International Journal of Research on Multidisciplinary Studies
Online ISSN: 3116-4137 | Print ISSN: 3116-4145
Volume 1, Issue 8, pp. 250-265, September 2026
https://ijroms.com
Original Article

Research-Related Competence, Productivity, and Culture among Secondary Mathematics Teachers in the Schools Division of Dagupan City

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Article History:

Date Received: August 11, 2026
Date Revised: August 20, 2026
Date Accepted: August 22, 2026
Date Published: September 19, 2026

DOI: https://doi.org/10.67903/ijroms0416

Document ID: *2026IJROMS0416*

Recommended Citation:
Cortez, A. Q. (2026). Research-related competence, productivity, and culture among secondary mathematics teachers in the Schools Division of Dagupan City. International Journal of Research on Multidisciplinary Studies, 1(8), 250–265. https://doi.org/10.67903/ijroms0416

Abstract. This study examined the relationship among research-related competence, research productivity, and research culture of secondary mathematics teachers in the Schools Division Office of Dagupan City. The inquiry was guided by Shulman's Pedagogical Content Knowledge, Bandura's Social Cognitive Theory, and the Framework Design Integration Model (FDIM), which emphasize the integration of knowledge, practice, and institutional support in teacher research. A descriptive–correlational design was employed, involving twenty-three mathematics teachers with prior action research experience. Data were collected through a validated questionnaire (Cronbach's α = 0.740), and descriptive statistics with correlational analysis were used to assess competence, productivity, and culture across curriculum, learning activities, assessment, and learning outcomes. Findings revealed moderate competence (Grand Mean = 3.11), strongest in learning activities but weakest in methodological fluency and statistical analysis. Productivity was also moderate (Grand Mean = 2.68), with strengths in classroom-based inquiry. Table 9 showed moderate productivity in learning outcomes (overall mean = 2.52, SD = 0.481), with dissemination of research findings ranked highest (mean = 3.35), reflecting strong engagement in presentations, publications, and workshops. This reconciles earlier references to "limited dissemination": while dissemination is relatively strong, weaknesses remain in collaboration and national-level presentation. Research culture was developing (Grand Mean = 3.12), supported by collaboration and institutional mechanisms but constrained in learning outcomes. Path analysis revealed that none of the tested relationships among competence, productivity, and culture were statistically significant at the 0.05 level. Weak but non-significant associations suggested that competence, productivity, and culture operated largely independently in this sample. A Proposed Research Development Framework was designed to integrate competence enhancement, productivity support, and culture strengthening, envisioning a cyclical system that promotes evidence-based practice and advances mathematics education outcomes.

Keywords: Action research; Mathematics teachers; Research competence; Research culture; Research productivity

Introduction

Teacher research is globally recognized as a mechanism for improving instructional quality and student achievement, particularly in mathematics where analytical reasoning and evidence-informed pedagogy are crucial. International studies highlight differences in teacher preparation and institutional support that shape research competence and productivity (Blömeke, S., & Delaney, S. (2012); Nasser Abu Alhija & Majdob, 2017).

In the Philippines, the Department of Education institutionalized research through DepEd Order No. 39, s. 2016 (Basic Education Research Agenda) and DepEd Order No. 16, s. 2017 (Research Management Guidelines). These policies emphasize teacher research competence, productivity, and culture as drivers of instructional improvement.

This study focuses on mathematics teachers in Dagupan City, examining how competence translates into productivity and how research culture sustains engagement. The study is anchored on Shulman's Pedagogical Content Knowledge (1986) and Bandura's Social Cognitive Theory (1986), complemented by research competence and productivity theories.

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Research Questions

This study critically analyzed the interplay of research related pedagogical competence, productivity and culture among Mathematics teachers in the secondary schools of Dagupan city. Results of this study will serve as basis in designing framework that will elevate and sustain the quality of research outputs towards quality Mathematics education.

Specifically, this study sought to answer the following questions:

1. What is the extent of research-related competence of the mathematics teachers along the following pedagogical aspects:
   1.1. Curriculum;
   1.2. Learning activities;
   1.3. Assessments; and
   1.4. Learning outcomes?
2. What is the extent of research – based productivity of the mathematics teachers in line with the aforementioned aspects?
3. What is the extent of research-related culture of the mathematics teachers in the aforementioned aspects?
4. What is the extent of significance of direct and indirect relationship that exist between and among the three variables?
5. What framework may be designed to promote research-related competence, productivity and culture among mathematics teachers in the secondary schools in the SDO of Dagupan city?

Scope and Delimitation of the Study

This study involved 23 mathematics teachers (16 Junior High School and 7 Senior High School) from eight public secondary schools in the Schools Division Office of Dagupan City who had conducted classroom-based action research**.** It focused on three variables: research competence, or teachers' ability to apply research skills**;** research productivity, referring to completed and shared outputs; and research culture, defined as institutional support and collaborative opportunities. The scope was limited to public secondary mathematics teachers engaged in action research, excluding private schools, elementary teachers, and other forms of inquiry such as theses or experimental studies. External factors like personal motivation or national achievement outcomes were not considered. By narrowing its focus, the study ensured context-specific findings to guide divisional strategies for strengthening teacher research engagement and fostering a sustainable culture of inquiry.

Literature Review

Research-Related Competence

Research competence has become a central focus in mathematics education, as teachers are increasingly expected to integrate inquiry, evidence-based strategies, and reflective practice into their professional roles. Blömeke, S., & Delaney, S. (2012) described competence as a multidimensional construct shaped by both cognitive abilities—such as content and pedagogical knowledge—and affective-motivational traits, including beliefs and attitudes, underscoring the importance of integrating knowledge and dispositions in teacher preparation. Comparative studies like TEDS-M and TEDS-FU (Yang & Kaiser, 2024; Springer, 2024) highlight cultural variations, with Western contexts emphasizing reflective practice and inquiry, while Eastern traditions focus on structured lesson planning and mastery of content, though both recognize research-informed teaching as essential. Other scholars have linked competence to ICT integration, scientific process skills, and interdisciplinary collaboration (Yildiz et al., 2024; Chkana et al., 2025), while embedding research methodology and reflective practice in teacher education programs has been shown to strengthen classroom-based inquiry (Borreo, 2023). Frameworks such as Medley's and empirical evidence from Nasser-Abu Alhija & Majdob (2017) confirm that competence is dynamic, context-dependent, and foundational for productivity. Philippine studies (Dullas & Soliven, 2021; Bartolome & Guzman, 2023; Paylangco et al., 2024; Baquirquir et al., 2025) further reveal systemic barriers—such as limited training, resources, and mentoring—that hinder competence and productivity despite teachers' positive attitudes toward research. Collectively, this body of literature emphasizes that strengthening competence through professional development, mentoring, and institutional support is vital for cultivating a sustainable research culture in mathematics education.

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Research Productivity

Research productivity in mathematics education refers to teachers' ability to generate, apply, and share scholarly work that informs classroom practice and contributes to the academic community. It includes activities such as conducting classroom-based studies, publishing findings, presenting at conferences, and engaging in collaborative inquiry. Productivity is shaped by individual competence, motivation, and academic preparation, as well as institutional mechanisms like mentoring, leadership support, and access to resources. Studies show that structured professional development, coaching, and collaborative inquiry enhance innovation and output (Toker & Aksoy, 2024), while leadership and recognition at the school level are critical drivers (Cardona, 2024). Competence and motivation strongly predict productivity (Nasser-Abu Alhija & Majdob, 2017), and countries with strong teacher research cultures, such as Finland and Singapore, demonstrate how systemic supports lead to higher productivity (OECD, 2022). Bibliometric analyses highlight interdisciplinary collaboration as a key factor (Chkana et al., 2025). In the Philippines, systemic barriers such as limited resources, mentoring, and training often constrain productivity (Paylangco et al., 2024; Baquirquir et al., 2025; Lituanas et al., 2021; Dullas & Soliven, 2021), though targeted training and incentive-based programs have been shown to improve output (Pendon, 2025). Overall, research productivity is not only about producing outputs but also about aligning competence, institutional support, and research culture to empower teachers as innovators and contributors to mathematics education.

Research Culture

Research culture in mathematics education is understood as the collective practices, values, and institutional supports that encourage teachers to engage in inquiry and evidence-based teaching. It thrives in schools that foster collaboration, mentoring, and professional learning communities, with leadership and recognition playing decisive roles in sustaining engagement (Cardona, 2024; Toker & Aksoy, 2024). International models, such as Finland and Singapore, show how systemic supports—time allocation, teacher education, and integration of research into school improvement plans—create strong cultures of inquiry (OECD, 2022). Cultural differences exist, with East Asian contexts emphasizing structured lesson planning and mastery of content, while Western traditions highlight reflective practice and inquiry (Springer, 2024). Research culture is also strengthened by ICT integration, scientific process skills, and interdisciplinary collaboration (Yildiz et al., 2024; Chkana et al., 2025), as well as embedding research methodology and reflective practice in teacher education programs (SciEP, 2023). In the Philippines, research culture remains emerging, with studies noting systemic barriers such as limited resources, training, and institutional support (Paylangco et al., 2024; Baquirquir et al., 2025; Lituanas et al., 2021). Despite these challenges, grassroots initiatives and motivated teachers demonstrate potential, though productivity often remains constrained without formal recognition or support (Marmito & Ventura, 2021; Lagrio et al., 2023). Overall, evidence underscores that cultivating a supportive environment—through leadership, mentoring, collaboration, and institutional reinforcement—is essential to sustain a vibrant research culture in mathematics education.

Methodology

Research Design

This study employed a descriptive–correlational research design to assess mathematics teachers' research competence, research productivity, and research culture in the Schools Division Office of Dagupan City. According to Creswell, J. W. (2014), descriptive research seeks to describe phenomena in their natural setting, while correlational research examines relationships among variables. The descriptive component measured how teachers applied research in curriculum, learning activities, assessment, and learning outcomes. This provided a baseline of existing practices. The correlational component analyzed whether competence predicted productivity, whether productivity reinforced culture, and whether culture sustained competence through collaboration and institutional support. This design was appropriate because it allowed the study to capture both the extent of teachers' engagement in research and the relationships among the three variables. The results served as the foundation for developing a Research Development Framework that integrates competence enhancement, productivity support, and culture strengthening to promote sustainable research engagement and improve instructional quality.

Sampling Design

The study employed a purposive sampling method to deliberately include mathematics teachers with actual and relevant research experience. This approach was appropriate since the variables examined—research competence, research productivity, and research culture—required participants with direct involvement in action research and familiarity with methodological procedures. Specifically, respondents were mathematics teachers from public junior and senior high schools in the Schools Division Office of Dagupan

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City who had conducted at least one action research project and voluntarily agreed to participate. A total of 23 teachers (16 JHS and 7 SHS) were included, representing eight public secondary schools. Two schools had no respondents, as their mathematics teachers had not yet undertaken action research, further underscoring the purposive nature of the sampling.

Research Locale

The study was conducted in the Schools Division Office of Dagupan City, Region I, Philippines, a highly urbanized area with diverse secondary schools. The division includes four public secondary schools, three integrated schools, and one technical-vocational institution offering both Junior and Senior High School programs. Dagupan City was deliberately chosen because of its active implementation of DepEd research initiatives and strong support for teacher-led action research. Its geographical and institutional diversity, spanning urban and coastal barangays, provided varied contexts for examining mathematics teachers' research competence, research productivity, and research culture. This ensured that findings were contextually grounded, practically relevant, and reflective of the division's commitment to inquiry, innovation, and evidence-based practice in mathematics education.

Research Participants

The study involved 23 mathematics teachers (16 Junior High School and 7 Senior High School) from public secondary schools in the Schools Division Office of Dagupan City, all of whom had prior experience in conducting action research, ensuring authentic engagement with the research process.

Research Instrument

The researcher utilized a structured questionnaire entitled "Research-Related Competence, Productivity, and Culture among Mathematics Teachers in the Schools Division Office of Dagupan City." It consisted of four sections: demographic information, research competence, research productivity, and research culture, each organized into the domains of curriculum, learning activities, assessment, and learning outcomes. Responses were rated on a four-point Likert scale (1 = Strongly Disagree to 4 = Strongly Agree), enabling quantification of perceptions and practices. Content validity was established through expert review, yielding a validity index of 4.945, while reliability testing produced a Cronbach's Alpha of 0.740, confirming acceptable internal consistency. These results ensured that the instrument was both reliable and valid, providing dependable data for descriptive and correlational analyses.

Data Gathering Procedure

The researcher first secured approval from the Graduate School to conduct the study. A formal request was then submitted to the Schools Division Superintendent of the Schools Division Office of Dagupan City, who endorsed it to the school principals. The principals identified the mathematics teachers eligible to participate. After receiving authorization, the researcher distributed the questionnaires, each accompanied by endorsement letters and a cover letter explaining the study's purpose. Respondents completed the survey, and the researcher collected and organized the questionnaires systematically. The data were then consolidated and prepared for statistical analysis, ensuring accuracy and reliability in the study's findings on research competence, research productivity, and research culture.

Results and Discussions

Research Question 1: What is the extent of research-related competence of the mathematics teachers along the following pedagogical aspects: Curriculum; Learning activities; Assessments; and Learning outcomes?

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Table 1. Extent of Research-Related Competence of Mathematics Teachers in terms of the curriculum

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I demonstrate knowledge of the current mathematics curriculum and apply research-based principles to guide instructional planning and decision-making.	3.39	0.656	Strongly Agree	1
2.	I apply various research methodologies relevant to mathematics education to strengthen curriculum design and delivery.	2.65	0.714	Agree	4
3.	I critically evaluate research literature to inform curriculum decisions and teaching practices.	3.13	0.548	Strongly Agree	3
4.	I use research databases and literature search strategies proficiently to access evidence that supports curriculum development.	3.26	0.540	Strongly Agree	2
	Overall Mean	**3.11**	**0.383**	**Agree**	

Table 1 shows that the statement "demonstrating knowledge of the current mathematics curriculum and applying research-based principles to guide instructional planning" obtained the highest mean of 3.39 with a standard deviation of 0.656, interpreted as strongly agree and reflecting strong competence, though variability suggests some teachers need further mentoring. The next indicators, "using research databases and literature search strategies" (mean of 3.26, SD = 0.540) and "critically evaluating research literature" (mean of 3.13, SD = 0.548), highlight consistent proficiency in evidence sourcing and reflective judgment. The lowest mean of 2.65 with a standard deviation of 0.714 was recorded for "applying diverse research methodologies," interpreted as agree but showing uneven methodological fluency. Overall, the mean of 3.11 with a standard deviation of 0.383 indicates moderate to strong competence in curriculum-related practices, supported by Okangba et al. (2026), LIS Academy (2026), Toker and Aksoy (2024), SciEP (2023), Quiño Justol and Gomez (2025), and Eder (2026), all of whom emphasize collaboration, reflective practice, and institutional support as essential to sustaining a robust research culture in mathematics education.

Table 2. Extent of Research-Related Competence of Mathematics Teachers in terms of Learning Activities

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I apply research-based approaches to understand the diverse learning needs of my mathematics students and use these insights to inform instructional strategies.	3.22	0.735	Agree	2.5
2.	I use research data to address the diverse learning needs of my mathematics students.	3.35	0.572	Strongly Agree	1
3.	I conduct and utilize research to identify factors affecting students' learning in mathematics	3.04	0.705	Agree	5
4.	I implement classroom-based research to improve student engagement and participation in mathematics	3.22	0.518	Agree	2.5
5.	I demonstrate confidence in conducting research in mathematics education	3.17	0.491	Agree	4
	Overall Mean	**3.20**	**0.386**	**Agree**	

Table 2 shows that the statement "using research data to address diverse learning needs" obtained the highest mean of 3.35 with a standard deviation of 0.572, interpreted as agree and reflecting strong competence. This indicates that teachers are able to apply evidence-based insights to improve instruction, though slight variability suggests the need for collaborative professional development to strengthen differentiation. The next indicators, "applying research-based approaches to understand students' learning needs" (mean of 3.22, SD = 0.735) and "implementing classroom-based research to improve engagement" (mean of 3.22, SD = 0.518), both ranked second, show agreement but reveal differences in confidence and practice, pointing to areas where mentoring and institutional support can balance variability. The indicator "confidence in conducting research in mathematics education" ranked fourth with a mean of 3.17 and a standard deviation of 0.491, suggesting

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stable but moderate confidence among teachers. The lowest mean of 3.04 with a standard deviation of 0.705 was recorded for "conducting and utilizing research to identify learning factors," interpreted as agree but reflecting noticeable variability, indicating that some teachers are less consistent in research utilization. These findings are supported by the collaborative work of Kulesa et al. (2024), Okangba et al. (2026), Toker and Aksoy (2024), SciEP (2023), and Eder (2026), who emphasize scholarly engagement, methodological alignment, and professional learning communities as essential for strengthening competence. Likewise, Nasser Abu Alhija and Majdob (2017), Quiño Justol and Gomez (2025), and Paylangco et al. (2024) highlight confidence, systemic support, and collaboration as critical to sustaining a robust research culture in mathematics education.

Table 3. Extent of Research-Related Competence of Mathematics Teachers in Terms of Assessment

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I design and implement effective mathematics assessments that are informed by research evidence.	3.18	0.650	Agree	1
2.	I apply my understanding of validity and reliability to ensure fairness and accuracy in assessment practices.	3.04	0.562	Agree	2.5
3.	I use research methods to analyze assessment results and improve the quality of tests and evaluation tools.	3.00	0.603	Agree	4
4.	I apply research evidence when selecting or modifying assessment tools to strengthen their effectiveness in measuring student learning.	3.04	0.705	Agree	2.5
	Overall Mean	3.07	0.355	Agree	

Table 3 shows that the statement "designing and implementing effective mathematics assessments informed by research evidence" obtained the highest mean of 3.18 with a standard deviation of 0.650, interpreted as agree and reflecting teachers' ability to translate research into practical assessment strategies, though variability suggests the need for collaborative professional development. The next indicators, "applying validity and reliability to ensure fairness and accuracy" (mean of 3.04, SD = 0.562) and "using research evidence in selecting or modifying assessment tools" (mean of 3.04, SD = 0.705), highlight agreement but reveal differences in confidence and practice, pointing to areas for targeted training. The lowest mean of 3.00 with a standard deviation of 0.603 was recorded for "using research methods to analyze assessment results," interpreted as agree but showing variability in methodological application. Overall, the mean of 3.07 with a standard deviation of 0.355 indicates moderate competence in assessment practices, supported by LIS Academy (2026), Kulesa et al. (2024), Okangba et al. (2026), Toker and Aksoy (2024), Salahuddin and Stupnisky (2025), Eder (2026), Quiño Justol and Gomez (2025), and Paylangco et al. (2024), all of whom emphasize collaboration, mentoring, and institutional support as essential to embedding a robust research culture in mathematics assessment.

Table 4. Extent of Research-Related Competence of Mathematics Teachers in Terms of Learning Outcomes

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I interpret research findings effectively and apply them to enhance teaching and learning in mathematics.	3.26	0.541	Strongly Agree	1
2.	I analyze student learning outcomes in mathematics using research-based approaches to identify strengths and areas for improvement.	2.96	0.638	Agree	2
3.	I use statistical software confidently for data analysis to generate evidence that informs instructional decisions and supports student achievement.	2.83	0.650	Agree	3
	Overall Mean	**3.02**	**0.382**	**Agree**	

Table 4 shows that the statement "interpreting research findings effectively and applying them to enhance teaching and learning in mathematics" obtained the highest mean of 3.26 with a standard deviation of 0.541, interpreted as strongly agree and reflecting teachers' ability to translate research evidence into

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classroom practice, though minor variability suggests opportunities for collaborative strengthening. The next indicator, "analyzing student learning outcomes using research-based approaches" (mean of 2.96, SD = 0.638), highlights agreement but reveals differences in consistency, pointing to the need for enhanced evaluation practices. The lowest mean of 2.83 with a standard deviation of 0.650 was recorded for "using statistical software confidently for data analysis," interpreted as agree but showing uneven proficiency, underscoring the importance of targeted training and mentoring. Overall, the mean of 3.02 with a standard deviation of 0.382 indicates moderate competence in research-related learning outcomes, supported by Kulesa et al. (2024), Okangba et al. (2026), Toker and Aksoy (2024), Salahuddin and Stupnisky (2025), Eder (2026), Quiño Justol and Gomez (2025), and Paylangco et al. (2024), all of whom emphasize collaboration, reflective practice, and institutional support as essential to sustaining a robust research culture that directly enhances student achievement.

Table 5. Summary of Research-Related Competence of Mathematics Teachers

Research-Related Competence	Mean	Standard Deviation	Descriptive Rating
Curriculum	3.11	0.383	Agree
Learning Activities	3.20	0.386	Agree
Assessment	3.07	0.355	Agree
Learning Outcome	3.02	0.382	Agree
Grand Mean	**3.11**	**0.376**	**Agree**

Table 5 summarizes the overall research-related competence of mathematics teachers across curriculum, learning activities, assessment, and learning outcomes, with a grand mean of 3.11 and a standard deviation of 0.376, interpreted as moderate competence with consistent responses. Learning activities obtained the highest mean of 3.20 (SD = 0.386), showing teachers' confidence in applying research-based approaches to enhance instruction, supported by Okangba et al. (2026) and Toker & Aksoy (2024), who emphasize collaborative inquiry and professional learning communities. Curriculum practices (mean of 3.11, SD = 0.383) reflect teachers' ability to integrate evidence into instructional planning, aligned with LIS Academy (2026) and SciEP (2023), while assessment (mean of 3.07, SD = 0.355) demonstrates consistent application of research principles in evaluation, resonating with Salahuddin & Stupnisky (2025) and Eder (2026). Learning outcomes, with the lowest mean of 3.02 (SD = 0.382), highlight moderate competence but variability in data analysis skills, echoing Quiño Justol & Gomez (2025) and Paylangco et al. (2024). Overall, the results reveal that teachers share a collective commitment to evidence-based practice, with strengths in learning activities and curriculum integration, and areas for improvement in assessment and learning outcomes. Consistent with Cardona (2024) and OECD (2022), collaboration, mentoring, and institutional leadership are essential to sustain a robust research culture that supports continuous improvement in mathematics education.

Research Question 2: What is the extent of research – based productivity of the mathematics teachers in line with the aforementioned aspects?

Table 6. Extent of Research Productivity of Mathematics Teachers in Terms of Curriculum

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I have incorporated research findings into my lesson plans.	3.04	0.878	Agree	1
2.	I have developed and implemented a new teaching strategy based on my research.	2.55	0.890	Agree	2
3.	I have presented research related to mathematics curriculum development in academic or professional forums.	2.22	1.011	Disagree	3
4.	I have published or documented curriculum-related research outputs applied in mathematics instruction.	2.20	0.790	Disagree	4
	Overall Mean	**2.51**	**0.470**	**Agree**	

Table 6 shows that the statement "incorporating research findings into lesson plans" obtained the highest mean of 3.04 with a standard deviation of 0.878, interpreted as agree and reflecting teachers' ability to apply research evidence directly to classroom practice, though variability suggests the need for collaborative support and training. The next indicator, "developing and implementing new teaching strategies based on

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research" (mean of 2.55, SD = 0.890), highlights agreement but reveals differences in practice, pointing to barriers such as limited time or institutional support. The lowest indicators, "presenting research in academic or professional forums" (mean of 2.22, SD = 1.011) and "publishing curriculum-related research outputs" (mean of 2.20, SD = 0.790), show limited engagement in dissemination and publication, with variability in forum participation but consistent lack of involvement in publication. Overall, the mean of 2.51 with a standard deviation of 0.470 indicates modest curriculum-related research productivity, supported by Cardona (2020, 2024), Toker & Aksoy (2024), Okangba et al. (2026), SciEP (2023), Eder (2026), Paylangco et al. (2024), Baquirquir et al. (2025), and Chkana et al. (2025), all of whom emphasize collaboration, mentoring, and institutional leadership as critical to strengthening productivity and sustaining a dynamic research culture in mathematics education.

Table 7. Extent of Research Productivity of Mathematics Teachers in Terms of Learning Activities

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I have conducted and completed research studies addressing students' learning needs in mathematics.	3.35	0.486	Strongly Agree	1
2.	I have produced research outputs that examine factors affecting students' performance in mathematics.	3.17	0.777	Agree	2
3.	I have shared learner-centered research findings with colleagues to improve mathematics instruction.	2.91	0.514	Agree	3
4.	I have implemented and documented research-based interventions to support diverse learners in mathematics.	2.83	0.576	Agree	4
	Overall Mean	**3.07**	**0.363**	**Agree**	

Table 7 indicates that mathematics teachers in Dagupan City demonstrate a moderate level of research productivity in learning activities, with an overall mean of 3.07 and a low standard deviation of 0.363, reflecting consistent perceptions of engagement. The highest indicator, conducting and completing research studies addressing students' learning needs, obtained a mean of 3.35 (SD = 0.486), showing strong involvement in inquiry-based practices that directly enhance instruction. These findings highlight teachers' confidence in applying research to address learning challenges and resonate with Cardona (2024) on the role of mentoring and leadership, Toker and Aksoy (2024) on collaborative professional development, and Okangba, Ngcobo, and Mahachi (2026) whose FDIM framework underscores aligning theory and methodology to strengthen competence and productivity. Consistent with SciEP (2023), embedding research methodology and reflective practice in teacher education fosters a culture of inquiry that sustains innovation and effectiveness in mathematics teaching.

Table 8. Extent of Research Productivity of Mathematics Teachers in Terms of Assessment

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I have developed research-based mathematics assessment tools or instruments.	2.88	0.510	Agree	2
2.	I have completed action or formal research studies analyzing students' mathematics assessment results.	2.91	0.596	Agree	1
3.	I have presented or published research outputs related to assessment practices in mathematics.	2.13	0.757	Disagree	4
4.	I have used assessment-related research findings to revise or improve evaluation practices in mathematics.	2.52	0.702	Agree	3
	Overall Mean	**2.61**	**0.412**	**Agree**	

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Table 8 shows that mathematics teachers demonstrate emerging research productivity in assessment, with an overall mean of 2.61 and a standard deviation of 0.412, interpreted as moderate and reflecting consistent engagement. The highest indicator, completing action or formal research studies analyzing students' mathematics assessment results (mean = 2.91, SD = 0.596), highlights teachers' shared ability to apply findings to improve assessment practices. These results align with Cardona (2023), who emphasized research as a tool for revisiting teaching strategies, and Eder (2026), whose Integrated Teacher Research Empowerment Model underscores classroom-based inquiry for professional growth. While teachers value research as a reflective means of enhancing instruction, they remain less active in disseminating findings, indicating the need for stronger institutional and cultural support. Consistent with Kulesa et al. (2024) and Salahuddin & Stupnisky (2025), the findings affirm that competence, productivity, and culture are interdependent, evolving through cycles of practice, reflection, and collaboration.

Table 9. Extent of Research Productivity of Mathematics Teachers in Terms of Learning Outcomes

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I have presented my research at a national conference.	1.57	0.787	Strongly Disagree	4
2.	I have collaborated with other teachers on research projects.	1.91	1.040	Disagree	3
3.	I have mentored other teachers in conducting research.	3.24	0.890	Agree	2
4.	I have disseminated my research findings to a wider audience (e.g., through presentations, publications, or workshops).	3.35	0.647	Strongly Agree	1
	Overall Mean	2.52	0.481	Agree	

Table 9 shows that mathematics teachers demonstrate a moderate level of research productivity in learning outcomes, with an overall mean of 2.52 and a standard deviation of 0.481, reflecting consistent engagement across respondents. The highest-ranked indicator, disseminating research findings through presentations, publications, or workshops (mean = 3.35, SD = 0.647), highlights teachers' strong activity in sharing outputs, though variability suggests differences in frequency or scope. Overall, the results reveal strengths in dissemination and mentoring but weaknesses in collaboration and national-level presentation, indicating that while teachers value research for instructional improvement, they require stronger institutional and cultural support to advance toward higher scholarly productivity. These findings align with conceptual literature emphasizing the interdependence of competence, productivity, and culture, as noted by Kulesa et al. (2024) and Salahuddin & Stupnisky (2025), who argue that productivity evolves through cycles of practice, reflection, and collaboration.

Table 10. Summary of Research Productivity of Mathematics Teachers

Research Productivity	Mean	Standard Deviation	Descriptive Rating
Curriculum	2.51	0.470	Agree
Learning Activities	3.07	0.363	Agree
Assessment	2.61	0.412	Agree
Learning Outcome	2.52	0.481	Agree
Grand Mean	**2.68**	**0.431**	**Agree**

Table 10 provides a consolidated view of mathematics teachers' research productivity across curriculum, learning activities, assessment, and learning outcomes, with a grand mean of 2.68 and a standard deviation of 0.431, interpreted as moderate and reflecting consistent engagement. The results show strongest productivity in learning activities and weakest in curriculum development, suggesting that while teachers are actively engaged in research practices, their productivity remains developmental rather than extensive. These findings reinforce the interconnection of competence, productivity, and culture, as noted by Kulesa et al. (2024) and Salahuddin & Stupnisky (2025), who emphasize that productivity evolves through cycles of practice, reflection, and collaboration. The moderate productivity observed underscores the need for institutional reinforcement, mentorship, and a collaborative research culture, as advocated by Brew, A., & Lucas, L. (2009) and Macfarlane & Hughes (2009), to elevate mathematics teachers' research engagement toward higher levels of scholarly contribution.

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Research Question 3: What is the extent of research-related culture of the mathematics teachers in the aforementioned aspects?

Table 11. Extent of Research Culture of Mathematics Teachers in terms of Curriculum

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I integrate research into my professional development opportunities to strengthen my curriculum knowledge and practice.	2.91	0.596	Agree	4
2.	I value research as an essential part of my professional development and use it to enhance my teaching competence.	3.22	0.518	Agree	2
3.	My school provides professional development opportunities related to research methods that support curriculum innovation.	3.48	0.665	Strongly Agree	1
4.	My school encourages and supports teacher research as a vital component of curriculum development and improvement.	3.17	0.716	Agree	3
	Overall Mean	**3.20**	**0.624**	**Agree**	

Table 11 shows that mathematics teachers exhibit a moderately strong research culture in curriculum-related practices**,** with an overall mean of 3.20 and a standard deviation of 0.624, reflecting consistent perceptions of the role of research in curriculum development. The highest-ranked indicator, professional development opportunities related to research methods supporting curriculum innovation (mean = 3.48, SD = 0.665), highlights the importance of institutional support in fostering a positive research culture. While teachers value research as a tool for professional growth, the moderate mean values suggest that integration into everyday teaching and curriculum design remains developmental. These findings align with Brew, A., & Lucas, L. (2009) and Altbach, P. G. (2015), who emphasize that a robust research culture thrives on collaboration, institutional backing, and alignment with global standards of scholarship. Strengthening these elements will further enhance teachers' capacity to innovate and sustain a culture of inquiry within curriculum practices, reinforcing the interdependence of competence, productivity, and research culture in mathematics education.

Table 12. Extent of Research Culture of Mathematics Teachers in terms of Learning Activities

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I have conducted research on students' learning needs in mathematics to inform and improve my instructional approaches.	3.22	0.518	Agree	3.5
2.	I have examined factors affecting student performance in mathematics through research to better understand challenges and supports.	3.35	0.572	Strongly Agree	2
3.	I have implemented research-based strategies to address the needs of diverse learners in mathematics classrooms.	3.22	0.599	Agree	3.5
4.	I have shared learner-focused research findings with colleagues to promote collaborative improvement in teaching practices.	3.00	0.674	Agree	5
5.	My colleagues share research findings and best practices with one another, fostering a culture of inquiry and continuous learning.	3.48	0.510	Strongly Agree	1
Overall Mean		**3.25**	**0.575**	**Agree**	

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Table 12 shows that mathematics teachers demonstrate a moderately strong research culture in learning activities, with an overall mean of 3.25 and a standard deviation of 0.575, reflecting consistent engagement. The highest-ranked indicator, colleagues sharing research findings and best practices (mean = 3.48, SD = 0.510), highlights collaboration and peer exchange as the most prominent aspects of research culture. This consistency underscores the strength of a collective culture of inquiry, where teachers actively exchange insights to support continuous learning and curriculum improvement. These findings support Macfarlane & Hughes (2009), who conceptualized research culture as co-constructed through collaboration and mentoring, and suggest that strengthening structured collaboration and mentoring will further enhance teachers' capacity to integrate research into learning activities and sustain a robust research culture within classrooms.

Table 13. Extent of Research Culture of Mathematics Teachers in terms of Assessment

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I am encouraged to use research-based assessment practices in my mathematics classes.	3.09	0.515	Agree	3.5
2.	I discuss research findings related to mathematics assessment results with my colleagues.	3.17	0.716	Agree	1
3.	I use research evidence to guide my assessment decisions in mathematics.	3.13	0.625	Agree	2
4.	I value research that improves assessment practices in my school and contribute to building a culture of evidence-based evaluation.	3.09	0.668	Agree	3.5
	Overall Mean	**3.12**	**0.631**	**Agree**	

Table 13 shows that mathematics teachers demonstrate a moderate research culture in assessment, with an overall mean of 3.12 and a standard deviation of 0.631, reflecting relatively consistent engagement. The highest-ranked indicator, discussing research findings related to mathematics assessment with colleagues (mean = 3.17, SD = 0.716), highlights collaboration and professional dialogue as the strongest aspects of research culture, though variability suggests differences in frequency of participation. These findings underscore the importance of collegial reflection and peer engagement in strengthening assessment practices, supporting Macfarlane & Hughes (2009) who conceptualized research culture as co-constructed through mentoring and collaboration. Overall, teachers exhibit a positive but developing culture characterized by evidence-based decision-making and institutional encouragement, consistent with Brew, A., & Lucas, L. (2009) and Altbach, P. G. (2015), who emphasized that robust research culture integrates values, practices, and institutional frameworks. The moderate engagement observed reflects the dynamic interplay of competence, productivity, and research culture, as discussed by Kulesa et al. (2024) and Salahuddin & Stupnisky (2025), highlighting the need for stronger mentorship, institutional support, and dissemination opportunities to sustain continuous improvement in assessment.

Table 14. Extent of Research Culture of Mathematics Teachers in terms of Learning Outcomes

	Indicators	Mean	Standard Deviation	Descriptive Rating	Rank
1.	I engage in collaborative research activities with my colleagues to strengthen professional learning and improve student outcomes.	3.00	0.738	Agree	1
2.	I utilize the resources provided by my school to support and sustain my research practices.	2.83	0.576	Agree	2
3.	My school provides opportunities for collaboration on research projects that enhance teaching effectiveness and student learning.	2.61	0.656	Agree	3
	Overall Mean	**2.81**	**0.657**	**Agree**	

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Table 14 shows that mathematics teachers demonstrate a moderate research culture in learning outcomes, with an overall mean of 2.81 and a standard deviation of 0.657, reflecting consistent perceptions of the importance of collaboration and institutional support. The highest-ranked indicator, participating in joint research activities with colleagues (mean = 3.00, SD = 0.738), highlights collaboration as the defining feature of this culture, though variability suggests differing levels of involvement. Overall, the findings reveal a developing research culture anchored in peer collaboration and supported by institutional resources, yet constrained by limited opportunities for structured engagement. Consistent with Brew, A., & Lucas, L. (2009) and Altbach, P. G. (2015), a robust research culture thrives on values, practices, and institutional frameworks that promote inquiry and innovation. The moderate engagement observed here reflects the dynamic interplay of competence, productivity, and research culture, as discussed by Kulesa et al. (2024) and Salahuddin & Stupnisky (2025), underscoring the need to strengthen mentorship, resource accessibility, and collaborative opportunities to sustain inquiry and improve student learning outcomes.

Table 15. Summary of Research Culture of Mathematics Teachers

Research Culture	Mean	Standard Deviation	Descriptive Rating
Curriculum	3.20	0.328	Agree
Learning Activities	3.25	0.302	Agree
Assessment	3.12	0.300	Agree
Learning Outcome	2.81	0.436	Agree
Grand Mean	**3.12**	**0.187**	**Agree**

Across the four domains, mathematics teachers exhibit a developing yet consistent research culture, with the highest engagement in learning activities (mean = 3.25, SD = 0.302) and curriculum (mean = 3.20, SD = 0.328), moderate application in assessment (mean = 3.12, SD = 0.300), and emerging collaboration in learning outcomes (mean = 2.81, SD = 0.436). These results highlight teachers' active use of research to inform instructional strategies and curriculum design, while assessment practices and collaborative inquiry in learning outcomes remain less extensive. The findings align with Lehtinen, Hakkarainen, and Lipponen (1999) and Eder (2026), who emphasized classroom-based inquiry as a driver of pedagogical innovation, and with Brew, A., & Lucas, L. (2009) and Altbach, P. G. (2015), who conceptualized research culture as a multidimensional construct integrating values, practices, and institutional frameworks. Consistent with Kulesa et al. (2024) and Salahuddin & Stupnisky (2025), the moderate engagement observed reflects the dynamic interplay of competence, productivity, and research culture, underscoring the need for mentorship, resource accessibility, and expanded collaboration to elevate mathematics teachers' research engagement toward higher levels of scholarly contribution.

Research Question 4: What is the extent of significance of direct and indirect relationship that exist between and among the three variables?

Table 16. Significance of Direct and Indirect Relationship Among Variables

Path	Path Coefficient	p-value	Interpretation	Decision
Research-Related Competence → Research Culture	-0.308	0.153	Not Significant	Accept H_0
Research Culture → Research Productivity	-0.022	0.926	Not Significant	Accept H_0
Research Competence → Research Productivity	0.103	0.665	Not Significant	Accept H_0
Indirect: Competence → Productivity → Culture	0.007	0.935	Not Significant	Accept H_0

The analysis of direct and indirect relationships among research competence, research productivity, and research culture revealed that none of the tested paths were statistically significant at the 0.05 level. As shown in Table 16, the path from competence to culture ($\beta = -0.308$, $p = 0.153$) indicated a weak negative but non-significant association, suggesting that higher competence scores were not reliably linked to stronger research culture. The path from culture to productivity ($\beta = -0.022$, $p = 0.926$) reflected a negligible and non-significant association, implying that variations in research culture did not correspond to meaningful differences in productivity. Similarly, the path from competence to productivity ($\beta = 0.103$, $p = 0.665$) showed a weak positive but non-significant association, indicating that competence was not a reliable predictor of productivity. Finally, the indirect path from competence to productivity through culture ($\beta = 0.007$, $p = 0.935$) was also non-significant, confirming that research culture did not mediate the relationship between competence and productivity. Overall, these results suggest that research competence, productivity, and culture operated largely independently in this sample, with no statistically significant associations among them. While competence displayed a slight positive tendency toward productivity, and culture showed weak negative tendencies toward both competence and productivity, these associations were not strong enough to

International Journal of Research on Multidisciplinary Studies
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be considered meaningful. This outcome underscores the need for stronger institutional mechanisms and collaborative structures to align competence, productivity, and culture in fostering a more cohesive research environment among mathematics teachers.

Research Question 5: What framework may be designed to promote research-related competence, productivity and culture among mathematics teachers in the secondary schools in the SDO of Dagupan city?

The proposed framework offers a systematic approach to cultivating mathematics teachers' research competence, productivity, and culture, emphasizing research as a continuous cycle of skill-building, inquiry, and output. It integrates three dimensions: competence enhancement through training, mentoring, and research clinics; productivity support via incentives, resources, and time allocation; and culture strengthening through collaboration, professional development, and leadership. At its core lies the Aligned and Integrated Approach, ensuring synergy where competence drives productivity, productivity reinforces culture, and culture sustains competence. Given current findings of moderate competence, productivity, and culture with weak correlations, the framework bridges individual capability with institutional reinforcement by promoting mentorship, collaborative communities, and support systems. Expected outcomes include greater confidence in conducting and publishing research, improved outputs, stronger collaboration, and a sustainable research culture that elevates teacher professionalism and student learning through continuous inquiry and innovation.

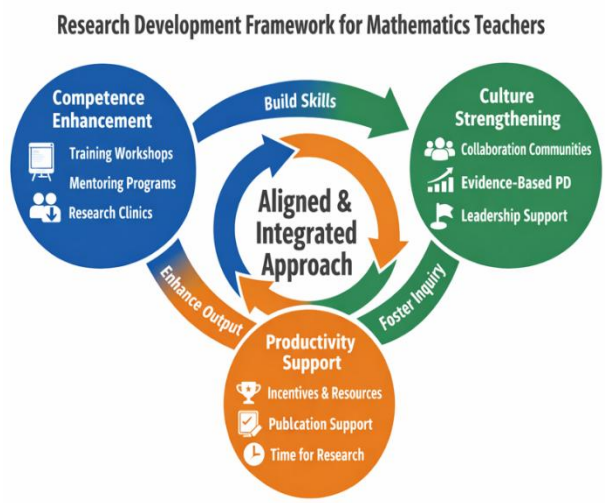

Figure 1. *Proposed Research Development Framework for Mathematics Teachers*

Figure 1 illustrates the Proposed Research Development Framework for Mathematics Teachers, showing how each component directly maps to the study's findings. The Competence Enhancement dimension is placed at the foundation because teachers were found to have moderate competence but weaknesses in methodological fluency and statistical analysis; this component addresses those gaps through training, mentoring, and research clinics. The Productivity Support dimension highlights institutional mechanisms such as incentives, time allocation, and publication assistance, reflecting the finding that productivity was moderate but not significantly associated with competence or culture—indicating the need for stronger structures to help teachers transform skills into outputs. The Culture Strengthening dimension emphasizes collaboration, leadership support, and evidence-based professional development, responding to the study's observation that research culture was developing but inconsistently embedded in assessment and learning outcomes, and largely disconnected from competence and productivity. At the center, the Aligned and Integrated Approach symbolizes the intended synergy among the three dimensions: competence builds productivity, productivity reinforces culture, and culture sustains competence. This circular relationship directly addresses the finding that current associations among competence, productivity, and culture were weak or non-significant, proposing instead a study-informed model that requires pilot testing to determine whether alignment can be achieved in practice. In sum, Figure 1 visually maps the framework's components to the empirical results, showing how each dimension responds to specific gaps identified in the study.

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Ethical Considerations

This study adhered to established ethical standards in educational research, with formal approval secured from the Schools Division Superintendent of Dagupan City and informed consent obtained from all participating mathematics teachers, who were clearly informed of the study's purpose, procedures, and their right to withdraw at any time. Confidentiality and anonymity were strictly maintained, as questionnaires required only general demographic data, responses were stored securely, and results were reported in aggregate form. Participation was voluntary, with no coercion or harm inflicted, and proper acknowledgment of sources and respect for intellectual property observed throughout. The study also complied with the Department of Education's Basic Education Research Agenda under DepEd Order No. 39, s. 2016, specifically within the Teaching and Learning theme, ensuring that objectives, methodology, and dissemination aligned with DepEd's standards for responsible research. This compliance reinforced the integrity of the study and guaranteed that its outcomes were ethical, relevant, and beneficial to the educational community, thereby sustaining a culture of evidence-based practice and continuous improvement in mathematics education.

Conclusion

The study found that mathematics teachers in the Schools Division Office of Dagupan City demonstrate moderate levels of research competence, productivity, and culture across curriculum, learning activities, assessment, and learning outcomes. Strengths were evident in curriculum knowledge, literature evaluation, and classroom application of research, while gaps remained in methodological fluency and advanced statistical analysis. Productivity was observed in lesson planning and inquiry addressing student needs, but broader scholarly engagement such as collaboration and national-level dissemination was less consistent. Research culture was developing, with collaboration more visible in curriculum and learning activities but less embedded in assessment and learning outcomes. Importantly, path analysis and correlation results revealed weak but non-significant associations among competence, productivity, and culture, indicating that these constructs currently operate more independently than as an integrated system. Competence showed a slight positive tendency toward productivity, while culture displayed weak negative tendencies toward both competence and productivity, but none of these associations reached statistical significance. This suggests that while teachers possess moderate levels of competence and productivity, these dimensions are not yet systematically aligned with their research culture. In response to these findings, the study proposes a Research Development Framework that integrates competence enhancement, productivity support, and culture strengthening. The framework is study-informed rather than empirically validated, serving as a conceptual model that requires further testing and refinement. It envisions a cyclical system where competence informs productivity, productivity contributes to culture, and culture sustains competence, thereby promoting evidence-based practice. Future research should examine the framework's effectiveness in practice, testing whether structured interventions can strengthen the alignment among competence, productivity, and culture and ultimately enhance mathematics education outcomes.

Recommendations

Based on the findings, the study recommends that mathematics teachers be given continuous professional development opportunities to strengthen their weakest areas, particularly methodological fluency and statistical analysis. Training programs such as workshops, mentoring sessions, and research clinics can help build confidence in research design and data interpretation, while collaborative inquiry groups can encourage reflective practice and peer learning. In addition, collaboration and national-level dissemination should be enhanced, since these were among the lowest indicators. Schools can support joint research projects, mentoring partnerships, and provide opportunities for teachers to present at conferences, thereby broadening scholarly engagement. Research culture also needs to be more consistently embedded in assessment and learning outcomes, which can be achieved by integrating research-based practices into evaluation systems and encouraging teachers to connect classroom inquiry with measurable student learning. Finally, instead of immediate formal adoption, the Proposed Research Development Framework should first be piloted in selected schools. Pilot implementation will allow for evaluation and evidence-based refinement of policies, training modules, and institutional mechanisms before scaling up. This stepwise approach ensures that the framework evolves through practice and feedback, making it responsive to teachers' actual needs and more effective in strengthening competence, productivity, and culture in mathematics education.

International Journal of Research on Multidisciplinary Studies
Online ISSN: 3116-4137 | Print ISSN: 3116-4145
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