

Professional Development Programs: Effects on Professional Capacity and Research Proficiency of Secondary School Science Teachers

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Abstract

Research-related inadequacy in knowledge and skills among research teachers contributes to poor-quality instruction and limited research development. Addressing the evidence gap on science teachers' actual research capacity is essential, given their critical role in research instruction. Hence, this study examined the perceived level of effects of professional development programs on the professional capacity and research proficiency of secondary school science teachers. It involved 50 purposively selected science teachers handling research subjects in either junior high school or senior high school across 14 public secondary schools in the Schools Division of Sultan Kudarat. Using a descriptive-correlational design, the result of the survey showed that respondents were generally capable in professional capacity, particularly in research knowledge and understanding (Mean = 4.10, SD = 0.73) and research skills and application (Mean = 4.05, SD = 0.71), with stronger performance in knowledge and understanding than in skills and application. In terms of research proficiency, teachers were rated proficient in technical skills (Mean = 3.93, SD = 0.77), conceptualizing skills (Mean = 4.05, SD = 0.73), designing skills (Mean = 4.14, SD = 0.75), and data-processing skills (Mean = 3.92, SD = 0.75). However, weaknesses were identified in data processing, particularly in statistical knowledge, data analysis, critical thinking, and theoretical grounding. A strong significant correlation ($r = .855$) was found between professional capacity and research proficiency, indicating a positive relationship among variables. Overall, the findings emphasize the need to strengthen and revitalize professional development programs to enhance science teachers' research competencies.

Keywords: Professional capacity, professional development programs, research education, research proficiency, science teachers

Introduction

Research is the methodical and controlled process of studying an issue, acquiring information, and evaluating data to gain new knowledge or validate current concepts. It is used to solve problems, improve methods, and broaden understanding in a variety of sectors, including education, science, and technology. In the field of education, research knowledge plays a significant role for teachers to improve classroom instruction as well as research outputs.

Countries across the world strive for high-quality education that addresses the demands and challenges of the new era of innovation and development, which focuses

on teachers' research competency (Amirova et al., 2020, p. 278). Although these efforts are seen globally in the field of education, global studies suggest that teachers must attain a sufficient level of research competency and require a deeper research understanding (Celebi, 2021, p. 99). In the Asian educational research context, teachers' research skills were generally at a minimal level, particularly in the areas of data collection and selection of statistical methods (Xu, 2024, 337).

In the Philippines, research is a key professional development program for teachers, which is supported by DepEd and CHED (Ulla, 2017, p. 103). However, this initiative does not reflect the country's

ranking in the Global Innovation Index (GII) in terms of research, indicating weak research and innovation capacity. Moreover, it also ranked 5th in Southeast Asia in education research journal performance (Guido & Orleans, 2020, p. 76). This reflects the situation in basic education, where many public elementary and secondary teachers lack basic research-writing knowledge (Anzaldo & Cudiamat, 2019).

Science teachers, on the other hand, as educators and in the area of specialization, should possess research skills to produce excellent, relevant, and responsive research outputs that would contribute meaningfully to the present situation of education in the country (Tolentino, 2021, p. 213). The studies presented thus far provide an evidence gap that this study aims to address, particularly on the level of effects of professional development programs on the professional capacity and research proficiency among public secondary school science teachers as research teachers. There is insufficient or inconclusive evidence in existing literature on this particular issue, particularly in the local and national setting (Ulla et al., 2017, p. 12).

The results and findings of the study are a vital source of literature in the field of science and research education in the country and globally. Also, it provides a supplemental discovery to basic and higher education, particularly in research and science education. To address this research gap, this paper aimed to answer the following problems: (a) what is the perceived level of effect of professional development programs in research on the professional capacity of secondary school science teachers in terms of; (b) what is the perceived level of research proficiency of secondary school science teachers in terms of; and (c) is there a significant relationship between the perceived level of professional capacity and the perceived level of research proficiency of secondary school science teachers?

Methods

Pedagogical Setting & Participants

The study was conducted in 14 purposively selected public secondary schools across 11 municipalities in the Division of Sultan Kudarat, Philippines. These schools were selected because each has a science teacher who also serves as a research teacher at either the junior high school or senior high school level. In addition, these schools have actively participated in the division, regional, and national-level research conferences for teachers and science investigatory project presentations for students.

This study involved 50 secondary school science teachers. Eligible respondents were science teachers who also served as research teachers in public secondary schools in the Division of Sultan Kudarat during School Year 2025–2026. They were required to have taught research for at least two school years and to have participated in research-related professional development programs, such as trainings and seminars, within the past three years.

Design of the Study

This study utilized a quantitative research approach, specifically a descriptive-correlational design employing a survey method, to determine the perceived level of effect of professional development programs on the perceived level of professional capacity and perceived level of research proficiency of science teachers, as well as to examine the relationship between these two variables. The choice of this method is justified by its suitability in quantifying teachers' perceptions and identifying patterns, trends, and relationships among measurable variables systematically and objectively.

Data collection & analysis

This study used purposive sampling due to the nature of the research problem. The sampling focuses on science teachers who teach research in either junior high school or

senior high school in public secondary schools in the Division of Sultan Kudarat, Philippines.

The primary data collection tool consisted of two structured survey questionnaires using a 5-point Likert scale, with a total of 56 items. The first instrument, composed of 28 self-developed items, measured the professional capacity of science teachers in research. This tool underwent both face and content validation by six field experts, yielding a Content Validity Index (CVI) of 0.80, and underwent pilot testing with 30 science teachers teaching research from non-participating schools to assess reliability. Internal consistency reliability was considered acceptable (Cronbach's $\alpha = 0.858$) and exhibited good internal consistency. The second instrument, also consisting of 28 items, assessed research proficiency and was adopted from Tolentino (2021), Research Capability Self-Assessment Instrument (RCSI), with an obtained 0.992 Cronbach alpha.

For data analysis, descriptive statistical techniques, namely: means and standard deviation, were employed to assess the perceived levels of professional capacity and research proficiency. Inferential statistics were also utilized; the Pearson Correlation Coefficient (Pearson's r) was used to examine the relationship between perceived level of professional capacity and research proficiency. Through these clearly defined procedures, instruments, and analytical techniques, the study ensures methodological rigor and transparency in arriving at its findings.

Results and Discussions

Perceived Level of Effect of Professional Development Programs on Professional Capacity in Research of Secondary School Science Teachers

The perceived level of effects of Professional Development Programs on Professional Capacity in Research is analyzed using the mean and standard deviation and is

interpreted using the corresponding descriptions. This section presents the role of science teacher to use their knowledge, skills, qualifications, and expertise within a work-related or professional context that provides specialized services in the field of research.

Table 1 shows the summary of the perceived level of effects of professional development programs on the professional capacity of science teachers in research. Overall, science teachers are "capable" in teaching research, as evident in the overall mean of 4.08 in professional capacity under the two domains, research knowledge and understanding, and research skills and application. However, results showed that science teachers' professional capacity in research knowledge and understanding obtained a higher mean of 4.10, interpreted as capable, than research skills and application.

Conversely, research skills and application registered a slightly lower mean of 4.05, though likewise interpreted as "capable". This implies that while science teachers demonstrate a solid grasp of research concepts and understanding, the practical application of these competencies remains comparatively less developed. Although both areas reflect competence, the findings suggest that teachers are relatively stronger in research knowledge and understanding than in the actual execution and application of research skills. Hence, there is a need to further strengthen professional development programs by placing greater emphasis on hands-on research activities and applied skill-building to enhance teachers' overall research capacity.

In the study by Bialen (2025), it was indicated that because professional development programs focus on theoretical concepts while practical application is constrained by heavy teaching workloads, time constraints, and limited access to resources, teachers frequently exhibit higher proficiency in research knowledge and understanding than in research skills and applications. Many teachers struggle with

Table 1. Summary of the Perceived Level of Effect of Professional Development Programs on the Professional Capacity in Research on Secondary School Science Teachers

	Indicator	Mean	S.D.	Description
1	Research Knowledge and Understanding	4.10	0.73	Capable
2	Research Skills and Applications	4.05	0.71	Capable
	Overall Mean	4.08	0.72	Capable

data analysis, statistical tools, and formal reporting, while having a good core understanding to recognize problems. Additionally, according to Roallos (2023), teachers had a low level of proficiency in selecting and utilizing the proper statistical tools as well as in aiding the validation and reliability testing of the research instrument.

Perceived Level of Research Proficiency of Secondary School Science Teachers

This section presents the proficiency in the skills in the research technicalities, conceptualization, designing, and data analysis and processing, which allows for effective research instruction and development.

Table 2 presents a summary of the perceived level of effects of professional development programs on the research proficiency of secondary school science teachers. Overall, science teachers are “proficient” in research skills, as evident in the overall mean of 4.01 in research proficiency under the four indicators: technical skills, conceptualizing skills, designing skills, and data processing skills. However, results showed that science teachers’ designing skills obtained the highest mean of 4.14, interpreted as proficient, compared to technical skills, conceptualizing skills, and data processing skills.

Conversely, data processing skills registered the lowest mean of 3.92, though likewise interpreted as proficient. This implies that science teachers may be more proficient in research design than in data processing because their training and classroom practice emphasize formulating problems, developing hypotheses, and planning investigations, while statistical analysis and data-handling skills often require more specialized technical preparation and software experience. Hence, there is a need to further improve these skills through professional development programs that focus on statistical analysis through the integration of software and Artificial Intelligence (AI).

The results imply that science teachers are more proficient in research design than in technical, conceptualizing, and data processing abilities, suggesting that their relative strengths are in research methodology. The lower results in the other skill categories, however, point to the necessity of focused professional development initiatives that will boost educators' technical expertise, expand their conceptual knowledge, and strengthen their capacity for data processing. This gap also suggests that although teachers in general may be good at organizing classes, improving

Table 2. Summary of the Perceived Level of Research Proficiency of Secondary School Science Teachers

	Indicator	Mean	S.D.	Description
1	Technical Skills	3.93	0.77	Proficient
2	Conceptualizing Skills	4.05	0.73	Proficient
3	Designing Skills	4.14	0.75	Proficient
4	Data Processing Skills	3.92	0.75	Proficient
	Overall Mean	4.01	0.75	Proficient

their technical and analytical skills is necessary to guarantee a more comprehensive teaching approach that promotes inquiry-based learning and data-driven instruction in scientific education.

According to Manila et al. (2022), public school teachers generally exhibit only moderate to slight competence in research design, with pronounced deficiencies in areas such as the selection of appropriate statistical tools, instrument validation, and data analysis. Such a disparity suggests that their research proficiency is stronger at the conceptual level than at the analytical and procedural level. The same findings were discovered in the study by Farin et al. (2021), which reported that teacher respondents had difficulties while choosing the statistical tools to be utilized in the investigation and when computing the data.

Correlation Between the Level of Perceived Professional Capacity and Perceived Level of Research Proficiency of Secondary School Science Teachers

The results revealed a strong and statistically significant positive relationship between teachers' professional capacity and their level of research proficiency. This is evidenced by the obtained Pearson correlation coefficient of $r = .855$, which indicates a very strong positive correlation, and a p-value of .000 ($p < .001$), confirming that the relationship is statistically significant at the 0.001 level. This means that as teachers' professional capacity increases, their research proficiency also tends to increase substantially. The high mean scores for both professional capacity ($\bar{x} = 4.07$, $SD = 0.56$) and research proficiency ($\bar{x} = 4.01$, $SD = 0.60$) indicate that respondents generally possess high levels in both variables. The strength of the correlation suggests that professional capacity—encompassing research knowledge, skills, and application—plays a critical role in enhancing teachers' ability to conduct, analyze, and apply research effectively.

In practical terms, this finding implies that efforts to improve teachers' professional capacity, such as through targeted training, mentoring, and continuous professional development, are likely to result in significant improvements in their research proficiency. Thus, professional capacity can be considered a key contributing factor and a strong predictor of research proficiency among secondary school science teachers. This finding implies that science teachers' professional capacity in research is strongly and significantly related to their level of research proficiency as research teachers. In essence, as teachers' professional capacity increases, their research proficiency likewise improves, highlighting the integral role of professional competence in strengthening research performance.

Additionally, teachers' active participation in professional development programs, especially through local and international trainings and seminars that enhance their theoretical and conceptual foundations for both instruction and research development, may be responsible for these research competencies. Their perspectives on new research trends and best practices are expanded, and their technical proficiency and methodological understanding are strengthened by such continuous academic pursuits. As a result, these professional activities are essential venues for ongoing development, giving educators the skills and self-assurance needed to plan, carry out, and present high-caliber research projects.

Caingcoy (2020) found that the professional capacity of teachers, such as mentoring and action planning skills, motivation and attitudes toward research, and the number of studies completed by teachers, were correlated with their research proficiency at various forms of levels. Also, Zhou (2022) supports the correlations between the teacher's scientific ability and professional capacity in teaching and developing scientific output.

Table 3. Correlation between teachers' perceived level of professional capacity and perceived level of research proficiency

	n	Mean	S.D.	Pearson r	p-value	Interpretation
Professional Capacity	50	4.07	.56	.855**	.000	Significant*
Research Proficiency	50	4.01	.60			

Conclusion

This study provides empirical evidence on the effects of professional development programs on the perceived level of professional capacity and research proficiency of secondary school science teachers in the Division of Sultan Kudarat. The results suggest that teachers demonstrated overall proficiency in professional capacity, particularly in research knowledge and understanding, as well as in research skills and application. They showed strong competence in distinguishing research methodologies and effectively mentoring students and collaborating with colleagues in research. However, there remains a need to further strengthen their statistical knowledge and improve data analysis skills to enhance their overall research capability. The school and community-based initiatives may design targeted interventions to strengthen these least-competent areas in research and enhance the research skills and application in teaching and developing research.

Meanwhile, teachers demonstrated overall proficiency across research domains, particularly in proper citation, formulating hypotheses, identifying suitable research settings, and effectively organizing and communicating findings. However, they need to further strengthen their critical and analytical thinking, deepen their theoretical grounding, and improve their competence in selecting and applying statistical methods, especially in research design and data analysis. Furthermore, there is a positive correlation between professional capacity and research proficiency among science teachers. The

concerned sectors may strengthen and revitalize professional development programs that will supplement the least proficient skills in research, enhance their field of teaching, and develop sound research outputs.

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