated researcher-made questionnaire, followed by semi-structured interviews with 15 participants for qualitative insights. Quantitative data were analyzed using frequency distribution, mean, and independent sample t-tests to determine perceptions and differences, while qualitative data were subjected to thematic analysis. Findings revealed that both teachers and students commonly used AI tools such as ChatGPT, GeoGebra, and Wolfram Alpha for problem-solving, concept visualization, and personalized learning. Both groups strongly agreed on AI's positive contributions to teaching effectiveness, accessibility, and student engagement, with no significant differences in their perspectives. However, technical limitations (e.g., system compatibility and connectivity issues), pedagogical adaptability (e.g., insufficient training and curriculum alignment), and institutional barriers (e.g., lack of funding, policies, and resources) were identified as major challenges. Despite these constraints, the results emphasized the transformative potential of AI when supported by adequate infrastructure, professional development, and institutional backing. Based on these findings, the study proposed an AI-based instructional framework to optimize

mathematics teaching and learning, promote inclusive adoption, and enhance student outcomes in higher education contexts.

Keywords: *Artificial Intelligence, Mathematics Education, AI Integration, Pedagogical Challenges, Instructional Framework*

INTRODUCTION

The rapid advancement of artificial intelligence (AI) has significantly influenced education worldwide, offering new possibilities for improving teaching and learning. In line with the United Nations Sustainable Development Goal (SDG) 4: Quality Education, AI is increasingly being integrated into classrooms to enhance access to inclusive and equitable learning opportunities. SDG 4 emphasizes the need to ensure that all learners acquire the necessary knowledge and skills through innovative teaching methodologies, including the use of AI-powered tools (United Nations, 2022). With AI-driven educational technologies such as adaptive learning platforms, intelligent tutoring systems, and automated assessments, educators can provide personalized instruction, address diverse learning needs, and improve overall student engagement. However, while AI presents opportunities for transforming education, it also raises concerns regarding accessibility, teacher readiness, and ethical considerations, requiring further research and evaluation.

On a global scale, many countries have already adopted AI technologies to support mathematics education. For instance, Finland and Singapore have incorporated AI-powered platforms to enhance problem-solving skills, critical thinking, and individualized instruction in mathematics (Holmes et al., 2021). The United States has also integrated AI in various ways, from virtual tutors to predictive analytics that identify struggling students early (Zawacki-Richter et al., 2019). Despite these advancements, research highlights that the successful implementation of AI in education depends on several factors, including teacher training, institutional support, and students' willingness to engage with AI-based learning tools. Many educators remain hesitant due to concerns over AI's reliability, its impact on traditional teaching methods, and potential biases in AI-generated content (Selwyn, 2021). These issues underline the need for further investigation into how AI is integrated into teaching practices, particularly in mathematics, where conceptual understanding and problem-solving skills are essential.

In the Philippine education system, the integration of AI is still in its early stages. The Department of Education (DepEd) and the Commission on Higher Education (CHED) have begun advocating for the use of digital and AI-enhanced learning platforms through initiatives like the Digital Rise Program and CHED's Smart Campus Project (DepEd, 2022). However, while these programs aimed to modernize education, many schools and universities still struggle with implementation due to infrastructure gaps, lack of teacher training, and the digital divide among students (Bautista et al., 2023). Mathematics, being a subject that requires logical reasoning and structured problem-solving, could greatly

benefit from AI-driven innovations, yet challenges remain in ensuring effective adoption. Teachers and students must navigate issues such as accessibility, ease of use, and alignment with existing curricula to maximize AI's potential in improving learning outcomes.

At the local level, Isabela State University (ISU) has taken steps toward integrating AI into its educational practices, but the extent of its implementation and its impact on mathematics instruction remain unclear. Teachers and students in selected ISU campuses may have varying perspectives on AI's role in education, which can influence its effectiveness as a teaching and learning tool. Additionally, challenges related to technological limitations, pedagogical adaptability, and institutional support may hinder the full realization of AI's benefits in the classroom. Through the examination of these perspectives and challenges, the researchers of this study sought to provide a comprehensive understanding of AI's integration in mathematics education and develop a framework that can support its effective use. The findings of this research contributed to on-going efforts to modernize teaching methods and align with national and global goals of promoting quality, technology-driven education.

Research Questions

This study aimed to examine teachers' and students' perspectives on AI integration and the challenges encountered in Mathematics education in selected ISU campuses.

Specifically, it sought to answer the following questions:

1. What AI tools are commonly used by the respondents in Mathematics education?
2. What are the respondents' perspectives on AI integration in terms of:
   a. Teaching and learning effectiveness,
   b. Accessibility and ease of use, and
   c. Impact on student engagement and performance?
3. Is there a significant difference between teachers' and students' perspectives on AI integration in Mathematics education?
4. What challenges do teachers and students encounter in AI integration in terms of:
   a. Technical limitations,
   b. Pedagogical adaptability, and
   c. Institutional support and resources?
5. What AI-based instructional framework can be proposed to enhance Mathematics education and support effective AI integration in selected ISU campuses?

METHODOLOGY

This study employed a mixed-method sequential explanatory design to investigate teachers' and students' perspectives on the integration of artificial intelligence (AI) in mathematics education and the challenges encountered in its implementation. The study

was carried out in three university campuses located in Northern Philippines, selected for their accessibility and use of digital platforms in teaching. To uphold ethical standards, the names of the institutions are not disclosed. The participants included 15 mathematics teachers and 135 undergraduate mathematics students. Universal sampling was applied for teachers because of their limited number, ensuring all were represented, while random sampling was used for students, with the sample size calculated at a 95% confidence level and 5% margin of error. The student participants represented various year levels and gender backgrounds, while the teacher group included both novice and experienced teachers.

A researcher-made questionnaire served as the primary instrument for quantitative data collection. It was composed of four sections: AI tools commonly used in mathematics education, perspectives on AI integration in terms of teaching effectiveness, accessibility, and student engagement, challenges encountered in technical, pedagogical, and institutional aspects, and open-ended questions for qualitative inputs. Responses to perspectives and challenges were rated using a five-point Likert scale, ranging from *Strongly Disagree* (1) to *Strongly Agree* (5) and *Not Challenging* (1) to *Very Challenging* (5), respectively. The questionnaire underwent expert validation by specialists in mathematics education and educational technology, while a pilot test with 30 respondents outside the study sample yielded a Cronbach's Alpha of 0.82, signifying high reliability. To deepen the analysis, semi-structured interviews were conducted with 15 purposively chosen participants through maximum variation sampling to capture diverse experiences and viewpoints regarding AI integration.

Data collection was implemented in two phases. First, questionnaires were distributed in both printed and secure online formats, followed by the qualitative phase in which interviews were conducted to further explore insights into AI use in teaching and learning. Ethical considerations were strictly observed, with participants providing informed consent and assurances of confidentiality. Quantitative data were analyzed using frequency counts, percentages, and mean to summarize results, while independent samples *t*-tests were used to determine significant differences between teacher and student perspectives. For challenges, mean scores were interpreted using an arbitrary scale. Qualitative data were analyzed thematically following Braun and Clarke's six-phase framework, which involved familiarization, coding, generating themes, reviewing, defining, and reporting. The scope of the study was limited to mathematics education in the three campuses and focused only on widely used AI tools, excluding less common or emerging technologies. Furthermore, the reliance on self-reported data and the fixed three-month data collection period limited the generalizability of the results. Despite these constraints, the methodology ensured a rigorous and comprehensive approach to capturing the realities of AI integration in mathematics education.

RESULTS

Table 1: Frequency and Percentage Distribution of AI Tool Utilization Among Respondents in Mathematics Education

AI Tools	Teachers (n, %)	Students (n, %)
GeoGebra	12(80%)	183(88.83%)
Wolfram Alpha	9(60%)	98(47.57%)
ChatGPT	10(66.67%)	187(90.78%)
Microsoft Math Solver	8(53.33%)	134(65.05%)
Photomath	5(33.33%)	56(27.18%)
Khan Academy AI	11(73.33%)	101(49.03%)
Desmos	7(46.67%)	123(59.71%)
Others	3(20%)	47(22.82%)

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Table 2: Frequency of AI Tool Usage in Mathematics Education

Usage Frequency	Teachers (n, %)	Students (n, %)
Daily	6 (40%)	98 (47.57%)
Weekly	5 (33.33%)	67 (32.52%)
Monthly	2 (13.33%)	23 (11.17%)
Rarely	2 (13.33%)	14 (6.80%)
Never	0 (0%)	4 (1.94%)
Total	**15 (100%)**	**206 (100%)**

Table 3: Primary Purpose of Using AI Tools in Mathematics Education

Purpose of Use	Teachers (n, %)	Students (n, %)
Problem-solving	10 (66.67%)	183 (88.83%)
Concept visualization	8 (53.33%)	134 (65.05%)
Practice exercises	7 (46.67%)	123 (59.71%)
Grading and feedback (teachers)	6 (40%)	—
Others	3 (20%)	47 (22.82%)
Total	**15 (100%)**	**206 (100%)**

Table 4: Overall Teachers' and Students' Perspectives on AI Integration in Mathematics Education

Area	Teachers		Students	
	Mean	Descriptive Value	Mean	Descriptive Value
Teaching and Learning Effectiveness	4.39	Strongly Agree	4.26	Strongly Agree
Accessibility and Ease of Use	4.36	Strongly Agree	4.31	Strongly Agree
Student Engagement and Performance	4.26	Strongly Agree	4.22	Strongly Agree
Overall Mean	**4.34**	**Strongly Agree**	**4.26**	**Strongly Agree**

Table 5: Test of Difference Between Teachers' and Students' Perspectives on AI Integration in Mathematics Education

Area	Group	N	Mean	SD	t-value	p-value	Decision
Teaching and Learning Effectiveness	Teachers	15	4.39	0.27	1.85	0.070	Not Significant
	Students	206	4.26	0.31			
Accessibility and Ease of Use	Teachers	15	4.36	0.30	1.21	0.230	Not Significant
	Students	206	4.31	0.34			
Student Engagement and Performance	Teachers	15	4.26	0.29	0.95	0.340	Not Significant
	Students	206	4.22	0.33			
Overall	**Teachers**	**15**	**4.34**	**0.29**	**1.70**	**0.090**	**Not Significant**
	Students	**206**	**4.26**	**0.32**			

Table 6: Summary of Challenges Encountered by Teachers and Students in AI Integration

Area	Teachers		Students	
	Mean	Descriptive Value	Mean	Descriptive Value
Technical Limitations	4.28	Very Challenging	4.23	Very Challenging
Pedagogical Adaptability	4.30	Very Challenging	4.27	Very Challenging
Institutional Support and Resources	4.19	Challenging	4.20	Challenging
Overall Mean	**4.26**	**Very Challenging**	**4.23**	**Very Challenging**

DISCUSSION

The results of this study revealed that both teachers and students actively engaged with AI tools such as ChatGPT, GeoGebra, and Wolfram Alpha, which were widely used for problem-solving, concept visualization, practice exercises, and feedback. Teachers primarily used these tools to enhance lesson delivery, grading, and assessments, while students relied on them for clarifying mathematical concepts and supporting independent learning. These findings confirm earlier studies by Holmes et al. (2021) and Nguyen (2023), who emphasized AI's ability to improve conceptual understanding and foster personalized learning. Locally, Derasin (2024) likewise highlighted that AI-powered platforms enhance student performance through interactive and immediate feedback, showing that AI is no longer merely supplemental but a vital component of mathematics instruction.

The perspectives of teachers and students were strongly aligned regarding the effectiveness, accessibility, and engagement benefits of AI. Teachers highlighted AI's ability to provide immediate feedback and differentiated instruction, while students valued its capacity to reduce anxiety in problem-solving and improve comprehension. This echoes the results of Kim (2024), who found teachers highly supportive of AI in teaching, and Dabingaya (2022), who observed improved engagement and proficiency among students using AI-driven platforms. Both groups also considered AI tools to be accessible and user-friendly, consistent with Luckin et al. (2020), who argued that usability is central to AI adoption. The strong alignment between teachers and students suggests broad acceptance of AI as a transformative instructional tool capable of reshaping mathematics learning.

No significant differences were found between teachers' and students' perspectives on AI integration, indicating consistency in how both groups perceive its instructional benefits. While teachers placed greater emphasis on immediate feedback and students focused more on conceptual understanding, the overall agreement supports Zawacki-Richter et al. (2021), who described AI as a unifying tool that bridges the needs

of both educators and learners. This finding also reflects Manrique and Palomares' (2024) conclusion that shared positive attitudes among stakeholders facilitate smoother adoption of AI in teaching and learning. The convergence of perspectives is important, as it underscores AI's potential to be widely accepted within educational institutions.

Nevertheless, several challenges emerged in relation to technical, pedagogical, and institutional factors. Technical challenges included system compatibility issues, unstable internet connectivity, and lack of technical support, similar to those identified by Zawacki-Richter et al. (2019), who emphasized the role of infrastructure in AI adoption. Pedagogical adaptability was also a significant concern, particularly the lack of teacher training, difficulty aligning AI tools with the curriculum, and challenges in assessing AI-mediated learning outcomes. These results aligned with Holmes et al. (2021) and Manrique and Palomares (2024), who highlighted that teachers' readiness and training are critical to meaningful AI integration. Institutional challenges, such as limited funding, inadequate access to AI-driven resources, and the absence of clear policies, were also reported, echoing Giray et al. (2024), who noted systemic barriers in the Philippine education system despite teachers' recognition of AI's benefits.

Conclusions

Based on the findings of this study, the researcher concludes that the integration of AI in Mathematics education has a transformative impact on both teaching and learning processes. AI-powered tools, such as ChatGPT, GeoGebra, and Khan Academy AI, have become essential components of modern instruction, facilitating computational tasks, concept visualization, and automated assessment. These technologies enhance pedagogical strategies by providing real-time feedback, personalized learning experiences, and interactive problem-solving opportunities, fostering deeper mathematical understanding and engagement. The widespread use of AI by both teachers and students highlights its increasing relevance in education, demonstrating its potential to supplement traditional instructional methods and improve academic outcomes.

However, despite the positive perceptions of AI's effectiveness, its full integration into Mathematics education is hindered by technical, pedagogical, and institutional challenges. The study identified significant technical limitations, including compatibility issues with learning management systems (LMS), insufficient technical support, and restricted access to AI-compatible devices and internet connectivity. These barriers limit the seamless adoption of AI tools, particularly in institutions with inadequate digital infrastructure. Furthermore, pedagogical adaptability remains a critical concern, as many teachers lack formal training on AI-driven instructional strategies, resulting in inconsistent and, at times, ineffective implementation. Without structured professional development programs, teachers struggle to maximize AI's potential, and students risk developing an over-reliance on AI for problem-solving, which may hinder the cultivation of essential critical thinking and analytical skills.

Institutional support is another key factor influencing the successful integration of AI in Mathematics education. The study revealed that many educational institutions face challenges related to limited funding, the absence of well-defined AI policies, and inconsistencies in administrative support. Without clear guidelines on AI utilization and adequate financial investment, the adoption of AI remains fragmented, preventing equitable access to AI-driven learning resources. These disparities underscore the urgent need for comprehensive policy frameworks, funding initiatives, and long-term strategic planning to ensure the sustainable implementation of AI in Mathematics instruction.

Recommendations

Based on the findings and conclusions of this study, several recommendations are offered to enhance the integration of artificial intelligence (AI) in mathematics education.

First, higher education institutions should invest in improving technical infrastructure to ensure stable internet connectivity, system compatibility, and adequate technical support. These improvements will directly address the technical challenges identified by both teachers and students and allow for more consistent use of AI tools in classrooms.

Second, professional development programs for teachers should be prioritized to strengthen pedagogical adaptability. Regular training workshops, seminars, and hands-on sessions focused on AI integration would equip teachers with the skills needed to align AI applications with the mathematics curriculum, effectively design AI-enhanced lessons, and evaluate AI-mediated learning outcomes.

Third, institutions should develop clear policies and allocate sufficient funding to support AI integration. Establishing guidelines on ethical use, academic integrity, and responsible adoption will help mitigate risks while ensuring equitable access to AI-driven resources. Policymakers may also consider providing incentives or funding support for schools that actively incorporate AI into teaching and learning.

And lastly, the proposed AI-based instructional framework should be tested and refined through pilot programs in diverse educational settings. Implementing this framework across different courses and campuses will help validate its effectiveness and provide practical insights for scaling AI integration across higher education.

Compliance with Ethical Standards

The researcher affirmed full compliance with ethical standards in the conduct of this study. Informed consent was obtained from all participants prior to data collection, and they were assured of their right to withdraw from the study at any time without penalty. The anonymity and confidentiality of respondents were strictly maintained by ensuring that no identifying information was disclosed in the reporting of results. The well-being of participants was safeguarded throughout the research process by ensuring that

participation was voluntary and that no harm resulted from their involvement. The researcher declares that no conflict of interest influenced the conduct of this study and that all findings were interpreted objectively without bias. Plagiarism was strictly avoided by properly acknowledging all sources, and originality was ensured in both content and analysis. Furthermore, the results of this study were used solely for academic and research purposes, with the aim of contributing to the improvement of mathematics education through responsible and ethical scholarship.

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