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Teachers' Readiness in the Integration of AI-Based Tools in the Teaching and Learning of Mathematics

Melissa B. Bacena

PhD Student in Mathematics Education, St. Paul University Philippines

Abstract

The integration of artificial intelligence (AI)-based tools in mathematics education requires teachers to demonstrate willingness, professional competencies, and access to appropriate technological resources. This study examined mathematics teachers' readiness to integrate AI-based tools in teaching and learning mathematics within the La Salette School System during School Year 2025–2026. Anchored on the Will–Skill–Tool (WST) Model, the study assessed readiness in terms of Will (openness, motivation, and attitude), Skill (technical and pedagogical competency), and Tool (accessibility, availability, and extent of utilization). It also examined differences between teacher and student assessments, differences according to selected teacher profile variables, relationships among the WST dimensions, and challenges encountered in AI integration. A mixed-methods research design was employed, combining quantitative descriptive-correlational analysis and qualitative thematic analysis. Participants consisted of 24 mathematics teachers and 446 students from the junior high school, senior high school, and college levels. Data were collected through teacher and student questionnaires and analyzed using descriptive and inferential statistics and thematic analysis. Results showed that teachers' self-assessed overall readiness was high (M = 3.04), whereas students assessed their teachers' readiness as moderate (M = 2.26). The combined overall mean was 2.65, interpreted as high. Will and Skill received high combined ratings, while Tool was assessed as moderate. Significant differences between teacher and student assessments were found in all Will and Skill indicators and in accessibility and extent of utilization, but not in availability. Significant relationships were also found between accessibility and both technical and pedagogical competency, as well as between extent of utilization and both competency indicators. Qualitative findings identified ten challenges related to student overreliance and academic integrity, ethical and privacy concerns, responsible AI use, professional development, curriculum and assessment alignment, classroom management, connectivity, access to devices and licensed software, institutional policies, and time constraints. The findings indicate that teachers' readiness for AI integration involves the alignment of willingness, professional competencies, and enabling technological conditions. The study provides an empirical basis for strengthening mathematics teachers' readiness and promoting the responsible integration of AI-based tools in mathematics education.

Keywords: artificial intelligence, mathematics education, teacher readiness, Will–Skill–Tool Model, technology integration

1. Introduction

Artificial intelligence (AI) has become an increasingly important component of contemporary education. Developments in machine learning, natural language processing, data analytics, and generative AI have expanded the range of tasks that digital technologies can perform, including information generation, pattern recognition, problem solving, and interaction with users. In educational settings, AI applications have developed from intelligent tutoring and adaptive learning systems into tools that support instruction, assessment, feedback, content development, and learning activities (Holmes et al., 2022; Luckin et al., 2022).

The growing availability of AI-based tools offers opportunities to support mathematics teaching and learning. These tools can assist teachers in preparing instructional materials, developing assessment activities, generating mathematical examples and explanations, and providing feedback suited to learners' needs. Generative AI has further expanded these possibilities by allowing users to produce and interact with educational content through conversational systems (Kasneci et al., 2023). In mathematics education, such applications may support lesson preparation, problem solving, individualized instruction, and the development of learning activities. However, their educational value depends on the appropriateness of their use, the accuracy of generated outputs, and teachers' ability to connect these tools with intended learning outcomes.

Despite these opportunities, integrating AI into instruction presents important challenges. AI-generated responses may contain inaccurate or misleading information, while the use of generative AI raises concerns about academic integrity, privacy, data protection, copyright, and students' possible dependence on AI-generated answers (Kasneci et al., 2023). The Global Education Monitoring Report emphasizes the need for a human-centered approach to educational technology that considers equity, inclusion, and the protection of human agency (Antoninis et al., 2023). These concerns place teachers in an important position: they must evaluate the suitability and reliability of AI-generated content, maintain appropriate instructional and assessment practices, and guide students toward responsible technology use.

The availability of AI applications, however, does not necessarily indicate that teachers are ready to integrate them into mathematics instruction. Readiness involves more than willingness to adopt new technologies. It also requires the technical and pedagogical competencies needed to use AI appropriately and the availability of resources and institutional conditions that support its application. Previous studies have examined different aspects of this concern. Wang et al. (2023) considered AI readiness among primary school teachers in relation to cognition, ability, vision, and ethics. Yue et al. (2024) investigated AI-related technological pedagogical content knowledge and attitudes among K–12 teachers, identifying the importance of teachers' knowledge and competencies. Other studies have associated readiness with technological competence, self-efficacy, attitudes, professional development, and institutional support (Alnasib, 2023; Ayanwale et al., 2022; Cheah et al., 2025).

In mathematics education, teachers' readiness is particularly important because AI-supported instruction requires the integration of technological capabilities with mathematical content and sound pedagogical decisions. Teachers need to determine whether an AI-based tool is appropriate for a particular lesson, examine the correctness of mathematical solutions and explanations, and ensure that AI-supported activities promote mathematical understanding rather than dependence on generated responses. Research on mathematics teachers' beliefs, practices, competencies, and experiences with AI provides relevant insights into these concerns (Agyei et al., 2022; Asanre et al., 2024; Busuttil & Calleja, 2025).

Nevertheless, readiness needs to be examined as a multidimensional construct that includes teachers' willingness, competencies, and access to and use of appropriate tools.

The present study is anchored on the Will–Skill–Tool (WST) Model, which provides a framework for examining the dimensions involved in technology integration (Knezek & Christensen, 2015). In this study, Will refers to teachers' openness, motivation, and attitude toward integrating AI-based tools. Skill concerns their technical and pedagogical competencies in using these tools for mathematics teaching and learning. Tool refers to the accessibility, availability, and extent of utilization of AI-based tools. These dimensions provide a basis for examining readiness beyond willingness alone. A teacher may demonstrate openness to AI integration but may still require further competencies or face limitations in accessing and utilizing appropriate technological resources.

Although previous research has investigated teachers' attitudes, competencies, technological access, and use of AI, there remains a need to examine how these dimensions relate to one another in the context of mathematics teachers' readiness. The present study addresses this concern by examining the relationships among Will and Skill, Will and Tool, and Skill and Tool. It also distinguishes accessibility, availability, and extent of utilization within the Tool dimension because access to an AI application does not necessarily mean that the tool is institutionally available or regularly used in instruction.

Another concern addressed by this study is the assessment of readiness from both teacher and student groups. Teacher self-assessments provide information about how teachers rate their own readiness, while student assessments offer an additional evaluation based on students' experiences with their mathematics teachers' instructional practices. Comparing these assessments makes it possible to identify areas in which the two groups' evaluations differ. Such comparisons provide complementary assessment evidence, although they do not constitute direct measures of teachers' demonstrated performance in using AI-based tools.

Furthermore, the study considers whether teachers' readiness differs according to selected demographic and professional characteristics and identifies the challenges encountered in integrating AI-based tools into mathematics instruction. Examining these areas provides a broader basis for understanding the conditions associated with readiness and the support that mathematics teachers may need.

Accordingly, this study examines mathematics teachers' readiness to integrate AI-based tools in teaching and learning mathematics within the La Salette School System. Specifically, it assesses readiness through the Will, Skill, and Tool dimensions of the WST Model; compares teacher and student assessments; examines differences according to selected teacher profile variables; determines the relationships among the WST dimensions; and identifies the challenges encountered by teacher-participants. The findings are intended to provide an empirical basis for recommendations and an action plan to strengthen mathematics teachers' readiness and support the responsible and effective integration of AI-based tools in mathematics education.

2. Methodology

2.1 Research Design

The study employed a mixed-methods research design combining quantitative descriptive-correlational analysis and qualitative thematic analysis. The quantitative component assessed mathematics teachers' readiness to integrate AI-based tools using the Will–Skill–Tool (WST) Model. It also examined differences between teacher and student assessments, variations in readiness according to selected teacher profile variables, and relationships among the three WST dimensions. The qualitative component explored

the challenges encountered by mathematics teachers in integrating AI-based tools into teaching and learning mathematics. Combining these approaches provided quantitative evidence of readiness and qualitative insights into the conditions and challenges associated with AI integration.

2.2 Participants and Sampling

The participants consisted of 24 mathematics teachers and 446 students from the junior high school, senior high school, and college levels of the participating campuses of the La Salette School System during School Year 2025–2026.

The teacher-participants were selected through purposive sampling. Of the 42 mathematics teachers in the participating campuses, 24 met the established inclusion criteria and were invited to participate. The student population consisted of 6,333 learners enrolled in mathematics classes handled by the participating teachers. The minimum sample size was computed as 388 using the Raosoft Sample Size Calculator, with a 95% confidence level, 5% margin of error, and 50% response distribution. An additional 15% allowance for possible non-response and incomplete questionnaires resulted in a target of 446 student-participants. Stratified random sampling was used to allocate the sample across campuses, followed by simple random sampling using official class lists.

2.3 Research Instruments

Two parallel survey questionnaires were used to obtain assessments from the teacher- and student-participants. The Teacher Readiness Questionnaire was adapted and modified from Bautista et al. (2024) and aligned with the WST Model of Knezek and Christensen (2015). It consisted of three parts: participant profile, readiness assessment, and open-ended questions concerning challenges encountered in AI integration.

The readiness section contained 40 items distributed across the three WST dimensions: Will, comprising openness, motivation, and attitude (15 items); Skill, comprising technical and pedagogical competency (13 items); and Tool, comprising accessibility, availability, and extent of utilization (12 items). Responses were recorded using a four-point Likert scale ranging from 1 (Low Readiness) to 4 (Very High Readiness).

The Student Assessment Questionnaire was patterned after the teacher instrument and contained 40 corresponding items using the same response scale. It assessed students' evaluations of their mathematics teachers' readiness across the same WST dimensions. The adapted instrument obtained an overall weighted mean of 4.46 in content validation and a Cronbach's alpha of 0.977, indicating excellent internal consistency.

2.4 Data Collection and Ethical Considerations

Data collection was conducted following ethical clearance from the Research Ethics Committee of St. Paul University Philippines and the necessary institutional approvals. Participation was voluntary, and informed consent was obtained. For participants below 18 years of age, parental or guardian consent and student assent were secured.

The questionnaires were administered electronically through Google Forms. Responses were organized in Microsoft Excel and processed using SPSS. Qualitative responses were examined to identify recurring challenges associated with AI integration.

2.5 Data Analysis

Frequencies and percentages were used to describe participant profiles, while weighted means summarized readiness assessments across the WST dimensions. Mean scores were interpreted as Very High (3.25–4.00), High (2.50–3.24), Moderate (1.75–2.49), and Low (1.00–1.74).

Independent-samples t-tests were used to examine differences between teachers' self-assessments and students' assessments. Tests of differences across participant-profile categories included t-tests and analysis of variance, as appropriate. Pearson product–moment correlation analysis was used to examine relationships among selected WST indicators. Qualitative responses were analyzed thematically to identify recurring challenges in the integration of AI-based tools into mathematics teaching and learning.

3. Results and Discussion

3.1 Mathematics Teachers' Readiness to Integrate AI-Based Tools

The findings revealed differences between mathematics teachers' self-assessments and students' assessments of teachers' readiness to integrate AI-based tools into mathematics teaching and learning.

Teachers reported an overall readiness mean of 3.04, interpreted as High, while students assessed their teachers' readiness at a Moderate level (M = 2.26). The combined overall mean was 2.65, interpreted as High.

In terms of the Will dimension, teachers obtained very high ratings in openness (M = 3.42), motivation (M = 3.41), and attitude (M = 3.25). Students, however, assessed these dimensions at a moderate level. For the Skill dimension, teachers reported high readiness in technical competency (M = 3.00) and pedagogical competency (M = 3.07), while students provided comparatively lower assessments.

For the Tool dimension, teachers reported high readiness in accessibility (M = 3.03) and moderate readiness in availability (M = 2.48) and extent of utilization (M = 2.63). The combined results showed high accessibility (M = 2.73), but moderate availability (M = 2.36) and extent of utilization (M = 2.47).

Table 1. Summary of Readiness Across the Will–Skill–Tool Dimensions

Dimension	Indicator	Teachers M	Students M	Combined M	Combined Interpretation
Will	Openness	3.42	2.27	2.84	High
Will	Motivation	3.41	2.14	2.77	High
Will	Attitude	3.25	2.14	2.70	High
Will	Category mean	3.36	2.18	2.77	High
Skill	Technical competency	3.00	2.47	2.74	High
Skill	Pedagogical competency	3.07	2.23	2.65	High
Skill	Category mean	3.04	2.35	2.70	High
Tool	Accessibility	3.03	2.42	2.73	High
Tool	Availability	2.48	2.25	2.36	Moderate
Tool	Extent of utilization	2.63	2.04	2.33	Moderate
Tool	Category mean	2.71	2.24	2.47	Moderate
Overall	Overall readiness	3.04	2.26	2.65	High

These findings suggest that teachers generally expressed willingness and perceived competence to integrate AI-based tools into mathematics instruction. However, the moderate ratings for availability and

utilization indicate that access to technological resources and their actual classroom use remain important considerations. The difference between teacher and student assessments further suggests that positive self-perceptions do not necessarily correspond to students' experiences of AI integration.

3.2 Differences Between Teachers' and Students' Assessments

Independent-samples t-tests revealed statistically significant differences between teachers' self-assessments and students' assessments across all indicators of the Will and Skill dimensions.

For Will, teachers reported higher mean scores in openness (M = 3.42), motivation (M = 3.41), and attitude (M = 3.25) than the corresponding student assessments of 2.27, 2.14, and 2.14, respectively. The differences were statistically significant.

Similarly, significant differences were found in technical competency and pedagogical competency. Teachers obtained mean scores of 3.00 and 3.07, respectively, compared with students' assessments of 2.47 and 2.23.

Within the Tool dimension, significant differences were established in accessibility and extent of utilization. However, no statistically significant difference was found in availability.

Table 2. Differences Between Teacher and Student Assessments

Indicator	Teacher M	Student M	Mean Difference	t	p	Decision
Openness	3.42	2.27	1.15	42.930	< .001	Significant
Motivation	3.41	2.14	1.27	50.859	< .001	Significant
Attitude	3.25	2.14	1.11	41.784	< .001	Significant
Technical competency	3.00	2.47	0.53	9.587	.002	Significant
Pedagogical competency	3.07	2.23	0.84	21.181	< .001	Significant
Accessibility	3.03	2.42	0.61	13.170	< .001	Significant
Availability	2.48	2.25	0.23	1.808	.179	Not significant
Extent of utilization	2.63	2.04	0.59	10.576	.001	Significant

These results indicate a consistent difference between teachers' assessment of their readiness and students' assessments of their teachers' readiness. Teachers generally rated their willingness and competencies more favorably than students did. This difference may reflect the distinct perspectives of the two respondent groups: teachers evaluated their own readiness, whereas students assessed their experiences of mathematics instruction.

The findings emphasize the importance of considering both teacher and student perspectives when evaluating the integration of AI-based tools in mathematics education.

3.3 Differences in Teachers' Readiness According to Their Profile

The analysis revealed significant gender-based differences in technical and pedagogical competencies. No significant differences were established in the other reported readiness indicators according to gender.

With respect to years of teaching experience, the results showed a statistically significant difference in technical competency (F = 5.231, p = .014). Teachers with 6–10 years of experience obtained the highest

mean score (M = 3.38), followed by those with less than five years (M = 2.93). Teachers with more than 10 years of experience obtained the lowest mean score (M = 2.13).

In contrast, no statistically significant difference was found in pedagogical competency (p = .116). Similarly, years of teaching experience did not significantly differentiate teachers' readiness in openness (p = .084), motivation (p = .594), attitude (p = .682), accessibility (p = .728), availability (p = .115), or utilization (p = .467).

These findings indicate that teachers' reported technical competency varied significantly according to their years of teaching experience. The differences in mean scores also show variations in the reported technical readiness of the three experience groups.

Table 3. Significant Differences in Readiness by Teacher Profile

Profile variable	Readiness indicator	Group result	Test statistic	p	Finding
Gender	Technical competency	Male 3.42; Female 2.65	t = 10.778	.003	Significant
Gender	Pedagogical competency	Male 3.36; Female 2.82	t = 5.466	.029	Significant
Years of teaching	Technical competency	<5 years: 2.93; 6–10 years: 3.38; >10 years: 2.13	F = 5.231	.014	Significant

Overall, the findings suggest that selected professional characteristics were associated with differences in teachers' reported competencies, particularly in technical competency.

3.4 Relationships Among the WST Dimensions

The correlation analysis revealed significant positive relationships between accessibility and both technical and pedagogical competencies. Significant positive relationships were also found between extent of utilization and the two competency indicators.

However, availability did not demonstrate statistically significant relationships with the competency indicators examined.

These findings suggest that teachers who reported greater accessibility and utilization of AI-based tools also tended to report higher technical and pedagogical competencies. The results highlight the importance of providing teachers with opportunities to access and use AI-based tools as part of their professional and instructional development.

Nevertheless, the correlational findings do not establish causal relationships. Greater accessibility or utilization cannot, based on these results alone, be concluded to cause higher competency.

Table 4. Relationships Between Will and Skill Indicators

Will indicator	Technical competency r	p	Pedagogical competency r	p
Openness	.181	.398	.219	.303
Motivation	.114	.595	.151	.480
Attitude	.192	.369	.111	.606

Table 5. Relationships Between Will and Tool Indicators

Will indicator	Accessibility r (p)	Availability r (p)	Utilization r (p)
Openness	.108 (.617)	−.265 (.212)	.343 (.101)
Motivation	.059 (.786)	−.265 (.211)	.326 (.120)
Attitude	.054 (.802)	−.430 (.036)	.214 (.314)

Table 6. Relationships Between Skill and Tool Indicators

Tool indicator	Technical competency r (p)	Pedagogical competency r (p)
Accessibility	.569 (.004)	.514 (.010)
Availability	.160 (.456)	.310 (.140)
Extent of utilization	.426 (.038)	.493 (.014)

3.5 Challenges in Integrating AI-Based Tools into Mathematics Instruction

The qualitative analysis identified ten recurring challenges encountered in integrating AI-based tools into mathematics teaching and learning. These included student overreliance on AI and academic integrity concerns; ethical and privacy issues; students' readiness for responsible AI use; insufficient professional development; difficulties aligning AI tools with curriculum and assessment requirements; classroom management challenges; internet connectivity problems; limited access to devices and licensed software; restrictive or unclear institutional policies; and time constraints.

These themes provide additional context for understanding the quantitative findings. Concerns involving technological resources, professional development, instructional alignment, and responsible AI use demonstrate that integrating AI-based tools involves more than teachers' willingness to adopt technology. The findings underscore the need for institutional support, continuing professional development, clear guidelines, and adequate technological resources to promote responsible and meaningful AI integration in mathematics instruction.

3.6 Synthesis of Findings

Overall, the study revealed that mathematics teachers demonstrated High self-assessed readiness to integrate AI-based tools, while students assessed their teachers' readiness at a Moderate level. Although teachers reported favorable willingness and competencies, the Tool dimension reflected limitations in availability and utilization.

Differences between teacher and student assessments, together with the significant variation in technical competency according to teaching experience, highlight the multidimensional nature of readiness. The qualitative findings further demonstrate that effective AI integration requires attention to professional competencies, technological resources, institutional support, and responsible classroom practices.

These results support the development of targeted institutional initiatives that strengthen teachers' technical and pedagogical competencies while improving access to appropriate AI-based tools and promoting their responsible use in mathematics teaching and learning.

4. CONCLUSION

The findings of the study indicate that mathematics teachers demonstrated a generally high level of readiness to integrate AI-based tools into the teaching and learning of mathematics. However, differences were evident between teachers' self-assessments and students' assessments. Teachers rated their readiness highly, whereas students provided a moderate assessment. The combined results showed high readiness

in the Will and Skill dimensions, while the Tool dimension was rated moderate. Specifically, accessibility received a high rating, whereas availability and extent of utilization received moderate ratings. These findings suggest that although teachers demonstrate willingness and competencies to integrate AI-based tools, access to and actual utilization of these tools remain areas requiring attention.

Significant differences were found between teachers' self-assessments and students' assessments in all indicators under the Will and Skill dimensions, as well as in accessibility and extent of utilization under the Tool dimension. However, no significant difference was found in availability. These results highlight the differences between teachers' perceptions of their readiness and students' experiences of AI integration in mathematics instruction.

The analysis of teachers' profiles revealed significant differences in technical and pedagogical competencies when grouped according to gender. Years of teaching experience also showed a significant difference in technical competency. However, no significant differences were found in the other readiness indicators when teachers were grouped according to their profile variables.

Regarding the relationships among the dimensions of the Will–Skill–Tool Model, openness and motivation were not significantly related to the indicators of Skill and Tool. Attitude was not significantly related to accessibility and extent of utilization, although a significant negative relationship was found between attitude and availability. For the Skill and Tool dimensions, accessibility was positively and significantly related to both technical and pedagogical competencies. Similarly, extent of utilization showed positive and significant relationships with both competency indicators. Availability, on the other hand, was not significantly related to technical or pedagogical competency.

The qualitative findings further revealed challenges that may affect the integration of AI-based tools in mathematics instruction. These include student overreliance on AI and concerns about academic integrity, ethical and privacy issues, student readiness and responsible use, limited training and professional development, difficulties in aligning AI with curriculum and assessment, classroom management concerns, internet connectivity problems, limited access to devices and licensed software, restrictive or unclear institutional policies, and time constraints.

Overall, the findings establish that readiness to integrate AI-based tools in mathematics instruction involves more than teachers' willingness to adopt technology. It also requires adequate competencies, accessible and available resources, meaningful utilization, and institutional support. Strengthening these areas may help ensure that AI-based tools are integrated responsibly and effectively to support mathematics teaching and learning.

5. RECOMMENDATIONS

Based on the findings and conclusions of the study, the following recommendations are proposed:

Strengthen teachers' professional development. Educational institutions may provide continuous training and professional development activities to enhance mathematics teachers' technical and pedagogical competencies in using AI-based tools. These activities may focus on selecting appropriate AI tools, evaluating AI-generated outputs, designing mathematics learning activities, and integrating AI into classroom instruction.

Improve access to and availability of AI resources. Institutions may assess their existing technological resources and identify areas that require improvement. Providing reliable internet connectivity, adequate devices, and access to appropriate AI platforms and licensed software may help address the limitations identified under the Tool dimension.

Promote responsible and purposeful AI utilization. Mathematics teachers may establish classroom guidelines for the appropriate use of AI-based tools. These guidelines should address academic integrity, responsible use, data privacy, and the importance of students' independent mathematical thinking. AI tools should support rather than replace students' reasoning and problem-solving abilities.

Develop clear institutional policies on AI integration. School administrators may establish or strengthen institutional policies that guide the ethical and responsible use of AI in teaching and learning. These policies may provide clear directions on data privacy, academic integrity, acceptable AI use, and the responsibilities of teachers and students.

Align AI integration with mathematics instruction and assessment. Mathematics teachers may select AI-based tools that support specific learning objectives, curriculum requirements, and assessment practices. Learning activities should encourage mathematical reasoning, critical thinking, problem-solving, and independent learning while making appropriate use of AI technologies.

Strengthen feedback mechanisms involving teachers and students. Since significant differences were observed between teachers' self-assessments and students' assessments in several readiness indicators, institutions may establish regular feedback mechanisms involving both groups. Student feedback may help teachers and administrators identify gaps between intended AI integration and students' actual learning experiences.

Provide support responsive to teachers' competency needs. Professional development initiatives may consider teachers' varying levels of technical and pedagogical competency. Training activities may be designed to address identified competency needs and provide opportunities for teachers to develop confidence and practical skills in using AI-based tools for mathematics instruction.

Conduct further research on AI integration in mathematics education. Future researchers may examine teachers' actual classroom practices and students' learning experiences through classroom observations, performance-based assessments, and interviews. Further studies may also investigate how institutional resources, teacher competencies, and patterns of AI utilization relate to the effectiveness of AI integration in mathematics teaching and learning.

The proposed recommendations may serve as a basis for institutional initiatives and professional development programs designed to strengthen mathematics teachers' readiness and support the responsible integration of AI-based tools into mathematics education.

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