ASSESSMENT OF THE PEDAGOGICAL CONTENT KNOWLEDGE OF THE SCIENCE TEACHERS IN SELECTED PUBLIC ELEMENTARY SCHOOLS IN THE SCHOOLS DIVISION OF QUEZON CITY

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ABSTRACT

This study assessed the pedagogical content knowledge (PCK) of science teachers in selected public elementary schools in the Schools Division of Quezon City during School Year 2025–2026. A quantitative descriptive-correlational design, with a developmental component, was employed. Respondents consisted of 262 science teachers selected from a population of 757 science teachers and all five school heads of the selected schools. Data were collected through survey-questionnaires for teachers and school heads and were analyzed using frequency count, percentage, weighted mean, t-test, and chi-square test of independence.

The findings showed that 47% of the science teachers were bachelor's degree holders, while 29% had completed the academic requirements for a master's degree, 17% were master's degree holders, 4% had completed doctoral academic requirements, and 3% were doctorate degree holders. In terms of experience, 33% had 11–15 years of science teaching experience, while 31% had 6–10 years. In training participation, 79% had attended not more than three science-teaching-related trainings during the previous five years.

Teachers perceived their PCK as high in employment of varied teaching strategies (AWM = 4.02), classroom management (AWM = 4.01), and assessment of learning outcomes (AWM = 4.01), yielding an overall weighted mean of 4.01. In contrast, school heads perceived the teachers' PCK as moderate in the three areas, with area weighted means of 2.88, 2.88, and 2.90, respectively, and an overall weighted mean of 2.89. The t-test indicated a significant difference between teacher and school-head perceptions ($p = 0.00$). Chi-square tests likewise showed significant relationships between PCK and highest educational attainment ($p = 0.01$; $\chi^2 = 6.77$), length of experience in teaching science ($p = 0.02$; $\chi^2 = 5.55$), and number of relevant trainings ($p = 0.01$; $\chi^2 = 7.20$).

Based on these findings, a three-session, school-based in-service professional development program was proposed, focusing on varied teaching strategies, classroom management, and assessment of learning outcomes.

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I. INTRODUCTION

Science plays a central role in contemporary society and influences health, communication, transportation, food production, computing, artificial intelligence, and renewable energy. The importance of science is reflected in the Philippine educational system, where the Department of Education's K to 12 Science Curriculum Guide emphasizes the development of scientifically, technologically, and environmentally literate learners who can think critically, solve problems, communicate effectively, and make informed decisions.

The K to 12 Science Curriculum is learner-centered and inquiry-based. It integrates scientific knowledge with scientific processes and attitudes and promotes multidisciplinary, contextual, problem- or issue-based, and inquiry-based approaches. The curriculum also encourages hands-on, minds-on, and hearts-on activities and presents concepts in Life Sciences, Physics, Chemistry, and Earth Sciences through spiral progression. These expectations require teachers to possess knowledge not only of science content but also of how science concepts can be effectively taught to diverse learners.

The thesis identifies pedagogical content knowledge as a synthesis of pedagogical knowledge and what teachers know about teaching. In the study, PCK is operationalized through three dimensions: employment of teaching strategies, classroom management, and assessment of learning outcomes. The study was anchored on the Sensory Stimulation Theory of Learning, Constructivist Theory, and Cognitive Theory of Multimedia Learning.

The rationale for the study was also connected to concerns about Philippine science achievement. The thesis cited the country's results in TIMSS and PISA as indications of persistent challenges in science learning. It therefore examined the PCK of science teachers in selected public elementary schools in the Schools Division of Quezon City and used the findings as a basis for proposing an in-service professional development program.

The specific objectives were to determine the teachers' profile, assess their PCK as perceived by themselves and their school heads, test whether the two perceptions differed significantly, determine whether profile variables were significantly related to PCK, and develop a professional development program based on the findings.

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I. INTRODUCTION (CONTINUED)

Research Questions

The study sought to answer the main question: What in-service professional development program may be proposed to enhance the PCK of science teachers in selected public elementary schools in the Schools Division of Quezon City?

Specifically, it sought to determine: (1) the teachers' highest educational attainment, length of experience in teaching science, and number of science-teaching-related trainings attended during the previous five years; (2) their PCK in employment of varied teaching strategies, classroom management, and assessment of learning outcomes as perceived by themselves and school heads; (3) whether there was a significant difference between the perceptions of teachers and school heads; (4) whether there was a significant relationship between teacher profile variables and PCK; and (5) the professional development program that could be proposed from the findings.

Conceptual and Theoretical Basis

The Sensory Stimulation Theory of Learning in the thesis emphasizes that learning can become more effective when learners' senses are actively engaged, particularly through visual and auditory channels. Constructivism emphasizes learners' active construction of understanding from prior knowledge and experience. The Cognitive Theory of Multimedia Learning explains learning through visual/pictorial and auditory/verbal channels and highlights the importance of managing cognitive load while supporting meaningful understanding.

These perspectives support the study's attention to varied teaching strategies, learner-responsive classroom management, and assessment practices. The study also adopted a positivist research paradigm, treating the phenomena under investigation as observable and measurable through structured data collection and statistical analysis.

Significance

The study is intended to benefit science teachers through professional development, selected public elementary schools through strengthened science teaching and learning, pupils through improved instruction, and future researchers through a basis for further investigations on effective science teaching.

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II. METHODS

Research Design

The study employed a quantitative descriptive-correlational research design with a developmental component. The descriptive component determined the profile of the science teachers and described their PCK as perceived by teachers and school heads. The correlational component examined the difference between the two groups' perceptions and the relationships between teacher profile variables and PCK. The developmental component was used to formulate an in-service professional development program based on the findings.

Participants and Setting

The study was conducted in selected public elementary schools in the Schools Division of Quezon City during School Year 2025–2026. The selected schools were Bagong Silangan Elementary School, Pres. Corazon C. Aquino Elementary School, Commonwealth Elementary School, Doña Juana Elementary School, and Benigno S. Aquino, Jr. Elementary School.

School	Population	Sample
Bagong Silangan Elementary School	178	62
Pres. Corazon C. Aquino Elementary School	182	63
Commonwealth Elementary School	163	57
Doña Juana Elementary School	137	47
Benigno S. Aquino, Jr. Elementary School	97	33
Total	757	262

A sample of 262 science teachers was computed using Slovin's formula with a 0.05 margin of error. Teachers were proportionately distributed among the selected schools and randomly selected. All five school heads were included as respondents.

Research Instrument

Two survey-questionnaires were used: one for science teachers and one for school heads. The teacher questionnaire contained a profile section and a PCK assessment section. The school-head questionnaire assessed the PCK of the science teachers. The PCK items were based on the instrument used by Balocating (2023) in a study on science teaching practices in selected public elementary schools in Malasiqui I District.

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II. METHODS (CONTINUED)

Data Collection and Ethics

The researcher personally administered the survey-questionnaires and gave the teachers three weeks to complete them before retrieval. Permission to conduct the study was secured from the Schools Division Superintendent of Quezon City. Informed consent was obtained from the science teachers. The researcher stated that the information would be treated confidentially and used only for the purposes of the study in accordance with the Data Privacy Act of the Philippines. Sources used in the research were cited and documented.

Data Analysis

Frequency counts and percentages were used to describe the teachers' profile. Weighted means were used to determine the level of PCK. The interpretation scale was: 1.00–1.49, very low; 1.50–2.49, low; 2.50–3.49, moderate; 3.50–4.49, high; and 4.50–5.00, very high. A t-test was used to determine whether there was a significant difference between the perceptions of teachers and school heads. The chi-square test of independence was used to determine whether the teachers' profile variables were significantly related to their PCK. Statistical decisions were made at the .05 level of significance.

Operational Dimensions of PCK

Dimension	Focus in the Study
Employment of varied teaching strategies	Use of varied, learner-responsive, contextualized, technology-supported, and inquiry-oriented strategies and learning experiences.
Classroom management	Maintenance of safe and orderly classrooms, behavior management, reinforcement, learner social development, and enforcement of school policies.
Assessment of learning outcomes	Use of formative and summative tests, non-traditional assessment, interpretation of assessment results, remediation, and authentic assessment.

The methodology was therefore aligned with the study's research questions and permitted comparison of self-perceptions with school-head perceptions while examining the relationship of teacher characteristics with PCK.

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III. RESULTS

Profile of the Science Teachers

Highest Educational Attainment	Frequency	Percentage
Bachelor's degree holder	123	47%
Finished master's academic requirements	77	29%
Master's degree holder	43	17%
Finished doctoral academic requirements	11	4%
Doctorate degree holder	8	3%
Total	262	100%

The largest group consisted of bachelor's degree holders (47%). Another 29% had completed academic requirements for a master's degree, while 17% were master's degree holders. Only 7% had completed doctoral academic requirements or held a doctorate. Thus, 76% of the teachers had no postgraduate degree, as summarized in the thesis findings.

Length of Science Teaching Experience	Frequency	Percentage
1–5 years	36	14%
6–10 years	80	31%
11–15 years	87	33%
16–20 years	38	14%
More than 20 years	21	8%
Total	262	100%

The largest single group had 11–15 years of science teaching experience (33%), followed by 6–10 years (31%). Overall, 55% had more than 10 years of experience.

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Relevant Training in Previous 5 Years	Frequency	Percentage
No training	0	0%
Not more than three trainings	208	79%
More than three trainings	54	21%
Total	262	100%

The training profile indicates that most teachers (79%) had attended not more than three science-teaching-related trainings during the previous five years.

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III. RESULTS (CONTINUED)

Perceived Level of Pedagogical Content Knowledge

PCK Area	Science Teachers AWM	Interpretation	School Heads AWM	Interpretation
Employment of varied teaching strategies	4.02	High	2.88	Moderate
Classroom management	4.01	High	2.88	Moderate
Assessment of learning outcomes	4.01	High	2.90	Moderate
Overall	4.01	High	2.89	Moderate

The results show a consistent difference in the two respondent groups' perceptions. Science teachers rated their own PCK at a high level across all three dimensions. The highest teacher-rated area was employment of varied teaching strategies (AWM = 4.02), followed by classroom management and assessment of learning outcomes (both AWM = 4.01).

School heads, however, rated the science teachers at a moderate level in all three areas. Their highest area rating was assessment of learning outcomes (AWM = 2.90), followed by employment of varied teaching strategies and classroom management (both AWM = 2.88). The overall school-head rating was 2.89, interpreted as moderate.

At the item level, teacher ratings were generally within the high range. Examples included understanding theories, approaches, and strategies in teaching the subject area (WM = 4.06), facilitating varied enrichment activities (WM = 4.10), and using varied strategies for individual and cooperative learning (WM = 4.04). The school-head ratings generally clustered around 2.80 to 3.00 in the reported tables.

Statistical Test of Perceptions

The t-test yielded a p value of 0.00, which is below the .05 level of significance. The thesis therefore rejected the null hypothesis and concluded that there was a significant difference between the perceptions of science teachers and school heads regarding the teachers' PCK.

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III. RESULTS AND DISCUSSION

Relationship of Profile Variables and PCK

Profile Variable	p Value	χ^2 Value	Decision at .05
Highest educational attainment	0.01	6.77	Significant
Length of experience in teaching science	0.02	5.55	Significant
Number of relevant trainings	0.01	7.20	Significant

All three profile variables were significantly related to PCK. Highest educational attainment had a p value of 0.01 and chi-square value of 6.77. Length of experience in teaching science had a p value of 0.02 and chi-square value of 5.55. Number of relevant trainings had a p value of 0.01 and chi-square value of 7.20. In each case, the p value was lower than .05 and the computed chi-square value exceeded the critical value of 3.84 reported in the thesis.

Discussion

The profile results indicate that the science-teaching workforce in the selected schools included many experienced teachers but relatively fewer teachers with completed postgraduate degrees. The training profile also showed that most teachers had participated in only a limited number of science-teaching-related trainings over the previous five years. These characteristics are relevant because the statistical analysis showed significant relationships between educational attainment, teaching experience, training participation, and PCK.

The difference between teacher and school-head perceptions is one of the central findings. Teachers consistently rated their PCK as high, whereas school heads rated it as moderate. The statistical test confirmed that the difference was significant. The result suggests that the two groups did not share the same assessment of the teachers' PCK, making the school-head perspective important when identifying areas for professional development.

The findings across the three PCK dimensions also provide a coherent basis for intervention. Because school heads rated all three dimensions at the moderate level, the proposed professional development program appropriately covers varied teaching strategies, classroom management, and assessment of learning outcomes rather than concentrating on only one dimension.

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III. RESULTS AND DISCUSSION (CONTINUED)

Implications for Science Teaching

The findings suggest that professional development should focus on helping teachers apply science pedagogy more effectively in the classroom. Aligned with the K to 12 Science Curriculum, training can strengthen learner-centered, inquiry-based, contextualized, and evidence-based teaching practices.

In teaching strategies, professional learning can promote the use of diverse activities, technology, instructional materials, and learner-responsive approaches. Although teachers rated themselves highly, the moderate ratings from school heads indicate a need for more classroom practice, collaboration, and feedback.

For classroom management, training can enhance teachers' ability to maintain safe, orderly, and supportive learning environments through case analysis, role-playing, and collaborative planning.

Regarding assessment, professional development can improve the use of formative, summative, and authentic assessments, helping teachers use assessment results to guide instruction, remediation, and lesson planning

Interpretation of the Statistical Findings

The statistical findings should be interpreted within the scope of the study. The significant relationships establish associations between the profile variables and PCK; they do not, by themselves, establish causal mechanisms. Similarly, the significant t-test establishes a difference between the two groups' perceptions but does not determine which perception is objectively correct. The findings instead demonstrate the value of considering both teacher self-assessment and school-head assessment when planning professional development.

The study's proposed intervention is therefore evidence-informed within the study's own data: it responds to the moderate school-head assessment, the significant relationships with education, experience, and training, and the identified three PCK dimensions.

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RESULTS AND DISCUSSION: PROPOSED INTERVENTION

In-Service Professional Development Program

The thesis proposed a three-session in-service professional development program for science teachers in the selected public elementary schools in the Schools Division of Quezon City. The program is school-based and is to be implemented by school heads in coordination with the Schools Division Office–Quezon City. Its delivery approach is interactive, collaborative, and participatory, with lectures or discussions comprising no more than 30% of total session time.

Session	Focus	Duration	Target Personnel
1	Training-Workshop on Employment of Varied Teaching Strategies	2 days	Science teachers in selected schools
2	Training-Workshop on Classroom Management	2 days	Science teachers in selected schools
3	Training-Workshop on Assessment of Learning Outcomes	2 days	Science teachers in selected schools

The program is funded through MOOE according to the thesis. Its stated intended outcomes are for science teachers to become highly competent in employment of varied teaching strategies, classroom management, and assessment of learning outcomes.

Program Rationale

The program is grounded in the study's finding that school heads perceived teachers' PCK as moderate in all three dimensions and in the significant relationship between training participation and PCK. It also reflects the K to 12 Science Curriculum's emphasis on varied, learner-centered, contextualized, inquiry-based, and evidence-supported learning experiences.

The proposed program can be understood as the developmental output of the research. Rather than introducing a separate research problem, it translates the empirical findings into a structured professional learning response focused on the same dimensions measured in the study.

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CONCLUSION

The study assessed the pedagogical content knowledge of science teachers in selected public elementary schools in the Schools Division of Quezon City during School Year 2025–2026. The typical profile reflected in the findings was a teacher without a postgraduate degree, with more than ten years of science teaching experience, and with not more than three science-teaching-related trainings during the previous five years.

The science teachers perceived their pedagogical content knowledge as high, with an overall weighted mean of 4.01. School heads perceived the teachers' PCK as moderate, with an overall weighted mean of 2.89. The three dimensions—employment of varied teaching strategies, classroom management, and assessment of learning outcomes—showed the same general pattern of high teacher self-ratings and moderate school-head ratings.

There was a significant difference between the perceptions of science teachers and school heads. There were also significant relationships between PCK and highest educational attainment, length of experience in teaching science, and number of relevant trainings. Based on these findings, the thesis proposed a three-session professional development program covering the three dimensions of PCK.

Recommendations

- Implement the proposed in-service professional development program in the selected public elementary schools, subject to appropriate approval.
- Evaluate the implementation of the professional development program to determine its usefulness in strengthening science teachers' PCK.
- Conduct similar studies in other schools or settings to examine whether the findings are observed in other groups of science teachers.

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