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The influence of professional background and action research competence of mathematics teachers

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Abstract Research productivity in mathematics action research is not just about the volume of outputs, but also their impact on teaching and learning practices. This study aims to examine the professional background of mathematics teachers—specifically their rank, highest educational attainment, and length of teaching experience—and how these variables relate to their research capacity. The study employed a quantitative correlational research design, using survey instruments to measure research knowledge, skills, and attitudes toward action research among 139 DepEd high school mathematics teachers selected through purposive sampling, ensuring they were actively engaged in mathematics action research. Descriptive statistics will be used to profile respondents' professional background, while inferential analyses will examine the relationships between background variables and research capacity. The researcher-developed survey questionnaire consists of four key sections to collect the data. The findings from this study indicate that mathematics teachers possess a strong overall understanding and competence in action research, with consistently "High" levels across the dimensions of knowledge, skills, and attitudes. These findings underscore the essential role of action research in enhancing teaching practices and professional development. Moreover, significant associations were revealed between teachers' research knowledge and the highest educational attainment ($r_s = 0.268$, $p = 0.001$); research skills and length of teaching experience ($r_s = -0.189$, $p = 0.026$); and research attitude and length of teaching experience ($r_s = -0.287$, $p = < .001$). This finding suggests that experience and academic qualifications positively influence teachers' engagement in action research. Thus, mathematics teachers demonstrate strong competence and positive attitudes toward action research, with experience and education further enhancing their proficiency. It is recommended to implement targeted training programs aligned with teachers' rank, educational attainment, and teaching experience to enhance their competencies in structured reporting and advanced research methodologies.

Keywords: research productivity, quantitative correlational, spearman rho, teacher research engagement, professional competence

1. Introduction

Mathematics education continuously evolves through research-informed practices, with action research playing a critical role in improving teaching and learning outcomes (Clark et al., 2023; Bullo et al., 2021). However, despite its recognized benefits, many mathematics educators encounter barriers to engaging in research, including limited research knowledge, insufficient research skills, and negative attitudes toward the research process (Alomoush, 2023; Tekin, 2023; Albalawi & Johnson, 2022). Additionally, teachers often perceive research as an added burden due to constraints such as lack of time, difficulty in conducting and writing research, and limited confidence in their research abilities (Bullo et al., 2021). These challenges hinder teachers' ability to effectively design, implement, and sustain action research initiatives, ultimately affecting their research productivity and professional growth.

While there is an increasing emphasis on the importance of action research in teacher professional development, relatively little attention has been given to understanding how teachers' professional backgrounds shape the interplay among research knowledge, attitudes. Understanding the relationships between professional background and research capacity is critical because it can provide insights into how teachers can be better supported in conducting action research. Teachers with a high level of research knowledge are likely to engage in more rigorous research processes, but without the necessary skills, they may struggle to execute their research effectively. Conversely, teachers with strong research skills but limited knowledge

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or negative attitudes may fail to translate their abilities into meaningful research outcomes. Positive attitudes are also essential for sustaining engagement in research, as they influence a teacher's willingness to overcome challenges and continue improving their practices (Kyaw, 2021). Thus, an integrated approach to enhancing knowledge, skills, and attitudes—grounded in an understanding of teachers ' professional background—may be the key to fostering greater research productivity among mathematics educators.

This study is designed to address this gap by mapping the research capacity of mathematics educators and examining how their professional background influences their levels of research knowledge, skills, and attitudes toward action research. By identifying patterns across rank, educational attainment, and teaching experience, the study aims to provide a deeper understanding of the conditions that support or hinder teacher engagement in research.

Furthermore, the integration of action research into the professional development of mathematics teachers is a growing trend, particularly in contexts where teacher research is seen as a tool for both improving practice and contributing to the academic community. However, teacher education programs often overlook the need to develop a comprehensive understanding of how these factors (research knowledge, skills, and attitudes) interact with professional background to produce effective and productive research outcomes (Valenzuela, 2022). This gap in the literature presents an opportunity for this study to contribute to the development of more effective professional development programs that are specifically designed to foster research productivity among mathematics educators.

In addition to the direct impact on teachers ' professional growth, improving research capacity among mathematics educators has broader implications for the field of mathematics education as a whole. Teachers who actively engage in action research can contribute to the development of more effective teaching strategies, instructional materials, and assessments, thereby improving student learning outcomes. Moreover, the knowledge generated through action research can inform broader educational policies, offering evidence-based recommendations for curricular reforms and teaching practices (Magallanes et al., 2021).

This study will contribute to the literature on mathematics education by offering a comprehensive profile of teachers' capacity and examining how professional background influences their knowledge, skills, and attitudes toward action research. In doing so, the research will provide insights into how these factors can be cultivated through professional development and institutional support to maximize research output and impact.

Moreover, the findings of this study will be helpful to educational institutions, policymakers, and professional development providers seeking to design effective programs that support mathematics educators in their research endeavors. By identifying the key background factors that influence research capacity, the study will offer practical recommendations for developing professional development programs that equip teachers with the necessary research knowledge, skills, and attitudes to engage in high-quality action research. These findings will be particularly relevant to institutions seeking to promote a culture of research and inquiry among their teaching staff, with the ultimate goal of improving the quality of mathematics education.

While previous studies have examined teachers' research knowledge, skills, and attitudes independently, there is limited research that simultaneously investigates how these dimensions interact and how they are influenced by teachers' professional background variables such as rank, educational attainment, and teaching experience. This gap limits a comprehensive understanding of the factors shaping teachers' research capacity, particularly in mathematics education.

Thus, this study aims to examine the professional backgrounds of mathematics teachers—specifically their rank, highest educational attainment, and length of teaching experience—and to examine how these variables relate to their research capacity. It investigates the levels of research knowledge (e.g., understanding concepts, problem formulation, design, data handling, and reporting), research skills (e.g., implementation, analysis, and application), and research attitudes (affective, cognitive, and behavioral). Furthermore, it explores whether significant correlations exist between teachers' rounds and each of these dimensions—knowledge, skills, and attitudes—regarding action research.

This study answered the following research questions:

1. What is the professional background of mathematics teachers in terms of:
a. rank,
b. highest educational attainment, and
c. length of teaching experience?
2. What are the levels of teachers' research capacity in terms of:
a. research knowledge,
b. research skills, and
c. research attitudes?
3. Are there significant relationships between teachers' professional background and their:
a. research knowledge,
b. research skills, and
c. research attitudes?

2. Materials and Methods

2.1. Design

The study employed a quantitative correlational research design, using survey instruments to measure mathematics teachers' research knowledge, skills, and attitudes toward action research. Descriptive statistics will be used to profile respondents' professional background, while inferential analyses will examine the relationships between background variables and research capacity. This design allows for mapping patterns and identifying significant predictors of research engagement.

2.2. Respondents

The target population for this study was consisted of high school mathematics teachers in the Department of Education who were involved in action research within educational settings. Inclusion criteria for participation were as follows:

• Involvement in mathematics action research: Participants must have been involved in at least one completed or ongoing action research project related to mathematics teaching and learning.

• Willingness to participate: Participants must voluntarily consent to share their experiences and data for the study.

The expected sample size of 139 participants was adequate for statistical analysis, particularly for regression analysis to model the relationships among the variables. The sample was drawn from a variety of educational institutions and regions to ensure diversity and generalizability of the findings.

2.3. Instrument

The researcher-developed survey questionnaire consisted of four key sections. The first gathered demographic information, including gender, years of service, highest educational attainment, and professional rank. The second assessed research knowledge, focusing on teachers' understanding of action research concepts, problem formulation, design, data handling, and reporting. The third measured research skills, including implementation, analysis, and application. The fourth examined attitudes toward conducting research, covering affective, cognitive, and behavioral dimensions. Data were collected manually using structured, self-administered instruments designed to comprehensively capture these dimensions.

These research instruments demonstrated strong reliability and validity, as confirmed through confirmatory factor analysis (CFA). Fit indices such as CFI, TLI, GFI, and SRMR consistently indicated good to excellent model fit across constructs measuring research knowledge, skills, and attitudes. Factor loadings were statistically significant and high, while internal consistency was robust, with Cronbach's alpha and McDonald's omega coefficients ranging from 0.86 to 0.98. These results affirm that the instruments reliably capture the intended dimensions and are suitable for assessing research capacity among mathematics educators.

2.4. Data Analysis

Quantitative data analysis was conducted using JASP software. The following statistical procedures were employed:

Descriptive statistics will be used to summarize participants' demographic characteristics, including age, rank, educational attainment, and teaching experience. Measures such as frequency, percentage, mean, and standard deviation will be computed to describe the distribution of research knowledge, research skills, research attitudes, and research productivity. These statistics will provide a general overview of the data and identify patterns or trends among variables.

Spearman's rank correlation coefficient (ρ) will be used to examine the relationships among variables such as age, rank, educational attainment, and research knowledge, skills, attitudes, and productivity. This nonparametric test is appropriate because the data may be ordinal or fail the normality assumptions required by parametric tests.

The use of Spearman's ρ assumes that: the variables are measured at least at the ordinal level, the observations are independent, and the relationship between variables is monotonic. The value of the correlation coefficient ranges from −1 to +1, where values closer to ±1 indicate stronger relationships, and values near 0 indicate little to no association. The strength of the relationship will be interpreted as very weak (0.00–0.19), weak (0.20–0.39), moderate (0.40–0.59), strong (0.60–0.79), and very strong (0.80–1.00). The direction of the relationship will be determined by the sign of the coefficient: positive values indicate a positive association, and negative values indicate an inverse association. Statistical significance will be assessed at the 0.05 level ($p < 0.05$) to determine whether the observed relationships are statistically significant.

3. Results and Discussion

3.1. Background of the Teachers

Teachers' backgrounds play a critical role in research because they influence how effectively they can contribute to, interpret, and carry out research. Specifically, a teacher's rank, highest educational attainment, and length of teaching experience all shape their ability to design and execute research projects, as well as analyze and interpret data.

Table 1 presents the distribution of professional ranks among the teachers. It shows that the majority of the teachers hold the rank of Teacher 1, accounting for 47.48% of the total, for a cumulative percentage of 100%. In contrast, the ranks of private teacher, SHS teacher, and Special Science Teacher 1 have the lowest representation, with each at 0.72%.

Table 1 Frequencies of Professional Rank.

Indicators	f	%	Cumulative %
Master Teacher II	3	2.16	2.16
Master Teacher I	8	5.76	7.91
SHS Teacher	2	1.44	9.35
Special Science Teacher 1	1	0.72	10.07
Special Science Teacher 1	1	0.72	10.79
Teacher III	27	19.42	30.22
Teacher II	31	22.30	52.52
Teacher I	66	47.48	100.00

Table 2 displays the distribution of the highest educational attainment among the mathematics teachers. It reveals that most of the teachers hold a bachelor's degree, with the highest percentage at 58.99%, which also represents the cumulative total. In contrast, teachers with a doctoral degree represent the smallest group, at 6.47%, with a cumulative total of 6.47%.

Table 2 Frequencies of Highest Educational Attainment.

Indicators	f	% of Total	Cumulative %
Doctor's Degree Graduate	9	6.47	6.47
Masters' degree holder	26	18.71	25.18
MA with units in Doctor's Degree	22	15.83	41.01
Bachelors' degree holder	82	58.99	100.00

Table 3 shows the distribution of years of service among the teacher respondents. It shows that teachers with 5 to 7 years of service have the highest percentage, at 23.02%, and account for 68.35% of the total. In contrast, teachers with 14 to 16 years of service represent the smallest group, accounting for only 3.60% and contributing to a cumulative percentage of 18.71%.

Table 3 Frequencies of length in Service.

Indicators	f	%	Cumulative %
17 and above	21	15.11	15.11
14-16 years	5	3.60	18.71
11-13 years	19	13.67	32.37
8-10 years	18	12.95	45.32
5-7 years	32	23.02	68.35
2-4 years	25	17.99	86.33
less than a year	19	13.67	100.00

3.2. Mathematics Teachers' Research Knowledge, Skills, and Attitude towards Action Research

Table 4 shows that Mathematics teachers' knowledge in conducting action research reflects their understanding of systematic inquiry aimed at improving instructional practices and student outcomes. The study assessed five dimensions of research knowledge: understanding action research concepts; identifying and formulating problems; designing and implementing research; collecting and analyzing data; and interpreting and reporting results. Across these dimensions, teachers consistently demonstrated a "High" level of knowledge, with overall mean scores ranging from 2.874 to 3.26.

Table 5 shows that Mathematics teachers demonstrated consistently "High" levels of research skills across five key dimensions: problem identification and formulation, research design and implementation, data collection, data analysis and interpretation, and application and reporting. In identifying and formulating problems, teachers showed a strong ability to recognize instructional challenges and frame research questions, with an overall mean score ranging from 2.83 to 3.056.

Table 6 shows that Mathematics teachers demonstrated consistently "High" levels of attitude toward conducting action research across three dimensions: affective, cognitive, and behavioral intention. Regarding affective attitudes, teachers expressed enjoyment, confidence, and a sense of reward when engaging in action research, with an overall mean score ranging from 2.986 to 3.35.

3.3. Relationship between the teachers' profile and their level of research knowledge, skills and attitudes

3.3.1. Relationship between the level of research knowledge and the teacher's profile

In Table 7, Spearman's rank-order correlation was used to assess the relationship between teachers' profiles and research knowledge. One hundred thirty participants were recruited. The analysis showed a statistically significant, strong positive correlation between research knowledge and the highest educational attainment ($r_s = 0.268$, $p = 0.001$). Based on the data obtained, the p-value is less than the chosen significance level of 0.05. As a result, the null hypothesis is rejected, indicating a significant relationship between research knowledge and the highest educational attainment. However, no statistically significant relationships were found for academic rank ($r_s = 0.065$, $p = 0.450$) and length of teaching experience ($r_s = -0.157$, $p = 0.067$).

Table 4 Level of Mathematics Teachers' Research Knowledge.

	Indicators	$\bar{x}$	±	LL	UL	VD
	Knowledge in Understanding of Action Research Concepts					
K1	I understand the purpose of action research as a tool for improving mathematics teaching practices.	3.246	1.873	3.08	3.413	H
K2	I am familiar with the cyclical process of action research (e.g., planning, acting, observing, and reflecting).	2.92	1.627	2.874	3.064	H
K3	I can differentiate between action research and traditional educational research.	3.036	1.761	2.874	3.198	H
	Overall	3.068	1.745	2.927	3.208	H
	Identifying and Formulating Problems					
K4	I can identify specific challenges or issues in teaching mathematics that are suitable for action research.	2.92	1.805	2.69	3.15	H
K5	I know how to frame research questions that address problems in mathematics instruction.	3.48	2.005	3.31	3.66	VH
K5	I can align research objectives with observed classroom needs.	3.38	1.955	3.21	3.56	H
	Overall	3.26	1.855	3.11	3.41	H
	Designing and Implementing Research					
K6	I understand how to develop a plan of action for conducting research in my mathematics classroom.	2.855	1.632	2.719	2.991	H
K7	I am familiar with different research designs (e.g., case studies, quasi-experimental) applicable to action research in mathematics.	2.885	1.636	2.716	2.994	H
K8	I can implement interventions in my teaching practice based on my research plan.	2.913	1.67	2.771	3.055	H
	Overall	2.874	1.626	2.748	3	H
	Data Collection and Analysis					
K9	I know how to collect data using various tools (e.g., surveys, tests, observations) in a mathematics classroom setting.	3.174	1.799	3.033	3.315	H
K10	I am familiar with qualitative and quantitative methods for analyzing classroom data.	3.167	1.815	3.012	3.321	H
	I understand how to interpret data to assess the effectiveness of instructional strategies in mathematics.	3.101	0.765	2.244	2.959	H
	Overall	3.147	1.777	3.012	3.283	H
	Interpreting and Reporting Results					
K11	I can draw conclusions based on the results of my action research in mathematics.	2.993	1.72	2.844	3.142	H
K12	I know how to document and report findings in a structured and professional format.	2.819	1.632	2.67	2.967	H
K13	I understand how to use research findings to inform and improve future mathematics instruction.	2.913	1.692	2.756	3.07	H
	Overall	2.908	1.666	2.767	3.049	H

Note: 4.200-5.0 Excellent;3.400-4.199 Very High (VH);2.600-3.399 High (H);1.800-2.599 Low (L);1.000-1.799 Very Low (VL).

3.3.2. Relationship between level of research skills and teacher's profile

To investigate the relationship between research skills and the teacher's profile, we opted to use Spearman's correlation coefficient rather than Pearson's because of the nature of the variables. Based on the data in the table, there was a statistically significant, strong positive correlation between research skills and the respondents' teaching experience ($r_s = 0.189$, $p = 0.026$). Based on the data obtained, the p-value is less than the chosen significance level of 0.05. Hence, the null hypothesis is rejected, indicating a significant relationship between research skills and teaching experience. However, we found significant relationships between research skills and the teacher's profile, including rank ($r_s = 0.055$, $p = 0.518$) and highest educational attainment ($r_s = 0.155$, $p = 0.069$).

3.3.3. Relationship between level of research attitude and teacher's profile

The table also shows the correlation via Spearman's rank-order to determine the relationship between the level of research attitude and the teacher's profile among 130 participants. There was a strong, positive association between the level of research attitude and the length of teaching experience, which was statistically significant ($r_s = -0.287$, $p = 0.001$). As a result, the null hypothesis is rejected, indicating a significant relationship between the level of research attitude and the length

of teaching experience. However, we found significant relationships between the research attitude and the teacher's profile, including rank (r_s = -0.059, p = 0.495) and highest educational attainment (r_s = 0.083, p = 0.336).

4. Discussion

Table 5 Level of Mathematics Teachers' Research Skills.

	Indicators	x̄	±	LL	UL	VD
	Skills in problem identification and formulation					
S1	I can identify specific challenges in teaching mathematics that require action research.	3.138	1.781	2.996	3.279	H
S2	I am skilled at framing clear and focused research questions for classroom problems.	2.862	1.656	2.713	3.012	H
S3	I can connect researchable issues with broader instructional goals in mathematics.	2.819	1.626	2.675	2.963	H
	Overall	2.94	1.669	2.807	3.072	H
	Research design and implementation					
S4	I can develop an actionable research plan to address issues in mathematics teaching.	2.833	1.634	2.689	2.978	H
S5	I am skilled in designing interventions that address identified problems in the classroom.	2.87	1.623	2.744	2.995	H
S6	I can manage the implementation of an action research project while teaching.	2.797	1.615	2.653	2.941	H
	Overall	2.833	1.607	2.707	2.96	H
	Data collection					
S7	I am proficient in selecting appropriate tools (e.g., surveys, interviews, tests) to gather classroom data.	2.942	1.69	2.796	3.088	H
S8	I can collect quantitative data (e.g., test scores) to evaluate the impact of instructional strategies.	3.196	1.834	3.038	3.353	H
S9	I can collect qualitative data (e.g., student reflections, observations) to gain insights into the learning process.	3.029	1.749	2.873	3.185	H
	Overall	3.056	1.743	2.913	3.199	H
	Data analysis and interpretation					
S10	I am skilled in analyzing quantitative data to evaluate the outcomes of my action research.	2.928	1.681	2.783	3.072	H
S11	I can interpret qualitative data to understand patterns and themes in student learning.	2.841	1.625	2.704	2.977	H
S12	I can draw evidence-based conclusions from the data collected during my research.	2.899	1.668	2.753	3.044	H
	Overall	2.889	1.647	2.754	3.024	H
	Application and reporting					
S13	I am skilled at applying research findings to improve my teaching practices in mathematics.	2.877	1.655	2.732	3.021	H
S14	I can effectively communicate the results of my research to colleagues or stakeholders.	2.877	1.655	2.732	3.021	H
S15	I can write clear and well-structured reports or articles documenting my action research.	2.732	1.596	2.579	2.885	H
	Overall	2.829	1.624	2.689	2.968	H

Note: 4.200-5.0 Excellent;3.400-4.199 Very High (VH);2.600-3.399 High (H);1.800-2.599 Low (L);1.000-1.799 Very Low (VL).

Table 6 Level of Mathematics Teachers' Research Attitude.

	Indicators	x̄	±	LL	UL	VD
	Affective attitude					
A1	I enjoy the process of conducting action research to improve my teaching of mathematics.	3	1.718	2.855	3.145	H
A2	I feel confident when engaging in action research in mathematics classrooms.	2.92	1.691	2.767	3.074	H
A3	I find conducting action research in mathematics to be a rewarding experience.	3.036	1.749	2.882	3.19	H
	Overall	2.986	1.705	2.844	3.13	H
	Cognitive attitude					
A4	I believe action research is an effective way to address challenges in teaching mathematics.	3.341	1.932	3.166	3.515	H
A5	I think conducting action research helps deepen my understanding of mathematics instruction.	3.297	1.893	3.134	3.46	H
A6	I consider action research essential for improving student learning outcomes in mathematics.	3.413	1.957	3.246	3.58	VH
	Overall	3.35	1.919	3.188	3.51	H
	Behavioral Intention					
A7	I intend to use action research regularly to improve my mathematics teaching practices.	3.152	1.816	2.992	3.312	H
A8	I am willing to allocate time and effort to conduct action research in my mathematics classroom.	3.217	1.850	3.056	3.378	H
A9	I plan to share the findings of my action research with colleagues to improve teaching strategies.	3.261	1.868	3.103	3.419	H
	Overall	3.21	1.830	3.06	3.36	H

Note: 4.200-5.0 Excellent;3.400-4.199 Very High (VH);2.600-3.399 High (H);1.800-2.599 Low (L);1.000-1.799 Very Low (VL).

4.1. Background of Teachers

4.1.1. Professional Rank

The distribution of professional ranks among teachers may have significant implications for research productivity. Teachers in lower ranks, such as Teacher 1, are likely to have fewer responsibilities in terms of research and curriculum development. They may also have less experience conducting formal research than their higher-ranked counterparts, which may influence both their confidence and their engagement in scholarly activities. Recent studies emphasize that professional growth meaningfully augments teachers' competence and engagement in research-related tasks (Zhou et al., 2023; Liu et al., 2025). Research has also revealed that when controlling for variables associated with publishing, such as rank, number of years since receiving one's Ph.D., type of academic setting, discipline, department and amount of time spent conducting research, the gender gap in publishing closed considerably and even disappeared entirely when the focus was on a specific period of publication (Neveu & Neveu, 2025). This finding underscores the importance of structural and institutional factors in shaping research productivity, rather than relying solely on individual characteristics. Recent studies accentuate the climactic role of institutional provision and professional learning systems in augmenting teacher performance and research involvement (Audisio et al., 2024; Nguyen et al., 2024). Consistent with the theory of Teacher Knowledge and Professional Development, this implies that when systemic barriers are addressed, and teachers receive adequate professional learning and institutional support, their expertise and scholarly contributions can flourish regardless of gender, strengthening both their subject-matter knowledge and their role as reflective practitioners. This could limit their involvement in research projects, both individually and institutionally. In contrast, teachers holding specialized or higher-ranking positions may have more opportunities and the necessary background to engage in research, as well as greater availability of mentorship, resources, and linkages, which are identified as key forerunners of teacher professionalism and research productivity in recent Scopus-indexed reviews (Çolak, 2025). Thus, the predominance of teachers in the lower ranks suggests a need for further professional development and training to enhance research capabilities across all teacher levels, ultimately increasing overall research productivity within the institution. Likewise, this suggests that research productivity is shaped less by rank itself and more by unequal access to institutional support, mentorship, and professional learning, highlighting the need for systemic interventions to ensure more equitable research engagement across teacher levels.

Table 7 Relationship between the teachers' profile and their level of research knowledge, skills and attitudes.

Variables	Spearman rho	*P*	Decision	Remark
Level of research knowledge and teachers'…				
Rank	0.065	0.450	Failed to reject H_o	Not significant
Highest Educational Attainment	0.268	0.001	Reject H_o	Significant
Length of Teaching Experience	-0.157	0.067	Failed to reject H_o	Not significant
Level of research skills and teachers'…				
Rank	0.055	0.518	Failed to reject H_o	Not significant
Highest Educational Attainment	0.155	0.069	Failed to reject H_o	Not significant
Length of Teaching Experience	-0.189	0.026	Reject H_o	Significant
Level of research attitude and teachers'…				
Rank	-0.059	0.495	Failed to reject H_o	Not significant
Highest Educational Attainment	0.083	0.336	Failed to reject H_o	Not significant
Length of Teaching Experience	-0.287	< .001	Reject H_o	Significant

4.1.2. Highest Educational Attainment

The educational attainment of Mathematics teachers plays a significant role in their research productivity. With the majority of teachers holding only a bachelor's degree, there may be limited exposure to advanced research methodologies, which could hinder their ability to engage in higher-level research or contribute to scholarly publications as recent studies indicate that graduate-level education enhances teachers' research literacy, critical thinking, and ability to apply systematic inquiry in educational settings (Dragaset et al., 2025). Although there is no clear evidence on the impact that teacher education attainment has on student achievement, general educational policy recommendations continue to push for teachers to obtain a master's degree (Đerić et al., 2021). More evidence suggests that advanced degrees contribute not only to content mastery but also to teachers' engagement in research, reflective practice, and pedagogical innovation (Audisio et al., 2024; Zhou et al., 2023). Teachers with doctoral degrees, though fewer in number, are generally better equipped with the knowledge and skills required to conduct and publish research. The relatively low percentage of teachers with doctoral qualifications suggests a gap in research expertise among the majority of the faculty. To improve research productivity, it is important to encourage and provide opportunities for further education and professional development, particularly at the graduate level, to foster a more research-oriented teaching community. This indicates that educational attainment functions not only as a measure of qualification but also as a key mechanism for developing research capacity, suggesting that disparities in research productivity may stem from unequal access to advanced academic training rather than differences in individual capability.

4.1.3. Length in Service

The number of years a teacher has been in service can significantly impact their research productivity. Teachers with 5 to 7 years of experience may be in a phase where they have gained sufficient expertise in their subject area, yet still possess the enthusiasm and drive to explore new teaching strategies and engage in research activities. However, the lower percentage of teachers with 14 to 16 years of service suggests that more experienced teachers may be less engaged in research, possibly due to increased administrative responsibilities or burnout. Teacher experience and knowledge are essential for engaging students in meaningful and effective mathematical practices in the classroom to construct a deep understanding of mathematics (Gonzalez & Maxwell, 2021). To boost research productivity among the teaching staff, institutions could focus on providing opportunities for professional development and research engagement for both early-career and more experienced teachers, ensuring sustained research involvement throughout their careers. This could involve offering targeted training workshops on research methodologies, providing mentorship programs that pair novice researchers with seasoned scholars, and granting access to research funding and resources. By supporting teachers at different stages of their careers and recognizing their evolving professional needs, schools can promote a culture of sustained research involvement and continuous scholarly growth. Furthermore, this suggests that research engagement across years of service may follow a nonlinear trajectory, with mid-career teachers representing a critical point for research productivity, indicating that institutional support should be strategically differentiated across career stages rather than uniformly applied.

4.2. Mathematics Teachers' Research Knowledge, Skills, and Attitude towards Action Research

4.2.1. Research Knowledge

Teachers showed strong familiarity with the cyclical process of action research and could differentiate it from traditional research approaches (Murro, 2022). They also recognized research as a tool for enhancing mathematics instruction, not merely an academic exercise.

In identifying and formulating problems, teachers exhibited commendable competence, particularly in framing research questions and aligning objectives with classroom needs. The indicator on crafting research questions scored "Very High" ($\bar{x}$ = 3.48), suggesting advanced analytical thinking. However, while teachers were proficient in pinpointing instructional challenges, the findings imply room for growth in mastering more complex or innovative problem-framing techniques (Ilhan, 2021; Mera et al., 2021). This highlights the need for professional development that deepens teachers' insight into nuanced classroom issues and equips them with strategies for articulating researchable problems.

Teachers also demonstrated a solid foundation in designing and implementing research, with mean scores indicating "High" proficiency in developing action plans, understanding applicable designs, and executing interventions. Although their capabilities are strong, the data suggest potential for refinement to reach excellence, particularly in adopting more sophisticated or innovative approaches (Herrity, 2025; Munna & Kalam, 2021). Their knowledge in data collection and analysis was similarly rated "High." However, the lowest mean score was observed in interpreting data for instructional decisions (K12), pointing to a gap in translating data into actionable insights (Tao et al., 2022). Strengthening these skills would empower teachers to make evidence-based decisions that enhance learning outcomes.

Finally, in interpreting and reporting research results, teachers showed consistent "High" proficiency, especially in drawing conclusions and applying findings to future instruction. However, structured and professional reporting (K14) emerged as an area needing targeted support. While teachers can communicate their findings, enhancing their reporting skills could improve the clarity and impact of their research outputs (Villagonzalo, 2021; Hong & Lawrence, 2021). Overall, the findings affirm that mathematics teachers possess a strong foundation in research knowledge, with clear implications for capacity-building programs that foster more profound expertise and more impactful engagement in action research. Likewise, this suggests that while teachers demonstrate strong foundational research knowledge, there remains a gap between procedural understanding and higher-order application, indicating that professional development should move beyond basic competencies toward fostering deeper analytical and interpretive expertise in research practice.

4.2.2. Research skills

Teachers' capacity to connect researchable issues with broader instructional goals reflects a proactive stance toward using action research for continuous improvement (Lewin, 2023). This suggests that teachers are not merely reacting to classroom issues but are engaging in systematic inquiry to enhance mathematics instruction. Their competence in framing focused questions and aligning them with instructional goals indicates a high level of analytical thinking and strategic planning (Brandt & Lorié, 2024; van der Steen et al., 2023).

In terms of research design and implementation, teachers scored an overall mean of 2.833, indicating "High" proficiency in developing actionable plans, designing interventions, and managing research execution. These skills are essential for translating theoretical understanding into practical classroom strategies. Teachers' ability to integrate research into their teaching demonstrates their engagement in reflective practice and their commitment to evidence-based improvement

(Pedersen, 2023). As noted by Hong and Lawrence (2022), action research serves as a professional language across educational hierarchies, enabling teachers to generate insights relevant to their own contexts. However, while the scores are strong, they also suggest room for growth in refining techniques and adopting more innovative approaches, especially as training initiatives have yet to meet envisioned standards (Liwanag et al., 2024).

Teachers also exhibited "High" proficiency in data collection, with an overall mean score of 3.056. They demonstrated competence in selecting appropriate tools and in gathering both quantitative and qualitative data, which are vital for understanding instructional effectiveness and student learning (Ndukwe & Daniel, 2021). Their ability to collect diverse data types ensures a comprehensive view of classroom dynamics, enabling informed decision-making. Cardona (2021) emphasized the importance of encouraging mathematics teachers to engage in research-related activities, and these findings affirm that teachers are well-positioned to contribute to research-informed teaching. Moreover, their data collection skills support the foundational stages of action research, where identifying trends and gaps is critical for designing effective interventions (Rechberg, 2021).

In data analysis and interpretation, teachers maintained a "High" level of skill, with an overall mean of 2.889. They demonstrated the ability to analyze quantitative outcomes, interpret qualitative patterns, and draw evidence-based conclusions. These competencies are crucial for evaluating instructional strategies and determining their impact on student learning (Williams, 2024). Taherdoost (2022) emphasized the importance of selecting appropriate data types for meaningful analysis, and teachers' proficiency in this area supports their capacity to make informed instructional adjustments. Finally, in application and reporting, teachers scored an overall mean of 2.829, indicating "High" proficiency in applying findings to improve teaching, communicating results, and writing structured reports. Their ability to integrate research into practice and share outcomes with stakeholders fosters a collaborative and transparent educational environment (Cutler et al., 2021; Goodwin & Klausmeier, 2021). These skills are essential for professional growth and for cultivating a culture of inquiry that enhances mathematics education.

4.2.3. Research Attitude

These emotional responses suggest that teachers view action research not as an obligation but as a meaningful and fulfilling activity. Their positive feelings toward research indicate a readiness to embrace inquiry as part of their professional identity. As Crawford (2023) emphasized, communicating and reflecting on research evidence is essential for educators' professional development and for improving teaching skills.

Cognitive attitudes were also notably strong, with teachers recognizing the effectiveness of action research in addressing instructional challenges, deepening their understanding of mathematics instruction, and improving student learning outcomes. The highest-rated item in this dimension (A6) received a "Very High" remark, underscoring the belief that action research is essential for enhancing educational impact. These findings suggest that teachers perceive action research as a practical and valuable tool for refining their pedagogy. Georgiou et al. (2023) noted that teacher educators must be able to identify and incorporate the best available evidence into their teaching practice, and the results here confirm that mathematics teachers align with this evidence-based mindset.

Behavioral intention scores further reinforce teachers' commitment to action research, with an overall mean of 3.210 and all indicators rated "High." Teachers expressed willingness to allocate time and effort, regularly use action research, and share findings with colleagues. These intentions reflect a proactive stance toward professional growth and collaborative improvement. Bialen (2024) emphasized that positive intentions toward action research indicate a teacher's motivation to engage in reflective practice and evidence-based decision-making. Teachers who embrace this cyclical process of inquiry—reflection, data collection, analysis, and adjustment—are well-positioned to foster a culture of continuous improvement in mathematics education.

Overall, the findings from Table 6 reveal that mathematics teachers hold favorable attitudes toward action research, both emotionally and cognitively, and are willing to integrate it into their teaching practices. These attitudes are critical for building a research-oriented school culture that values collaboration, evidence-based strategies, and ongoing professional development. As Georgiou et al. (2023) emphasized, teacher educators play a pivotal role in fostering future teachers' attitudes toward research-informed practice. The strong attitudes observed in this study suggest that mathematics teachers are not only prepared to engage in action research but are also capable of leading initiatives that enhance instructional quality and student learning outcomes.

4.3. Relationship between the teachers' profile and their level of research knowledge, skills and attitudes

4.3.1. Research knowledge and the teacher's profile

The strong positive correlation between research knowledge and the highest educational attainment implies that individuals with more advanced degrees have greater research knowledge. This finding supports the idea that further academic advancement contributes meaningfully to an individual's understanding and engagement with research practices. Agatep and Villalobos (2020) examined graduate students' research capabilities. They found that their proficiency in research proposal

writing and publication was significantly influenced by their highest level of education and academic position. Their findings support the view that advanced education equips students with essential skills that enhance research literacy and performance. As such, professional development and postgraduate education may be pivotal strategies for institutions aiming to improve faculty research competencies. De Asis et al., (2023) conducted a study on school heads in the Philippines and similarly concluded that higher educational attainment significantly contributed to more substantial research knowledge and competence. The authors emphasized that postgraduate education exposed school leaders to more rigorous academic training, fostering a deeper understanding of research methodology and its application.

On the other hand, the study found no statistically significant relationship between research knowledge and academic rank or length of teaching experience. This implies that having more years of teaching experience or holding a higher academic position does not necessarily translate into greater research knowledge. A study by Dapiawen (2017) involving graduate school faculty at the University of Baguio found that neither years of teaching experience nor academic rank significantly affected faculty members' research knowledge or capability. These findings challenge the assumption that seniority or rank inherently reflect research competency and highlight the importance of continuous research training regardless of career stage.

From a policy and practice perspective, these findings suggest that academic institutions should not rely solely on tenure or rank as proxies for research proficiency. Instead, targeted interventions such as structured research training, mentorship programs, and incentives for postgraduate studies could be more effective in building and sustaining research capacity across all faculty levels. Hence, formal academic training, rather than experiential or positional factors, plays a more decisive role in developing research knowledge, reinforcing the view that research competence is systematically acquired through structured learning rather than accumulated solely through tenure.

4.3.2. Research skills and teacher's profile

The significant relationship between research skills and teaching experience suggests that as teachers gain more years of experience, their research skills improve. This may be attributed to the cumulative exposure to academic practices, increased involvement in scholarly activities over time, or the practical application of research in teaching and learning environments. Therefore, length of service is a key factor in the development of research competencies among educators. A study by Willison et al. (2020) found that graduates' ability to transfer research skills and evidence-based practices was influenced by their teaching experiences. The study highlighted that teaching roles offered graduates opportunities to apply and refine their research skills in real-world contexts, thereby improving their competency in evidence-based practice.

Conversely, the study found no significant relationship between research skills and the teacher's profile variables of academic rank and highest educational attainment. This indicates that holding a higher academic position or possessing advanced academic degrees does not necessarily translate to stronger research skills. This is supported by the studies of Abella et al. (2024) and Dignos (2021), which found no significant difference in teachers' competence skills when grouped by highest educational attainment. This indicates that a teacher's level of education does not necessarily correlate with their competence skills, suggesting that factors other than educational attainment may influence teaching effectiveness. These findings highlight that formal qualifications or hierarchical status alone may not ensure research proficiency and that experience-based learning might play a more critical role.

For educational institutions, these results underscore the importance of continuous professional development and hands-on research engagement throughout a teacher's career. Rather than relying solely on rank or credentials, programs aimed at enhancing research skills should be inclusive and accessible to all faculty members, regardless of their academic standing or degree level. Thus, research skills are more effectively developed through sustained, practice-based engagement rather than formal academic attainment, upholding the argument that experiential learning plays a more critical role than credentials in building applied research competence.

4.3.3. Research skills and teacher's profile

The significant relationship between research attitude and teaching experience suggests that educators with longer teaching experience are more likely to develop favorable attitudes toward research. With time, teachers may encounter more opportunities to engage with research, witness its practical value in education, and participate in institutional projects, which collectively help shape a more constructive attitude toward research. The study by Cinches et al. (2020) established a structural model showing that teachers' positive research attitudes were influenced by their research beliefs and motivation, which, in turn, affected their research utilization. This suggests that fostering positive research attitudes can enhance teachers' engagement in research activities. This trend highlights experience as a key factor in shaping one's disposition toward scholarly inquiry.

In contrast, no statistically significant association was found between research attitude and two commonly examined aspects of a teacher's profile: academic rank and highest educational attainment. This outcome challenges common assumptions that higher qualifications or elevated positions within the academic hierarchy inherently lead to stronger research inclinations. Moral (2020) conducted a study to examine the relationship between teachers' attributes and their students'

research productivity. The findings revealed that teachers' attitudes towards research were statistically significant predictors of students' research output. However, there was no significant correlation between students' research output and teachers' academic rank or highest educational attainment. Without sustained exposure or active participation in research-related activities, these credentials alone may not influence attitude. Therefore, research attitude is more influenced and shaped by experiential engagement than by formal qualifications or positional status, corroborating the argument that sustained involvement in research activities is essential for cultivating positive dispositions toward scholarly inquiry.

5. Conclusions

The findings from this study indicate that mathematics teachers possess a strong overall understanding and competence in action research, with consistently "High" levels across the dimensions of knowledge, skills, and attitudes. These findings underscore the essential role of action research in enhancing teaching practices and professional development.

Mathematics teachers exhibit strong knowledge and skills in problem identification, research design and implementation, data collection, and interpretation of results. The results suggest that while teachers demonstrate high capabilities, targeted training in structured reporting and advanced research techniques could further elevate their proficiency. The teachers' attitudes toward action research, including affective, cognitive, and behavioral aspects, were categorized as "High to Very High." Their positive outlook toward conducting action research reflects a strong belief in its relevance and effectiveness for improving educational practices. There were significant associations between teachers' length of service and educational attainment with their research knowledge, skills, and attitudes. This finding suggests that experience and academic qualifications positively influence teachers' engagement in action research.

These findings imply that professional development programs should build on teachers' strengths while addressing areas such as structured reporting and advanced research methodologies. Educational institutions may also foster a supportive research culture through mentorship, resources, and incentives.

It is recommended that targeted training programs aligned with teachers' rank, educational attainment, and teaching experience be provided to enhance their research knowledge and skills.

This study is limited by its focus on selected variables and the use of self-reported measures, which may introduce bias. Future research may consider additional factors and use mixed methods to provide a more comprehensive understanding of teachers' research capacity.

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6. Declarations

6.1. Ethical considerations

Ethical considerations were a priority throughout the study. Participants were fully informed about the nature and purpose of the research, and their participation was voluntary. They were assured that their responses would remain confidential and that any identifying information would be anonymized in the final report. Consent forms were obtained prior to participation, and participants had the right to withdraw from the study at any time without penalty.

6.2. Use of artificial intelligence (AI)

The authors declare that the generative artificial intelligence (AI) tool [Grammarly] was used exclusively for language editing and/or grammatical improvement. The use of AI did not influence the scientific content, study design, data analysis, data interpretation, results, or conclusions of the manuscript. Full responsibility for the content remains with the authors.

6.3. Conflict of Interest

The authors declare no conflicts of interest.

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