World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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ARTIFICIAL INTELLIGENCE IN MATHEMATICS: THE TEACHERS' AWARENESS, ACCEPTABILITY AND UTILIZATION IN THE DIVISION OF TAGUIG CITY AND PATEROS

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World Journal of Advanced Research and Reviews, 2026, 31(02), 894–906

Publication history: Received on 04 July 2026; revised on 16 August 2026; accepted on 18 August 2026

Article DOI: https://doi.org/10.30574/wjarr.2026.31.2.2150

ABSTRACT

Artificial Intelligence (AI) is becoming increasingly visible in education, particularly in Mathematics, where it can support lesson preparation, classroom interaction, feedback, and differentiated learning. This study examined teachers' awareness, acceptability, and utilization of AI in Mathematics instruction among public elementary school teachers in the Division of Taguig City and Pateros. A descriptive research design was used, with data gathered from 218 teacher-respondents through a structured survey questionnaire. Results showed that teachers were generally aware of AI in Mathematics instruction, with the highest awareness in Direct Instruction (M = 3.97), followed by Teacher Facilitation (M = 3.94) and Problem-Solving Activities (M = 3.83). AI was also generally acceptable, particularly in relation to teachers' professional roles, learners' needs, curriculum alignment, and pedagogical usefulness. Utilization was likewise reported as Utilized, with Lesson Planning and Delivery obtaining the highest mean (M = 3.94), followed by Classroom Facilitation and Student Engagement (M = 3.92), and Problem-Solving and Assessment Activities (M = 3.83). Age, sex, and AI-related training exposure did not produce significant differences in the major measures. Years of teaching experience, however, were associated with significant differences in overall awareness and utilization and in several instructional dimensions. The study concludes that teachers have a favorable foundation for AI integration, but further support is needed to move beyond preparation toward deeper learner-centered, problem-solving, and assessment applications. Program AIM HIGH is proposed as a sustained capacity-building approach combining hands-on training, prompt engineering, ethical AI use, Learning Action Cell sessions, coaching, mentoring, classroom demonstrations, and differentiated professional development.

Keywords: Artificial Intelligence; Mathematics Education; Teacher Awareness; AI Utilization; Teacher Preparedness; Public Schools

1 INTRODUCTION

Artificial Intelligence (AI) is becoming increasingly visible in education. Teachers now use AI-powered applications to generate examples, explain concepts, organize information, provide feedback, and support routine instructional tasks. In Mathematics, these capabilities can be useful because learners often need repeated practice, varied explanations, and timely feedback. However, the value of AI depends largely on how prepared teachers are to use it appropriately. UNESCO (2024) emphasizes that AI should support, rather than replace, teachers by strengthening technological, pedagogical, and ethical competencies. Similarly, the OECD recognizes AI's potential to assist with lesson preparation, resource development, and other routine tasks, allowing teachers to focus more on meaningful instruction. In Mathematics, AI can provide alternative explanations, practice activities, and immediate responses. However, AI-generated content still requires teacher review to ensure accuracy, appropriateness, and alignment with learning objectives. Thus, awareness of AI does not necessarily mean that teachers accept or regularly use it in instruction.

This study therefore examines three related dimensions: awareness, acceptability, and utilization of AI in Mathematics instruction. The study is guided by the TPACK framework of Mishra and Koehler (2006), which emphasizes the integration of technology, pedagogy, and content, as well as technology acceptance perspectives such as Davis's Technology Acceptance Model and Venkatesh et al.'s UTAUT.

In the Philippines, the growth of digital learning has increased teachers' exposure to technology. However, digital familiarity does not automatically translate into AI literacy. Teachers may still face challenges related to training, infrastructure, time, and clear guidelines for responsible AI use.

These concerns are relevant in the Division of Taguig City and Pateros, where public elementary teachers work under varying instructional conditions. The study focuses on teachers from Maharlika Integrated School, Tenement Elementary School, and Silangan Elementary School and examines how they perceive and use AI in Mathematics instruction.

Specifically, the study determined teachers' levels of awareness, acceptability, and utilization of AI and examined differences according to age, sex, teaching experience, educational attainment, and AI-related training. It also considered awareness in Direct Instruction, Teacher Facilitation, and Problem-Solving Activities, and utilization in Lesson Planning and Delivery, Classroom Facilitation and Student Engagement, and Problem-Solving and Assessment Activities.

The findings aim to provide a practical basis for teacher training, school-based support, and responsible AI integration, particularly in expanding AI use beyond lesson preparation toward learner engagement, mathematical reasoning, and assessment.

2 MATERIALS AND METHODS

2.1 Research Design

The study employed a quantitative descriptive research design. This approach was appropriate because the investigation sought to describe existing teacher perceptions and practices without manipulating classroom conditions or introducing an experimental treatment. Descriptive methods allow responses to be summarized through frequencies, percentages, means, and inferential tests, providing a clear picture of the phenomenon as it existed during School Year 2025–2026.

2.2 Participants and Sampling

The target population consisted of teachers assigned to Mathematics instruction in three selected public elementary schools in the Division of Taguig City and Pateros. The source manuscript reports a total population of 501 teachers for the final sample computation and a sample of 218 respondents. Proportionate allocation was used so that each participating school contributed respondents in relation to its teacher population, followed by random selection within school strata.

Table 1: Distribution of Teacher-Respondents by Participating School

Participating school	Teacher population	Proportion	Respondents
Maharlika Integrated School	97	19.36%	42
Tenement Elementary School	260	51.90%	114
Silangan Elementary School	144	28.74%	62
Overall	501	100%	218

Cochran's sample-size procedure was used as the basis for determining the required sample, using a 95% confidence level, 5% margin of error, and 50% assumed response distribution, followed by finite population correction. The resulting 218 respondents provided representation across the three participating schools.

2.3 Research Instrument

Data were collected through a structured questionnaire developed for the study and informed by literature on AI awareness, technology acceptance, and instructional use. The instrument contained a profile section and scales covering awareness, acceptability, and utilization. Awareness focused on Direct Instruction, Teacher Facilitation, and Problem-Solving Activities. Acceptability covered pedagogical usefulness, curriculum appropriateness, relevance to learners' needs, and alignment with teachers' roles. Utilization covered Lesson Planning and Delivery, Classroom Facilitation and Student Engagement, and Problem-Solving and Assessment Activities.

The questionnaire used a five-point response scale. During instrument preparation, AI applications such as ChatGPT, Meta AI, and Gemini were used only as supplementary tools for wording and presentation review. The research instrument remained under the researcher's academic responsibility

2.4 Data Collection and Ethical Procedures

Before data collection, the researcher secured the required authorization from the Office of the Schools Division Superintendent and coordinated with the heads of the participating schools. Teachers were informed about the purpose and scope of the study, the nature of their participation, and the intended use of the data. Informed consent was obtained before respondents answered the questionnaire. The instrument was administered online to facilitate participation and efficient collection of responses.

Participation was voluntary. Respondents were informed that they could decline participation or withdraw without penalty. The questionnaire did not require names, and findings were reported in aggregated form. Research files were stored securely, with access limited to the researcher and authorized personnel. The source manuscript states that records were to be retained for one year and then securely deleted or disposed of.

2.5 Statistical Treatment

Frequency and percentage were used to summarize respondents' profiles. Weighted means were used to describe awareness, acceptability, and utilization. One-way ANOVA was used when comparing groups with more than two categories, while an independent-samples t-test was used for the two-category sex comparison. Decisions were based on the 0.05 level of significance. Effect sizes were also reported in the inferential tables.

Table 2: Summary of Verbal Interpretation

Measure	1.00–1.80	1.81–2.60	2.61–3.40	3.41–4.20	4.21–5.00
Awareness	Not Aware	Slightly Aware	Moderately Aware	Aware	Extremely Aware
Acceptability	Not Acceptable	Slightly Acceptable	Moderately Acceptable	Acceptable	Highly Acceptable
Utilization	Not Utilized	Slightly Utilized	Moderately Utilized	Utilized	Highly Utilized

The interpretation ranges in the source manuscript were applied consistently to the reported means. In presenting the findings below, the wording has been streamlined so that the statistical results are separated from the practical interpretation. This helps avoid treating a mean score as proof that every teacher engages in the same practice.

3 RESULTS AND DISCUSSION

3.1 Profile of the Respondents

The study included 218 public elementary Mathematics teachers. The profile provides useful context for understanding the results because teachers enter AI-related professional learning with different career experiences, academic backgrounds, and exposure to training.

Table 3: Respondents by Age

Age group	n	%
21–30	50	22.94
31–40	71	32.57
41–50	65	29.82
51–60	28	12.84
61 and above	4	1.83
Total	218	100.00

Teachers aged 31–40 formed the largest group (32.57%), followed by those aged 41–50 (29.82%). The youngest group represented 22.94% of the sample, while only 1.83% were 61 or older. This distribution indicates that the study captured teachers at several career stages rather than representing a single age group.

Table 4: Respondents by Sex

Sex	N	%
Male	38	17.43
Female	178	81.65
LGBTQIA+	2	0.92
Prefer not to disclose	0	0
Total	218	100.00

Female teachers constituted the majority of the respondents. The distribution is consistent with the composition commonly observed in elementary teaching, but the presence of other groups also provides a broader perspective on teachers' experiences with AI.

Table 5: Respondents by Years of Teaching Experience

Experience	n	%
0–5 years	57	26.15
6–10 years	55	25.23
11–15 years	44	20.18
16–20 years	29	13.30
21–25 years	33	15.14
Total	218	100.00

More than half of the respondents (51.38%) had ten or fewer years of teaching experience. At the same time, the sample included teachers with more than a decade of service, providing perspectives from both relatively early-career and more experienced educators.

3.2 Educational Background and AI Training

The respondents generally demonstrated continued engagement in graduate education. Teachers with Master's units formed the largest group, while others had completed or were pursuing doctoral-level study. This suggests a professional group with substantial exposure to continuing education. However, academic advancement should not be assumed to equal AI competence; the ability to use AI meaningfully also depends on opportunities for practical learning and classroom application.

Table 6: Respondents by Highest Educational Attainment

Educational attainment	N	%
College graduate	74	33.94
With Master's units	91	41.74
Master's degree	36	16.51
With doctoral units	11	5.05
Doctoral degree	6	2.75
Total	218	100.00

Table 7: Participation in AI-Related Training or Seminars

Training exposure	N	%
None	106	48.62
1–5 sessions	47	21.56
6–10 sessions	29	13.30
11–15 sessions	4	1.83
More than 15	32	14.68
Total	218	100.00

Nearly half of the teachers reported no attendance in AI-related training or seminars. This is one of the clearest practical signals in the study. Teachers may already be aware of AI through personal exploration or informal exposure, but almost half had not participated in formal AI-focused professional learning. This gap supports the need for accessible, sustained, and practice-oriented capacity building.

The training pattern also cautions against equating the number of sessions with competence. The later inferential results show that training exposure, measured by the categories used in the study, did not produce significant group differences. This does not mean training is unnecessary. Instead, it suggests that the quality, relevance, hands-on nature, and follow-through of professional learning may matter more than attendance alone.

3.3 Teachers' Awareness of AI in Mathematics Instruction

Awareness was examined through Direct Instruction, Teacher Facilitation, and Problem-Solving Activities. The pattern was consistently positive, but the means suggest that teachers were somewhat more familiar with AI as a support for explaining or preparing content than with more demanding uses involving guided mathematical reasoning.

Table 8: Awareness by Instructional Dimension

Dimension	Mean	Interpretation
Direct Instruction	3.97	Aware
Teacher Facilitation	3.94	Aware
Problem-Solving Activities	3.83	Aware

Direct Instruction received the highest mean (M = 3.97). The strongest individual indicator was the use of AI tools such as simulations and interactive visuals to explain Mathematics topics (M = 4.27). This suggests that teachers readily recognize AI's potential to make abstract ideas more visible and understandable. The lowest indicator in this dimension concerned using AI to model problem-solving processes step by step (M = 3.71), pointing to a possible area for further development.

Teacher Facilitation obtained M = 3.94. Teachers were particularly aware of AI-based tools that can introduce or deepen concepts (M = 4.10) and of the need to recognize how AI may influence learners' understanding and misconceptions (M = 4.09). The lower rating for learner-led exploration (M = 3.81) is important because it suggests that awareness of AI may still be more teacher-directed than learner-driven.

Problem-Solving Activities received M = 3.83. The highest indicator involved presenting multiple solution strategies that can support critical thinking (M = 3.89), while guided support during problem solving received the lowest mean (M = 3.78). The pattern is consistent with the idea that teachers see AI's possibilities but may need more practical experience in designing activities where learners interrogate, compare, and verify AI-generated mathematical reasoning.

Taken together, the results indicate that teachers have a useful base of AI awareness. The next step is to deepen that awareness into pedagogical judgment: selecting appropriate tools, checking outputs, constructing prompts, anticipating misconceptions, and ensuring that AI supports mathematical thinking rather than simply supplying answers.

3.4 Teachers' Acceptability of AI

Acceptability was examined in four areas: pedagogical usefulness, appropriateness to the curriculum, relevance to learners' needs, and alignment with teachers' roles. Across all four areas, the ratings fell within the Acceptable category, indicating a generally positive disposition toward AI as an instructional resource.

Table 9: Acceptability by Dimension

Dimension	Mean	Interpretation
Pedagogical Usefulness	4.05	Acceptable
Appropriateness to the Curriculum	4.04	Acceptable
Relevance to Learners' Needs	4.06	Acceptable
Alignment with Teachers' Roles	4.07	Acceptable

Pedagogical usefulness received M = 4.05. The highest item concerned AI-supported assessment and immediate feedback (M = 4.11). Teachers also viewed AI favorably for making lessons engaging, improving lesson preparation, explaining abstract concepts, and supporting critical thinking. The closeness of the means suggests that acceptability was not tied to one single benefit.

Curriculum appropriateness obtained M = 4.04. The highest rating was for using AI to support differentiated instruction in line with curriculum goals (M = 4.08). Teachers appear to value AI when it remains connected to competencies, learning standards, and lesson objectives. This is an important condition for responsible adoption: the tool should serve the curriculum rather than drive the curriculum.

Relevance to learners' needs received M = 4.06. Teachers gave the highest rating to remedial and enrichment activities tailored to learners' needs (M = 4.09). This suggests that teachers see particular promise in AI as an additional layer of support for learners who need more practice or more challenging work.

Alignment with teachers' roles obtained the highest overall acceptability mean, M = 4.07. The strongest item was the view that AI can improve teacher efficiency without replacing the teacher's central role (M = 4.11). This finding is particularly important because it places professional judgment at the center of AI integration.

3.5 Extent of AI Utilization

The study found that AI was generally Utilized across the three instructional dimensions. The strongest use was in Lesson Planning and Delivery, followed by Classroom Facilitation and Student Engagement, while Problem-Solving and Assessment Activities received the lowest mean.

Table 10: Utilization by Instructional Dimension

Dimension	Mean	Interpretation
Lesson Planning and Delivery	3.94	Utilized
Classroom Facilitation and Student Engagement	3.92	Utilized
Problem-Solving and Assessment Activities	3.83	Utilized

Lesson Planning and Delivery obtained M = 3.94. The highest item involved using AI to suggest varied examples and exercises (M = 3.99). Teachers also used AI to create instructional materials, develop lesson plans, prepare explanations of complex topics, and organize classroom content. This confirms a common and practical entry point for AI adoption: teachers use it first where it can save time and broaden the pool of instructional resources.

Classroom Facilitation and Student Engagement received M = 3.92. The highest item involved using AI resources to support group work, collaboration, or peer learning (M = 3.97). Teachers also used AI for immediate responses to questions and interactive activities. The lowest item, maintaining students' interest and participation throughout the lesson (M = 3.85), suggests that sustained engagement remains more complex than simply introducing an AI-supported activity.

Problem-Solving and Assessment Activities obtained M = 3.83. Immediate feedback on problem-solving activities was the strongest item (M = 3.89), while checking, scoring, or evaluating learner outputs was lowest (M = 3.78). This difference is understandable. Teachers may be more comfortable using AI to generate feedback or practice material than delegating formal evaluation to an automated system.

Overall, the utilization results show that AI has already entered selected teaching routines. However, use is stronger in preparation than in the more demanding work of assessment and mathematical reasoning. This pattern provides a clear direction for professional development.

Table 11: Summary of Tests by Age and Sex

Grouping variable	Overall awareness	Overall acceptability	Overall utilization	Interpretation
Age	p = 0.172	p = 0.331	p = 0.136	No significant differences
Sex	p = 0.282	p = 0.910	p = 0.610	No significant differences

The age finding is useful because it challenges the assumption that younger teachers necessarily use AI more effectively. The study's respondents across age groups reported broadly comparable levels. Individual differences certainly exist, but age alone did not explain the observed variation. This suggests that access to opportunities, personal interest, school culture, and actual experience may be more relevant than age as a single predictor.

The sex comparison likewise showed no significant differences. Male and female respondents reported similar levels of awareness, acceptability, and utilization. The small differences in descriptive means were not statistically meaningful. This suggests that AI-related professional development can be designed around instructional needs rather than separated by sex.

3.6 Interpretation

These findings support an inclusive approach to AI capacity building. Rather than targeting training only at younger teachers or assuming that one demographic group needs more support, schools can provide common foundational learning and then differentiate activities according to demonstrated needs and teaching experience.

The absence of demographic differences also reinforces the importance of avoiding stereotypes about technology adoption. Teachers' professional identities and classroom experiences are more complex than a single demographic characteristic. Training should therefore focus on what teachers need to accomplish with AI, not on assumptions about who is likely to adopt it.

3.7 Differences by Years of Teaching Experience

Years of teaching experience produced the clearest overall differences in the study. Significant differences were found for the awareness composite (p = 0.002) and the utilization composite (p = 0.037). Significant differences also appeared in Direct Instruction (p = 0.010), Teacher Facilitation (p = 0.002), Problem-Solving and Critical Thinking Activities (p = 0.001), and Problem-Solving and Assessment Activities (p = 0.018). Acceptability remained statistically consistent across experience groups (p = 0.178).

Table 12: Significant Results by Teaching Experience

Measure	F	p	Decision
Awareness composite	4.553	0.002	Reject H_0
Utilization composite	2.599	0.037	Reject H_0
Direct Instruction	3.434	0.010	Reject H_0
Teacher Facilitation	4.269	0.002	Reject H_0
Problem Solving & Critical Thinking	4.645	0.001	Reject H_0
Problem Solving & Assessment	3.041	0.018	Reject H_0

The pattern suggests that teachers' years in the profession may be connected with how they encounter and apply AI, even though teachers across experience levels are similarly positive about the technology. The 11–15-year group recorded the highest awareness mean (M = 4.23) and the highest acceptability mean (M = 4.27), while the 16–20-year group recorded the lowest utilization composite mean (M = 3.74). These descriptive differences should be interpreted alongside the ANOVA results rather than treated as proof that one group is inherently better at AI use.

A plausible interpretation is that teaching experience provides a different kind of knowledge base. More experienced teachers may have stronger pedagogical routines and therefore recognize where AI can add value; teachers earlier in their careers may have greater exposure to newer digital tools but less accumulated classroom experience with which to judge them. The important point is that professional experience and AI competence can develop in different ways.

Table 13: Selected Results by Educational Attainment

Measure	p-value	Interpretation
Awareness composite	0.194	Not significant
Acceptability composite	0.414	Not significant
Utilization composite	0.094	Not significant
Classroom Facilitation & Student Engagement	0.042	Significant; small effect

The results suggest that formal academic attainment alone does not determine teachers' AI readiness. Graduate study may strengthen analytical and professional skills, but effective AI integration also requires specific exposure to AI tools, practice, feedback, and school support.

Table 14: Overall Results by AI-Training Exposure

Measure	F	p	Decision
Awareness composite	2.034	0.091	Fail to reject H_0
Acceptability composite	1.587	0.179	Fail to reject H_0
Utilization composite	1.101	0.357	Fail to reject H_0
Direct Instruction	2.038	0.090	Fail to reject H_0
Teacher Facilitation	1.908	0.110	Fail to reject H_0
Problem Solving & Critical Thinking	1.721	0.146	Fail to reject H_0

This result should not be interpreted as evidence that AI training has no value. Instead, it points to an important distinction between attendance and meaningful professional learning. A short demonstration may increase awareness but may not change classroom practice. Conversely, a teacher may learn through self-directed exploration, peer collaboration, or actual classroom use. Effective training should therefore be practical, sustained, and connected to teachers' real instructional work.

3.8 Program AIM HIGH

The findings support the institutionalization of Program AIM HIGH—Artificial Intelligence in Mathematics: Harnessing Innovation for Greater Heights. The program can provide a structured pathway from awareness to responsible classroom application. Its core components may include AI orientation, hands-on tool exploration, prompt engineering, ethical and privacy guidance, curriculum alignment, Learning Action Cell sessions, coaching and mentoring, classroom demonstrations, peer sharing, and differentiated professional development based on teaching experience.

AIM HIGH should be designed as a continuing process rather than a single seminar. Teachers can begin with simple, low-risk tasks and gradually move toward learner-centered problem solving, formative feedback, differentiated practice, and assessment support. Monitoring should focus on the quality of classroom applications and teacher reflection rather than the number of AI tools used.

4 CONCLUSIONS

The study concludes that the participating public elementary Mathematics teachers provide a favorable foundation for the responsible integration of AI. They were generally aware of AI applications in Direct Instruction, Teacher Facilitation, and Problem-Solving Activities; they viewed AI as acceptable across pedagogical, curricular, learner-centered, and professional-role dimensions; and they reported using AI in lesson planning, classroom facilitation, engagement, problem solving, and assessment.

However, utilization was stronger in lesson preparation and delivery than in more demanding learner-centered and assessment practices. This indicates that the next phase of AI integration should focus less on introducing tools and more on developing teachers' judgment, confidence, and instructional design skills.

Age and sex were not associated with significant differences in the major measures. Educational attainment and training exposure likewise did not produce broad significant differences, although one utilization dimension varied by educational attainment. Teaching experience was the clearest grouping variable associated with differences in awareness and utilization. Acceptability, however, remained positive across experience levels.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Acknowledgments

I sincerely thank Almighty God for His grace, wisdom, strength, and guidance throughout this journey. My heartfelt appreciation goes to the Polytechnic University of the Philippines – Open University System**,** my research adviser Dr. Diana Lee Tracy K. Chan**,** and my thesis evaluators for their guidance, valuable insights, and support in completing this study. I am also grateful to the Schools Division Office of Taguig City and Pateros, school heads, and teachers of the participating schools for their cooperation and valuable contributions. To my family**,** thank you for your unconditional love, prayers, sacrifices, and unwavering support. Finally, to everyone who contributed to this research in any way, my sincerest gratitude and heartfelt thanks.

Funding Source

This research was self-funded by the author. No financial support or external funding was received from any institution, organization, or agency for the conduct of this study.

Disclosure of conflict of interest

The author declares that there are no financial or non-financial conflicts of interest that could have influenced the conduct, findings, or reporting of this study.

Statement of ethical approval

The study followed established ethical principles for research involving human participants. Appropriate institutional approval and permission from the concerned education authorities and school heads were obtained before data collection.

Statement of informed consent

Respondents provided informed consent, participated voluntarily, and were informed of their right to decline or withdraw. Confidentiality and anonymity were maintained, and data were used solely for academic and research purposes.

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