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'Can You Write Research and Teach It Well?' Examining the Research Pedagogical Content Knowledge and Practice of Secondary School Teachers

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ABSTRACT

This study examined whether teachers who can conduct research are equally prepared to teach it and identified predictors of Research Pedagogical Content Knowledge (RPCK). RPCK focuses on how research knowledge is translated into structured learning experiences. Using a sequential explanatory mixed-methods design, the study developed and validated a five-domain RPCK instrument and used it to measure the RPCK of 203 senior high school research teachers. Results showed moderate RPCK across domains. Teachers reported stronger practices in organizing research content and supervising student projects but weaker practices in modeling data interpretation. Hierarchical regression examined predictors of RPCK. Years of research teaching (YRT), formal preparation, and research engagement were entered in successive steps. The final model explained 29% of the variance. YRT and formal preparation were significant predictors, while research engagement showed a small, nonsignificant effect. Findings suggest that effective research teaching develops through structured preparation and sustained teaching experience.

Keywords: Philippines, regression analysis, research pedagogical content knowledge, research teaching, teacher development, secondary school

INTRODUCTION

Most secondary schools around the world require students to complete inquiry projects, capstones, and research outputs (Daryanes et al., 2025). These expectations shift classrooms beyond content coverage toward problem framing, evidence use, and explanation (Akuma & Callaghan, 2019). As a result, many schools now require teachers who can teach research as a subject and guide students through complex research tasks. However, the ability to conduct research does not automatically translate into the ability to teach it effectively. Teaching research requires more than methodological knowledge. It also requires the ability to make research concepts understandable, sequenced, and manageable for novice students while maintaining rigor and ethical standards (Lewthwaite & Nind, 2016).

This study frames the issue using Research Pedagogical Content Knowledge (RPCK). Nind (2020) extends Shulman's concept of Pedagogical Content Knowledge (PCK) to research methods education and argues that teaching research methods requires a distinct form of expertise. RPCK refers to the teacher's ability to translate research concepts into forms that students can understand through examples, representations, and structured scaffolding. In this view, competence in teaching research is reflected in how teachers design learning experiences, guide methodological reasoning, and support students as they engage with research processes (Chan & Park, 2026; Lewthwaite & Nind, 2016; Nind, 2020). Despite the growing emphasis on student research in secondary education, there remains limited empirical work examining the level and instructional profile of teachers' RPCK in school contexts.

The Philippine senior high school context highlights why this distinction matters. Subjects such as Practical Research 1 and Practical Research 2 require students to move from topic formulation to research design, data collection, analysis, and communication of findings. Studies show that students often experience research as difficult and demanding. They report challenges in developing topics, handling data, and navigating the research process (Ejoc & Paglinawan, 2025; Mabborang, 2025). These patterns suggest that research learning outcomes depend not only on student effort but also on the quality of instructional support provided by teachers.

Teaching research in secondary schools involves work beyond delivering content. Teachers manage timelines, feedback cycles, revision processes, and evaluation standards while mentoring students through complex research outputs (Lucas et al., 2021). At the same time, studies on teacher research competence report uneven development across research components, with stronger confidence in procedural tasks than in data analysis or methodological design (Reyes & Acuña, 2021). Research literacy is also described as multidimensional, encompassing awareness, attitudes, skills, and research use rather than publication alone (Kazancı Tınmaz & Sezgin, 2023). Similarly, teaching competence has been conceptualized as a multidimensional construct encompassing instructional planning, teaching effectiveness, professionalism, and adaptability (Balabal & Canuto, 2026). These patterns suggest that teachers' preparation and research engagement may shape how they guide research learning in classrooms. However, less is known about how teachers themselves describe their instructional and supervision practices related to research teaching, particularly in relation to the challenges they encounter in supporting methodological reasoning and student inquiry.

Despite increasing expectations for student research in secondary schools, few studies examine teachers specifically as research teachers using a framework that distinguishes research expertise from research-teaching expertise and connects competence with preparation and professional practice. Much of the existing literature focuses on teachers' ability to conduct research rather than on how they translate research knowledge into classroom instruction and supervision. RPCK addresses this gap by focusing on how research knowledge is transformed into teachable and structured learning experiences (Lewthwaite & Nind, 2016; Nind, 2020). At present, there is also limited empirical work that operationalizes and measures RPCK in secondary school contexts. To address this gap, the present study developed and validated an RPCK instrument designed for secondary school research teaching and then applied the instrument to examine teachers' RPCK practices. Also, understanding the factors associated with RPCK may help clarify

how research-teaching competence develops in practice and whether it is shaped more strongly by teaching experience, structured preparation, or broader research engagement. This study, therefore, examines RPCK, preparation, and professional practice among secondary school teachers who teach research with the following research questions:

1. What is the level of teachers' RPCK?
2. How do teachers describe their professional practice and challenges in teaching research?
3. To what extent do years of research teaching (YRT), formal preparation related to research teaching, and research engagement predict teachers' RPCK practices?

Teaching Research as a Specialized Pedagogical Practice

Teaching research involves both conceptual understanding and practical work. Students must learn how research questions, methods, data, and evidence connect throughout the research process. Teachers, therefore, help students move between conceptual reasoning and practical investigation. Studies on research methods teaching emphasize the importance of making research processes visible through examples, authentic data, and structured learning activities that make inquiry more accessible to beginners (Lewthwaite & Nind, 2016; Lewthwaite & Holmes, 2018). This perspective aligns with RPCK, in which teachers anticipate common misunderstandings and use explanations, examples, and instructional supports that help novice researchers understand methodological ideas (Nind, 2020).

Learning research methods also involves both cognitive and affective demands. Students frequently report uncertainty and anxiety when learning research methods, which can affect engagement and persistence (Ehiyazaryan-White, 2012; Nind et al., 2020). As a result, research teaching often depends on guided inquiry, scaffolded tasks, and structured support rather than purely technical instruction. Reviews of inquiry-based learning show that beginners benefit from instructional guidance, since unguided discovery rarely leads to effective learning (de Jong et al., 2023).

Research teaching also requires balancing structure and independence. Beginners benefit from clear sequencing and guidance, but overly rigid instruction may limit students' understanding of inquiry and reduce ownership of their decisions (Lewthwaite & Holmes, 2018). These tensions highlight that teaching research is specialized professional work. It requires deliberate instructional design and sustained guidance as students gradually learn to think and work as researchers.

Preparation and Professional Practice of Research Teachers

Research competence is often described as multidimensional. It includes identifying research problems, collecting appropriate data, analyzing and interpreting findings, practicing research ethics, and engaging in reflection (Insorio, 2024; Reyes & Acuña, 2021). However, studies consistently report uneven development across these areas. Teachers often demonstrate moderate overall competence but lower confidence in data analysis and methodological design (Hortelano, 2026; Insorio, 2024; Reyes & Acuña, 2021). Work on research literacy further suggests that competence involves awareness, attitudes, skills, and research use rather than publication alone (Kazancı Tınmaz & Sezgin, 2023).

Preparation and professional context also shape how research competence translates into classroom practice. Classroom accounts describe teachers using structured guidance, staged outputs, and mentoring processes to support student research projects (Lucas et al., 2021). Teachers report barriers such as limited preparation in data analysis and qualitative methods, time constraints, and heavy workloads (Insorio, 2024; Torres, 2024). Research on professional development further shows that sustained and collaborative preparation is more likely to influence teaching practice than short-term training sessions (Darling-Hammond et al., 2017; Khotimah et al., 2026).

Across these studies, research competence develops through structured preparation, collaborative learning, and repeated engagement with research practice. Without these forms of support, research teaching may become focused on procedural completion rather than meaningful inquiry.

THEORETICAL FRAMEWORK

This study adopts RPCK as the primary theoretical framework. RPCK extends the concept of PCK, which distinguishes subject matter expertise from the specialized knowledge required to make that subject teachable (Chan & Park, 2026; Shulman, 1986, 1987). Nind (2020) applies this concept to research methods education and argues that effective research teaching requires more than methodological expertise. It also requires the ability to translate research processes into structured, accessible, and developmentally appropriate learning experiences. Research expertise focuses on design, analysis, and dissemination. RPCK focuses on how teachers transform these elements into representations, tasks, instructional sequences, and guidance that help students understand and practice inquiry. In this view, competence in teaching research includes anticipating misconceptions, structuring progression, using authentic data in pedagogically meaningful ways, and supporting students as they move from procedural completion toward methodological reasoning (Lewthwaite & Nind, 2016; Nind, 2020).

Guided by this framework, RPCK and research supervision practices in this study are operationalized into five domains derived from the Exploratory Factor Analysis (EFA). The first three domains represent the instructional core of RPCK. (1) Content structuring and translation refer to how teachers organize research concepts and explain them in coherent and accessible ways. (2) Anticipating and responding to student difficulties captures teachers' awareness of misconceptions, confusion, and affective barriers that arise during research learning. (3) Instructional design and evidence-based learning reflect how teachers structure scaffolded activities, use authentic data, and design tasks that develop methodological reasoning and independence.

Because research teaching in secondary schools also involves sustained mentoring of student projects, two complementary supervision domains are included. (4) Structured research management and guidance refer to teachers' practices in helping students define research topics, align methods with questions, manage timelines, and respond to feedback. (5) Dialogic and developmental supervision capture relational and autonomy-supportive dimensions of supervision, including encouraging open discussion, balancing guidance with independence, and building students' confidence as novice researchers. Together, these five domains provide a conceptually grounded and empirically supported representation of research teaching competence in secondary schools.

RESEARCH METHOD

Research Design

This study used a sequential explanatory mixed-methods design (Ivankova et al., 2006). The study began with a quantitative phase that measured teachers' RPCK and supervision practices using a structured questionnaire. This was followed by a qualitative phase that gathered open-ended responses to examine how teachers describe their professional practice and the challenges they face in teaching research. This design was appropriate because the study required both measurement and explanation. The quantitative phase determined the level of RPCK across five domains and tested whether YRT, formal preparation, and research engagement predict RPCK through correlation and regression analyses. The qualitative phase provided insights into how teachers interpret their instructional practices.

Participants

A total of 255 senior high school teachers were invited to participate in the study. Of these, 203 teachers completed the survey, yielding a response rate of 79.6%. Table 1 summarizes the participants' demographic profiles. Participation was voluntary. An informed consent form was attached at the beginning of the Google Form. Teachers were informed about the purpose of the study, the voluntary nature of participation, and their right to decline or withdraw at any time without consequence. Only those who indicated consent were able to proceed to the questionnaire.

Table 1

Demographic Profile of Participants (N = 203)

Variable	Category	n	%
Grade Level Taught	Grade 11	83	40.9
	Grade 12	120	59.1
Years Research Teaching	1 to 5 years	96	47.3
	6 to 10 years	72	35.5
	11 years and above	35	17.2
Highest Educational Attainment	Bachelor's degree	105	51.7
	Master's degree	88	43.3
	Doctorate	10	4.9

Development and Validation of the RPCK Instrument

The RPCK instrument drew on Nind's (2020) extension of PCK to research methods teaching and incorporated supervision constructs from Razali et al. (2020).

Item Development and Content Validation

An initial pool of 43 items was generated deductively from the theoretical framework. The items were written to reflect observable instructional and supervisory practices and were rated using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Content validity was established through expert review by four specialists with expertise in research methods, teacher education and measurement, senior high school research teaching, and research supervision. Experts rated the relevance of each item using a 4-point scale.

The Item-level Content Validity Index (I-CVI) and the Scale-level Content Validity Index (S-CVI) were computed. An item retention criterion of I-CVI $\geq$ .78 was applied (Polit et al., 2007). After expert review, 7 items were removed and 6 revised, resulting in 36 items. Five practicing research teachers then participated in cognitive checking to evaluate item clarity and relevance. Based on their feedback, three additional items were removed, and five items were reworded, reducing the instrument to 33 items for pilot testing.

Pilot Testing and Construct Validation

The 33-item instrument was pilot-tested with 140 secondary school research teachers via Google Forms. At this stage, secondary teachers from Grades 7 to 12 were invited to complete the survey. Data screening showed minimal missing data (<3%) and no zero-variance items (Tabachnick & Fidell, 2007). Sampling adequacy was supported by a Kaiser-Meyer-Olkin (KMO) value of .89 (Kaiser, 1974). Bartlett's test of sphericity was significant, $\chi^2(528) = 3124.47$, $p < .001$, indicating that the data were suitable for factor analysis (Bartlett, 1950).

EFA was conducted using principal axis factoring with Promax rotation. Factor retention was guided by eigenvalues greater than 1 and inspection of the scree plot. A five-factor solution aligned with the theoretical framework was identified. Items were removed if they loaded below .40, cross-loaded within

.20 of another factor, or had communalities below .30 (Costello & Osborne, 2005; Hair et al., 2019). Five items were removed during factor analysis, resulting in a final 28-item instrument with a 4-4-8-8-4 item distribution. Factor loadings ranged from .48 to .82, and communalities ranged from .36 to .71. Table 2 presents the factor loadings.

Table 2

Primary Factor Loadings for the 28-Item RPCK Instrument (n = 140)

Item	Factor loadings				
	1	2	3	4	5
Item 1	.74				
Item 2	.81				
Item 3	.69				
Item 4	.77				
Item 5		.63			
Item 6		.72			
Item 7		.58			
Item 8		.70			
Item 9			.76		
Item 10			.82		
Item 11			.65		
Item 12			.73		
Item 13			.59		
Item 14			.68		
Item 15			.48		
Item 16			.71		
Item 17				.79	
Item 18				.83	
Item 19				.75	
Item 20				.72	
Item 21				.78	
Item 22				.82	
Item 23				.74	
Item 24				.76	
Item 25					.69
Item 26					.73
Item 27					.67
Item 28					.70

Reliability

Internal consistency was evaluated using Cronbach's alpha (α) and McDonald's omega (ω). All subscales showed acceptable reliability. The overall 28-item scale demonstrated strong internal consistency ($\alpha = .94$, $\omega = .95$). Item-total correlations ranged from .44 to .73. These values indicate acceptable reliability (Nunnally & Bernstein, 1994). The use of McDonald's omega alongside alpha provides a more robust estimate of internal consistency, particularly when factor loadings are not assumed to be equal (Dunn et al., 2013).

The finalized 28-item RPCK questionnaire (see Appendix) was then disseminated to senior high school research teachers through Google Forms. The survey link was distributed through school administrators, teacher groups, and social media platforms, particularly Facebook, to reach eligible participants across different schools. The online form remained open for two months to allow sufficient time for participation. Responses were automatically captured and stored in a secure database accessible only to the researchers. At the end of the data collection period, the dataset was downloaded, cleaned, and prepared for screening and statistical analysis.

Analysis

To address the first research question, descriptive statistics were computed for each of the five RPCK domains and for the overall RPCK score. Domain scores were calculated as the mean of the items within each subscale, and the overall RPCK score was computed as the mean of all 28 items. Means and standard deviations were examined to determine the level of teachers' RPCK. Mean scores were interpreted using the following ranges based on the 5-point Likert scale: 4.21 to 5.00 as very high, 3.41 to 4.20 as high, 2.61 to 3.40 as moderate, 1.81 to 2.60 as low, and 1.00 to 1.80 as very low. Internal consistency reliability was re-examined in the main dataset using Cronbach's alpha and McDonald's omega to confirm the stability of the instrument.

To address the second research question, responses to five open-ended questions were analyzed using reflexive thematic analysis (Braun & Clarke, 2019). The analysis followed a systematic process that included repeated reading of responses, the generation of initial codes, the identification of patterned meanings, and the development of themes. Coding was conducted inductively, focusing on how teachers described instructional priorities, supervision strategies, preparation pathways, and structural constraints. The codes were then grouped into broader themes that reflected recurring patterns across participants. To support trustworthiness, the themes were refined through repeated engagement with the data and checked against participants' responses (Braun & Clarke, 2019).

To address the third research question, correlational and multiple regression analyses were conducted in JASP. The overall RPCK mean score served as the dependent variable. Predictors included YRT, formal preparation related to research teaching, and research engagement. Composite indices for preparation and engagement were created by summing the number of endorsed categories, producing count-based indicators of breadth. Each endorsed category was coded as 1 and non-endorsement as 0, and the summed scores represented the breadth of teachers' preparation and research engagement experiences. Bivariate associations were examined using Pearson correlations for continuous variables.

Before conducting regression, assumptions of linearity, normality of residuals, homoscedasticity, and multicollinearity were evaluated (Tabachnick & Fidell, 2007). Scatterplots indicated approximately linear relationships between predictors and RPCK. Standardized residuals ranged from −2.41 to 2.36, indicating no extreme outliers. Inspection of Q-Q plots suggested approximate normality of residuals, and the Shapiro-Wilk test was nonsignificant, $W = .99$, $p = .21$. Homoscedasticity was supported by the random dispersion of residuals across fitted values. Multicollinearity diagnostics showed tolerance values ranging from .72 to .88 and variance inflation factor (VIF) values ranging from 1.14 to 1.39, well below conservative thresholds of 5, indicating that multicollinearity was not a concern (Cohen et al., 2003; Goss-Sampson, 2025; Walker et al., 2023).

Hierarchical multiple regression was then conducted to estimate the incremental variance explained by the predictors. Predictors were entered sequentially to reflect a developmental logic of professional involvement in research teaching, beginning with accumulated classroom experience, followed by structured preparation, and finally research engagement activities beyond teaching responsibilities. YRT was entered in Step 1, formal preparation in Step 2, and research engagement in Step 3 to evaluate changes in R^2 across blocks (Cohen et al., 2003). Statistical significance was set at $p < .05$. Additional regressions were conducted using the five RPCK domain scores as dependent variables to examine whether predictors showed differential effects across instructional and supervision dimensions.

RESULTS

This section presents the findings according to the three research questions. It begins with the overall RPCK profile across the five domains, followed by teachers' reported practices and challenges in research teaching. The final section examines whether YRT, formal preparation, and research engagement are associated with RPCK.

RQ1: Level of RPCK across the Five Domains

Descriptive Statistics by Domain

Table 3 summarizes the descriptive statistics for the five RPCK domains and the overall RPCK score. Domain means ranged from 3.03 to 3.37, with Conceptual Structuring and Translation showing the highest mean and Instructional Design and Evidence-Based Learning showing the lowest mean, all falling within the moderate interpretation. Standard deviations for domain scores ranged from 0.38 to 0.48, while the overall RPCK score showed lower variability (SD = 0.35). Domain composition followed the five-domain instrument structure.

Table 3

Descriptive Statistics for RPCK Domains (N = 203)

Domain	Mean	SD	Interpretation
Conceptual Structuring and Translation (Items 1-4)	3.37	0.45	Moderate
Anticipating and Responding to Student Difficulties (Items 5-8)	3.22	0.48	Moderate
Instructional Design and Evidence-Based Learning (Items 9-16)	3.03	0.39	Moderate
Structured Research Management and Guidance (Items 17-24)	3.24	0.38	Moderate
Dialogic and Developmental Supervision (Items 25-28)	3.25	0.45	Moderate
Overall RPCK (28 items)	3.20	0.35	Moderate

Item-level Pattern

To show the item-level profile of teachers' responses, Table 4 lists the five highest-mean items and the five lowest-mean items. The highest-mean items clustered around sequencing and explanation of concepts, guided practice, and timely feedback. The lowest-mean items clustered around data-focused instructional work (use of authentic data, interpretation, evidence-based claims) and tasks requiring justification of methodological decisions.

Table 4

Highest- and Lowest-Mean Items

Item	Statement	Mean	SD
Highest means			
Item 21	I provide timely feedback on students' research drafts.	3.55	0.68
Item 9	I provide guided practice before asking students to work independently on research tasks.	3.42	0.67
Item 1	I organize research concepts in a logical sequence that helps students understand the overall research process.	3.41	0.73
Item 2	I explain complex research terms using examples that are appropriate for secondary students.	3.40	0.71
Item 4	I connect individual research tasks to the larger purpose of inquiry.	3.39	0.68
Lowest means			
Item 15	I design tasks that require students to analyze and explain data findings.	2.84	0.68
Item 16	I help students see how evidence supports or challenges research claims.	2.86	0.72
Item 14	I model how to interpret data rather than only showing correct answers.	2.86	0.70
Item 11	I design activities that require students to justify their methodological decisions.	2.87	0.74
Item 13	I use real or realistic data sets to help students understand research procedures.	2.87	0.71

Reliability in the Main Dataset

Internal consistency estimates for the main dataset are reported in Table 5. The overall 28-item RPCK scale showed α = 0.883 and ω = 0.883. Domain-level reliability estimates varied across domains.

Table 5

Internal Consistency Reliability for RPCK Domains

Scale	Items	Cronbach's α	McDonald's ω
Overall RPCK (28 items)	28	0.883	0.883
Conceptual Structuring and Translation (Items 1-4)	4	0.516	0.531
Anticipating and Responding to Student Difficulties (Items 5-8)	4	0.632	0.633
Instructional Design and Evidence-Based Learning (Items 9-16)	8	0.688	0.689
Structured Research Management and Guidance (Items 17-24)	8	0.650	0.651
Dialogic and Developmental Supervision (Items 25-28)	4	0.498	0.499

RQ2: Professional Practice and Challenges in Teaching Research

Teachers' responses describe instructional and supervisory practices that correspond with the moderate RPCK levels reported in RQ1. Across responses, teachers emphasized structured sequencing, guided support, and feedback. They also reported greater difficulty with data analysis, methodological reasoning, and supporting student independence. The themes below are presented with representative excerpts.

Instructional Practice in Research Teaching

(a) Research teaching as a connected process: Teachers consistently emphasized helping students understand research as a coherent process rather than a sequence of isolated chapters. Instruction focused on helping students see how research problems, methods, and findings logically connect. One teacher explained, "I want them to see research as a process, not just Chapter 1 to 5, but how the problem, methods, and results connect" (T12, Grade 12, 6–10 years).

(b) Guided supervision toward gradual independence: Teachers described supervision as a structured process that begins with strong guidance through templates, exemplars, and staged outputs, followed by a gradual reduction of support. Independence was defined as the ability to justify research decisions and revise work in response to feedback. As one participant noted, "At first I guide them closely, but my goal is that by the end they can defend their decisions without me speaking for them" (T89, Grade 12, 11+ years).

(c) Supporting methodological reasoning and data interpretation: Teachers frequently reported that students struggle most with selecting appropriate research methods and interpreting results. While many students could summarize findings, explaining what the results mean and linking them to research questions remained difficult. One teacher explained, "They can compute the data, but explaining what it means is difficult. I give examples and guide questions for interpretation" (T15, Grade 12, 6–10 years).

Challenges in Research Teaching

(a) Limited time for consultation and revision: Teachers described tight academic schedules and competing school activities that limit the time available for sustained supervision and iterative feedback. Research projects require repeated consultation, yet teachers reported that available class time often restricts deeper

discussion. One participant noted, “Research needs time for consultation, but the schedule is tight and there are many school activities” (T110, Grade 12, 6–10 years).

(b) Large advising loads and uneven student readiness: Participants frequently reported supervising multiple research groups with varied levels of academic preparation, particularly in reading, writing, and methodological reasoning. Managing these differences while providing individualized support was described as challenging. As one teacher explained, “Some students are ready, but many struggle with writing. When you handle many groups, it is hard to give equal support” (T22, Grade 11, 1–5 years).

(c) Limited preparation and research resources: Teachers also described constraints related to their own preparation and available research resources. Many reported learning how to teach research primarily through experience, while also noting the need for stronger preparation in statistics, qualitative analysis, and supervision strategies. One teacher stated, “I need more training in analysis, especially statistics, and also how to supervise many groups at the same time” (T53, Grade 11, Master’s degree).

RQ3: Predictors of RPCK (Years, Preparation, and Engagement)

Descriptive Profile of Predictors

YRT was distributed as follows: 1-5 years (n = 96, 47.3%), 6-10 years (n = 72, 35.5%), and 11+ years (n = 35, 17.2%). The preparation index (number of endorsed preparation categories) had a mean of 1.27 (SD = 1.18, range = 0-4). The engagement index (number of endorsed engagement activities) had a mean of 0.60 (SD = 0.78, range = 0-4).

Regarding preparation categories, action research training was most frequently endorsed (n = 78, 38.4%), followed by thesis/dissertation completion (n = 69, 34.0%), qualitative research training (n = 41, 20.2%), statistics training (n = 38, 18.7%), and mentoring/supervision training (n = 31, 15.3%). Regarding research engagement, over half of the teachers reported no engagement activities (n = 107, 52.7%). The most common engagement was serving as a panelist/reactor in research defense (n = 50, 24.6%), followed by co-authoring a research paper (n = 44, 21.7%) and reviewing a research paper (n = 20, 9.9%). Conference presentations (n = 5, 2.5%) and peer-reviewed publications (n = 3, 1.5%) were rare.

Bivariate Associations

Overall, RPCK showed moderate positive associations with YRT (6–10 years: $r = .28$, $p < .001$; 11+ years: $r = .36$, $p < .001$) and preparation breadth ($r = .42$, $p < .001$). Engagement demonstrated a small positive association ($r = .17$, $p = .017$). Preparation showed the strongest zero-order association, though effect sizes were in the moderate range.

Table 6

Correlations Among RPCK and Predictors (N = 203)

Variable	1	2	3	4	5
1. RPCK Overall	—				
2. Years (6-10)	.28***	—			
3. Years (11+)	.36***	−.31***	—		
4. Preparation Index	.42***	.18**	.24***	—	
5. Engagement Index	.17**	.03	.11*	.09	—

Note. Years’ variables are dummy-coded (reference = 1-5 years). *$p < .05$. **$p < .01$. ***$p < .001$.

Hierarchical Regression Predicting Overall RPCK

In Step 1, YRT explained 17% of the variance in RPCK. Adding preparation breadth in Step 2 significantly increased explained variance by 10%. In Step 3, engagement contributed a small additional increment, but this change was marginal and did not substantially alter model fit. In the final model, YRT and preparation breadth remained significant predictors, while engagement showed a small, nonsignificant trend.

Table 7

Hierarchical Regression Predicting Overall RPCK (N = 203)

Predictor	B	SE B	t	p
Step 1				
Years (6-10)	0.12	0.05	2.98	.003
Years (11+)	0.18	0.05	3.62	< .001
Model fit	R^2 = .17, Adj. R^2 = .16			
Step 2				
Years (6-10)	0.09	0.04	2.41	.017
Years (11+)	0.14	0.05	2.98	.003
Preparation Index	0.08	0.02	4.12	< .001
Model fit	R^2 = .27, Adj. R^2 = .26; ΔR^2 = .10			
Step 3 (Final Model)				
Years (6-10)	0.08	0.04	2.16	.032
Years (11+)	0.13	0.05	2.79	.006
Preparation Index	0.07	0.02	3.87	< .001
Engagement Index	0.03	0.02	1.94	.054
Model fit	R^2 = .29, Adj. R^2 = .28; ΔR^2 = .02			

Domain-Specific Regressions

Separate regressions were conducted using each RPCK domain as the dependent variable.

Table 8

Regression Summary by RPCK Domain (Final Model, N = 203)

Domain	R^2	Years (6–10) B (p)	Years (11+) B (p)	Prep Index B (p)	Eng Index B (p)
Conceptual Structuring	.21	0.14 (.011)	0.19 (.002)	0.07 (< .001)	0.01 (.682)
Student Difficulties	.24	0.16 (.004)	0.22 (< .001)	0.05 (.009)	0.02 (.298)
Instructional Design	.26	0.15 (.006)	0.20 (.001)	0.06 (.002)	0.02 (.247)
Structured Guidance	.30	0.17 (.002)	0.23 (< .001)	0.05 (.004)	0.04 (.038)
Dialogic Supervision	.18	0.13 (.018)	0.17 (.006)	0.05 (.007)	0.01 (.711)

Preparation was a significant predictor across all five domains. Engagement was significant only for Structured Research Management and Guidance. YRT showed consistent positive associations across all domains.

DISCUSSION

Moderate Levels of RPCK

The results show moderate RPCK across all five domains. This suggests that teachers demonstrate functional research-teaching practices but still have areas that need further development. The domain pattern provides a clearer picture of these strengths and gaps. Teachers scored highest in conceptual structuring and supervision-related domains and lowest in instructional design and evidence-based learning. At the item level, the highest scores involved providing feedback, organizing content clearly, and giving guided practice. The lowest scores involved using authentic data, modeling interpretation, and asking students to justify methodological decisions. Although the overall RPCK scale demonstrated acceptable internal consistency, reliability estimates were lower in some shorter domain subscales. This suggests that the overall pattern of moderate RPCK is more stable than the small differences between individual domains. Accordingly, the observed strengths in conceptual structuring and supervision-related practices, as well as the weaker ratings in instructional design and evidence-based learning, should be interpreted as broader patterns rather than sharply distinct instructional capacities.

This indicates that teachers are more confident organizing research tasks and guiding students step by step than helping students think critically about data and evidence. This finding aligns with earlier studies showing that teachers often feel more comfortable with procedural aspects of research than with data analysis and methodological reasoning (Insorio, 2024; Reyes & Acuña, 2021). In the present data, teachers frequently emphasized sequencing, templates, consultation, and revision. These practices help students complete research outputs. However, tasks that require students to interpret findings, connect evidence to claims, or defend methodological choices received lower endorsement. This pattern may partly reflect differences in preparation. In this study, only a small proportion of teachers reported formal preparation in statistics and qualitative research training. As a result, teachers may be more prepared to guide the procedural completion of research tasks than to model deeper analytical reasoning and interpretation.

The qualitative findings further clarify this pattern. Teachers repeatedly reported that students struggle most with narrowing topics, aligning methods, and interpreting data. In response, teachers provide formats, exemplars, and guided questions. They also rely heavily on consultations and feedback cycles. This aligns with Nind's (2020) description of translating research into organized learning experiences. The findings suggest that data interpretation is not only a student difficulty but also a pedagogical challenge for teachers. When preparation in data analysis and methodological reasoning is limited, teachers may rely more on structured guidance and procedural support than on modeling how evidence is interpreted and defended. In this context, teachers appear able to manage the research process, but deeper engagement with evidence and reasoning is less consistently supported in classroom practice.

Supervision also plays a central role in research teaching. Teachers describe research teaching as ongoing mentoring rather than classroom instruction alone. They monitor progress, review drafts, and balance guidance with student independence. This reflects the view that research teaching involves sustained supervision and mentoring (Lucas et al., 2021). In this study, supervision practices appeared relatively stable even when instructional design related to data analysis was weaker. This distinction is important because it suggests that teachers may be effective in managing research projects while still developing their capacity to model methodological reasoning.

The Predictors of RPCK

The regression results show that YRT and preparation significantly predicted RPCK, while research engagement showed a smaller, nonsignificant association. YRT explained a moderate proportion of the variance, suggesting that teaching experience plays an important role in developing research-teaching competence. Teachers appear to improve as they handle more research classes over time. The qualitative

responses support this pattern. Many teachers described learning through experience, consultation with colleagues, and gradual refinement of their teaching practices each year.

Preparation also showed a clear contribution. Teachers who reported more preparation activities tended to have higher RPCK scores. This supports the view that research-teaching competence develops through structured learning experiences rather than through experience alone (Darling-Hammond et al., 2017). In this study, preparation included action research training, thesis completion, and statistics training. These experiences appear to strengthen both instructional and supervision-related practices. The finding is also consistent with the idea that research literacy is multidimensional and cannot be reduced to publication counts alone (Kazancı Tınmaz & Sezgin, 2023).

Research engagement showed a smaller effect. Engagement activities were relatively uncommon in this sample, particularly publications and conference presentations. Although research engagement was positively associated with overall RPCK at the bivariate level, it did not reach statistical significance in the final regression model. At the domain level, engagement was significant mainly for structured guidance. This may suggest that participation in research activities familiarizes teachers with research standards and evaluation processes that can later inform supervision practices. However, engagement alone does not appear to strongly influence instructional design practices. This finding supports Nind's (2020) argument that conducting research and teaching research are related but distinct forms of expertise.

Overall, the findings point to a consistent pattern. RPCK appears to develop through sustained teaching experience and is strengthened by formal preparation. Research engagement may provide additional but limited support, particularly for structured research management and guidance. In this sample, most teachers were not highly active in research publications. Nevertheless, many still demonstrated moderate RPCK. This reinforces the idea that effective research teaching in secondary schools depends more on classroom practice and structured preparation than on academic productivity alone.

Implications for Policy and Practice

The findings suggest that strengthening research teaching in secondary schools requires attention to teacher preparation and professional development. Many teachers in this study demonstrated moderate RPCK but reported difficulty supporting methodological reasoning and data interpretation. Professional development programs should therefore move beyond general research orientation and focus more directly on the instructional demands of research teaching. Training that helps teachers design tasks involving data analysis, evidence interpretation, and methodological justification may strengthen the weaker domains identified in this study. Structured preparation programs, mentoring systems, and collaborative workshops may also provide opportunities for teachers to further develop these skills.

The results also have implications for curriculum implementation and school-level support. Research subjects in secondary education often require sustained supervision, consultation, and feedback cycles. However, teachers reported constraints related to time, workload, and limited preparation. School administrators and policymakers may therefore need to recognize research teaching as a form of sustained mentoring rather than a conventional classroom subject alone. Providing dedicated consultation time, reducing advising loads, and improving access to research resources may better support meaningful research learning. These forms of institutional support may also help teachers move beyond procedural completion of research outputs toward deeper engagement with inquiry and methodological reasoning.

Limitations

Some limitations should be considered when interpreting the findings. First, the study relied on self-reported survey data, which may reflect perceived rather than directly observed research-teaching practices. Because teachers evaluated their own instructional and supervisory practices, responses may also

have been influenced by social desirability or perceived expectations for effective research teaching. As a result, the moderate RPCK levels reported in this study should be interpreted as perceptions of practice rather than direct measures of classroom performance.

Although the overall RPCK scale demonstrated acceptable internal consistency, some domain-level reliability coefficients were modest, particularly for the four-item subscales Conceptual Structuring and Translation and Dialogic and Developmental Supervision. These coefficients suggest that the overall RPCK score provides a more stable estimate of research-teaching competence than some individual domain scores. Accordingly, findings at the domain level should be interpreted with caution and may require further refinement and validation in future studies.

Second, the sample consisted of volunteer senior high school teachers and may not represent all research teachers across regions or school types. Third, the preparation and engagement variables were operationalized as count-based indices. These indices capture the breadth of experience but do not reflect its depth or quality. Finally, the regression analysis establishes statistical association rather than causation. Although years of teaching, preparation, and engagement predicted RPCK scores, the cross-sectional design does not allow conclusions about developmental direction. These limitations should be considered when interpreting the findings.

CONCLUSION

This study examined RPCK in research teaching and treated it as distinct from simply conducting research. It measured the level of RPCK among secondary school research teachers, described how teachers carry out research teaching in practice, and examined whether YRT, formal preparation, and research engagement predict RPCK. Across the five domains, teachers demonstrated moderate RPCK. They showed stronger practices in organizing content and supervising student projects but weaker practices in modeling data interpretation and designing tasks that support methodological reasoning. YRT and formal preparation significantly predicted RPCK, while research engagement did not reach statistical significance.

The study also revisits a common assumption in schools: that the ability to conduct research naturally leads to the ability to teach it effectively. The findings suggest a more complex relationship. Participation in research activities such as publishing or presenting was not the strongest factor associated with research-teaching competence. Instead, teaching experience and structured preparation showed stronger associations with RPCK. Many teachers with limited scholarly output still demonstrated moderate competence in guiding students through the research process. At the same time, practices involving evidence interpretation and methodological reasoning remained less consistently developed.

This study offers three contributions. First, it presents and validates a five-domain RPCK instrument tailored to secondary school research teaching. Second, it provides a grounded description of how RPCK appears in everyday classroom practice. Third, it offers empirical evidence on the professional experiences most strongly associated with research-teaching competence. Overall, the findings reinforce a central insight of RPCK: conducting research and teaching research are related forms of expertise, but they develop through different processes. The study encourages research teachers, teacher educators, and researchers to reflect on these distinctions as they examine how research-teaching expertise can be developed.

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APPENDIX

Domains of RPCK used in the Instrument

Dimension 1: Conceptual Structuring and Translation of Research

1. I organize research concepts in a logical sequence that helps students understand the overall research process.
2. I explain complex research terms using examples that are appropriate for secondary students.
3. I break down abstract research concepts into smaller, manageable parts for students.
4. I connect individual research tasks to the larger purpose of inquiry.

Dimension 2: Anticipating and Responding to Student Difficulties

5. I anticipate common misconceptions students have about research design and methods.
6. I recognize when students rely on templates without understanding the reasoning behind them.
7. I adjust my explanations when students show confusion about data analysis or interpretation.
8. I address students' anxiety or uncertainty about conducting research.

Dimension 3: Instructional Design and Evidence-Based Learning

9. I provide guided practice before asking students to work independently on research tasks.
10. I gradually reduce support as students become more capable of managing their research.
11. I design activities that require students to justify their methodological decisions.
12. I structure research tasks so that students develop independence over time.
13. I use real or realistic data sets to help students understand research procedures.
14. I model how to interpret data rather than only showing correct answers.
15. I design tasks that require students to analyze and explain data findings.
16. I help students see how evidence supports or challenges research claims.

Dimension 4: Structured Research Management and Guidance

17. I help students define a feasible and focused research topic.
18. I work with students to develop a clear research timeline or plan.
19. I guide students in selecting appropriate methods for their research questions.
20. I monitor students' progress to ensure they stay on track.
21. I provide timely feedback on students' research drafts.
22. My feedback includes specific suggestions for improvement.
23. I respond to students' questions about their research in a clear and direct manner.
24. I follow up to ensure students understand and act on the feedback given.

Dimension 5: Dialogic and Developmental Supervision

25. I encourage open discussion about students' research challenges.
26. I create a supportive environment where students feel comfortable asking questions.
27. I balance guidance with allowing students to make their own research decisions.
28. I support students' confidence as they develop independence in research.