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THE INFLUENCE OF TEACHING COMPETENCIES ON TEACHERS' PERFORMANCE AND STUDENTS' ACADEMIC ACHIEVEMENT IN PRIMARY SCIENCE EDUCATION

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Abstract

The teaching competencies of science teachers significantly influence students' science academic achievement. It shapes the students' understanding of complex science concepts and their ability to excel in scientific exploration, ultimately nurturing their scientific literacy. This study assessed the teaching competencies influencing the teaching performance of 58 primary science teachers relative to the academic achievement of their students in science at the Tinoc District, Tinoc, Ifugao, Philippines. The significant differences by teacher demographics were also determined. This is relevant to the district's observed low scientific literacy and achievement of students in science education as assessed in recent years. Using a quantitative approach, the study employed a modified questionnaire that was validated and pilot-tested. Results disclosed that the science teachers strongly agreed that professionalism is the most common teaching competence influencing their performance, indicating their adherence to local and national standards and code of conduct. They also strongly agreed with teaching effectiveness, personal skills, educational planning, and management skills. Generally, there were no significant differences among the teaching competencies regardless of the teachers' gender, age, highest educational attainment, and years in service. Meanwhile, the students' science academic achievement was determined to be lower average, suggesting low scientific literacy. Correspondingly, the teaching competencies and students' academic achievement were not correlated. Nonetheless, the teacher's capacity to impact the learners' scientific exploration and achievement remains intact. Further studies are recommended to be undertaken.

Keywords: *primary science education, primary science teachers, students' science academic achievement, teaching competency, teacher performance*

Introduction

Education greatly impacts nationwide development where teachers play a central role, involving acquiring students' knowledge and skills and securing the nation's future. The role of teachers is paramount, serving as the cornerstone of educational and societal development. Beyond the transmission of knowledge, teachers play a pivotal role in shaping students' character, values, attitudes, and behaviors. The public recognizes not only the teachers' responsibilities but also their roles in society (Jan, 2017; Keiler, 2018; Siddiqui & Ahamed, 2020). Their influence extends beyond the classroom, contributing to forming responsible, informed, and morally grounded members of society.

The role of a teacher is essential in facilitating knowledge transfer and technical skills between generations, contributing to the preservation and advancement of the nation's perspective. They serve as the nation's builders and as a source of information and principles for

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young individuals. Teachers uphold cultural values and pass these on to subsequent generations (Siddiqui & Ahamed, 2020). They are widely regarded as the primary stakeholders within the educational system, given that their performance is vital in shaping the academe (Abdallah & Alkaabi, 2023). They convey worthwhile changes to students (Rajagopalan, 2019). Thus, better education plays a significant role in achieving students' success.

The role and quality of teachers are mostly evaluated through their performances. Teacher performance is an observable set of attitudes and behaviors that lead to students' acquisition of knowledge and skills (Martin, 2018). There is a more favorable evaluation of the teachers' performance as the students gain more knowledge. As teachers continue their professional development, their teaching effectiveness, quality, and performance are enhanced. Teachers with better teaching performance can be characterized by their ability to implement pedagogical practices suitable for students' developmental stages and based on a deep understanding of the subject matter. They can establish learning environments conducive to learning by ensuring safety, security, equity, and support, fostering student accountability and success. They can create educational environments that are attuned to students' diversity. Teaching performance also embodies the teacher's ability to implement diverse assessment tools and methodologies to oversee, record, and communicate students' requirements, advancement, and accomplishments. They recognize and diligently carry out their responsibilities to maintain professional integrity and openness, fostering professional and harmonious relationships with students, parents, stakeholders, and the community (Department of Education, 2017; Martin, 2018).

Teaching is a complex endeavor involving a series of planned activities to facilitate predetermined students' learning outcomes. In this teacher's endeavor, competencies encompass a broad range of abilities extending beyond their subject matter expertise. Teaching competency pertains to the knowledge, skills, values, attitudes, and behaviors possessed by a teacher to improve their performance or qualifications. Competency is crucial to teachers' aim of excellence (Nessipbayeva, 2012). It can include pedagogical expertise, academic credentials, motivation, experiences, interests, professional development, and aptitude. Though related to teacher performance, teaching competency embodies a teacher's underlying knowledge, skills, and abilities. Teacher performance is directly observed in the actual teaching process, while teaching competency is the qualifications that a teacher brings to their educational role (Department of Education, 2017; Martin, 2018; Nessipbayeva, 2012).

Teachers integrate their expertise, proficiency, and capabilities to form distinct performance skills that drive students' knowledge acquisition and accomplishments. Since competency is measurable, various variables can be used to evaluate teachers' competencies. It can include assessment capabilities, developing classroom and educational plans, classroom maintenance and safety, student behavior management, relationships with students, collaborating with colleagues and superiors, implementing and adhering to policies, and curriculum management (Nessipbayeva, 2012), among others. These variables directly influence students' achievement, as the primary objective of teaching is to facilitate the holistic development of students (Javed et al., 2020).

Teaching competency in science education is significant as it ensures the accurate and effective transmission of complex scientific concepts and fosters students' critical thinking, inquiry skills, and passion for scientific inquiry. Science education is often characterized by its abstract and complex nature. Consequently, the effective teaching of science requires particular attention on the part of the teachers. It is imperative to optimize student involvement and promote the understanding of scientific principles through tangible and straightforward education (Bal-Taştan et al., 2018). It is asserted that teachers matter and that their attributes have a crucial role in shaping the motivation to learn among science students (Bietenbeck, 2011). Teachers play a significant role in influencing student progress in all areas of science education within the school setting (Rockstroh, 2013).

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Primary education is widely recognized as the foundational stage in the educational journey (Wechsler et al., 2016). The inclusion of science education in primary schools has been found to enhance students' decision-making skills development. The acknowledgement that science is everywhere and can be interconnected with any aspect of the natural world is present (Fitzgerald & Smith, 2016). Emerging research highlights the significance of directing attention toward the primary school years as a fundamental basis for subsequent achievements in the field of science. This level is crucial in acquiring scientific information and abilities. Additionally, this level serves as a significant point where disparities in academic achievement begin to emerge among the students (Jimenez & Menendez Alvarez-Hevia, 2021; Morgan et al., 2015).

Research Significance

Examining the teaching competencies of primary science teachers holds significance for teaching effectiveness and student outcomes. By comprehensively examining the teaching competencies, such as personal skills, management skills, educational planning, teaching effectiveness, and professionalism, and their influence on teaching performance and students' achievement can provide valuable insights among global researchers and educational institutions into the factors influencing the quality of science education at the primary level. A deeper understanding of teaching competencies in primary science education is crucial for shaping informed pedagogical approaches that can empower teachers to create engaging and effective learning experiences, laying a solid foundation for students' lifelong learning and future academic success. This research may be a valuable reference for other scholars investigating teaching competencies. The researchers hope this study contributes to enhancing teacher training programs, curriculum development, and educational practices, ultimately fostering an environment that nurtures students' scientific literacy and critical thinking skills.

Teaching Competencies

Personal Skills. The teaching profession is considered noble, encompassing both science and art. The teacher can enhance the teaching experience by enjoying and demonstrating a commitment to carrying out their professional responsibilities. The attainment of productive outcomes can be achieved by adopting a perspective that views the role of the teachers not solely as a giver of knowledge but also as an individual who demonstrates concern for students' needs and behaviors (Maazouzi, 2019). Hughes and Chen (2011) posited that students who establish a stronger emotional connection with their teachers tend to develop more favorable relationships with their peers. This positive relationship is associated with enhanced academic self-efficacy when students reach higher grades. Skaalvik and Skaalvik (2013) determined a favorable correlation between teacher-affective behaviors and students' intrinsic drive and academic self-concept.

Management skills. The most effective teachers can optimize students' educational capabilities. According to Maazouzi (2019), fostering academic achievement can be accomplished by establishing a pleasant, respectful, and robust management of students. An ideal classroom environment conducive to learning is characterized by a climate that embraces accepting mistakes which are integral to the learning process (Hattie, 2008). Teachers must manage an environment that fosters the acceptance and acknowledgment of mistakes. Further, the educational environment is characterized by a classroom that promotes active learning engagement and enthusiasm, with both teachers and students actively participating (Hattie, 2008). Teachers must possess expertise in various domains for effective learning, such as providing constructive criticism and praise, managing mistakes, addressing inquiries, and

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delivering well-organized lessons. Teachers must emphasize several aspects as well, such as anxiety reduction, motivation enhancement, incorporation of humor, and allocation of sufficient time for learning (Sieberer-Nagler, 2015).

Educational planning. This facilitates the teachers' comprehensive and reasonable introduction of subjects and the attainment of educational aims (Hofer & Harris, 2019). Instead of learning new information through reading, observing a demonstration, or attending a lecture, teachers should plan and create lessons that encourage students to learn new information through inquiry. Teachers should allow students to examine, discuss, and challenge ideas with their peers during a lesson (Ozfidan et al., 2017). In a conducive environment, students possess the capacity and liberty to pursue self-improvement and can exercise agency over their learning trajectory. Consequently, teachers should invest effort in ensuring that their students acquire the most knowledge possible and develop a genuine interest in them. By doing so, they provide quality education so long as the student remains at the core of their teaching.

Teaching effectiveness. Muijs and Reynolds (2011) discussed that developing students' critical thinking is vital whenever possible by posing higher-level questions. They hold questioning to be a crucial component of effective teaching and should be allocated a significant amount of time. Inquiries that probe for more advanced concepts, like requiring students to devise an experiment in science, are advocated. This is because questions at the higher level require students to comprehend the lesson better. Students must understand the science processes and abilities to be acquired, and they should be provided with guidance through exploration questions. Rauf et al. (2013) implied that teachers should consistently provide guidelines throughout experiments or lessons to ensure students recognize their acquisition of science process skills. Since science demands great passion from teachers (Lebata, 2014), they must allocate sufficient time to facilitate the comprehension of scientific concepts, sometimes perceived as intricate, uninteresting, and inconsequential by students. They have to make the subject engaging.

Professionalism. It is critical to acknowledge that the responsibilities of a teacher extend beyond the act of teaching itself (Nurhayati, 2018). This includes planning, implementing, and assessing educational activities. Teachers are responsible for fostering professional advancement, enhancing their pedagogical abilities, acquiring proficiency in contemporary educational approaches that align with current educational demands, and cultivating expertise in information and communication technology (ICT). It is significant to devise the elements and standards of teachers' professional development to facilitate their comprehension of the diverse needs of students in social, emotional, and educational domains, as well as to demonstrate the teachers' competencies across knowledge, skills, and attitudes (Darling-Hammond et al., 2017). The teachers' professional development is widely recognized as a means to augment their knowledge and expertise in various subject areas. It catalyzes behavioral change among teachers and facilitates their attainment of a higher level of professional growth. Consequently, when schools offer opportunities for learning, knowledge acquisition, and skill development, teachers' performance is expected to improve (Darling-Hammond et al., 2017).

Teacher Characteristics and Competencies

In Wood's (2012) survey of primary school teachers, the differentiation between female and male teachers remains ambiguous. The survey results indicated no statistically significant disparities in the perceptions of females and males. However, qualitative distinctions were observed, as male teachers received more negative comments than their female counterparts regarding their ability to nurture students effectively. Likewise, Islahi and Nasreen (2013) indicated no statistically significant disparity in teaching styles between male and female teachers. Lim and Meer (2017) indicated that female students tend to achieve higher

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examination scores when female teachers teach them. However, they revealed a limited impact of same-gender teachers on the academic achievement of male students. They proposed that the observed student accomplishment can be attributed to teacher behavior.

Sivasakthi Rafammal and Muthumanickam (2012) determined no discernible disparity in teachers' effectiveness between those younger, namely those at 30 years old and below, and those who are more mature or middle-aged, specifically between 30 and 40 years old. It suggested that age, irrespective of whether teachers are young, mature, or older, does not have a discernible impact on teacher effectiveness. Chiang and Wang (2014) showed that teachers above the age of 30 exhibited a greater inclination toward autonomous decision-making in the field of education as compared to other age groups. Waseka et al. (2016) yielded that teacher's age does not possess much predictive power concerning a student's academic achievement.

Ronfeldt et al. (2013) and Klassen and Tze (2014) determined that there is limited knowledge regarding the impact of graduate education on teachers' professional status, which can indirectly affect student outcomes. Sahlberg (2015) posited that implementing a master's degree prerequisite has effectively enhanced the appeal of the teaching profession, attracting individuals who possess exceptional talent and motivation. This elevation in the teaching profession has resulted in expanded opportunities beyond traditional classroom settings, including pursuing doctoral studies (Horn & Jang, 2017). On the contrary, Tucker and Fushell (2013) and Kowalczuk-Waledziak et al. (2017) demonstrated that pursuing a postgraduate master's degree has a beneficial influence on teachers' perceptions of themselves as professionals.

Unal and Unal (2012) noted a significant association between teachers' experience and their attitudes towards classroom management. Experienced teachers exhibited distinct attitudes characterized by a higher level of classroom control, effective interaction with students, and enhanced decision-making abilities compared to their less experienced counterparts. Sadik and Akbulut (2015) asserted that teachers with a minimum of ten years of teaching experience exhibit heightened effectiveness and proficient managerial abilities.

Teacher Competencies and Students' Academic Achievement

The teachers' competencies influence students' academic achievement and level of engagement in science. This includes the teachers' effectiveness of the teaching design and materials, confidence, and pedagogical abilities (Moeini et al., 2018). Undoubtedly, students' accomplishments can be attributed to the efforts of their teachers. The South African Council for Educators (SACE) report in 2010 found evidence of an association between the level of content knowledge possessed by teachers and students' academic achievement. According to Gitaari et al. (2013) and SACE (2010), it is generally acknowledged that teachers have a pivotal position in successfully implementing the curriculum. In order to effectively deliver the program, teachers must possess a high level of training and expertise. The significance of the role of teachers in determining the quality of education is underscored by Spaull (2013), who asserted that the quality of teachers inherently limits the quality of education. Studies have indicated that students who were instructed by teachers lacking proper qualifications or trained teachers who require assistance in comprehending the subject matter of science tend to get unsatisfactory outcomes (Lebata, 2014).

Empirical evidence suggests that teachers who cannot employ an appropriate pedagogical approach and exhibit a suitable demeanor during teaching contribute to students developing unfavorable perceptions of the field of science (Abudu & Gbadamosi, 2014). Consequently, this phenomenon is associated with students' subpar academic achievement. Quality science teachers possess specialized knowledge in science, demonstrating a comprehensive understanding of scientific concepts that extend beyond the prescribed curriculum. They employ diverse teaching strategies to effectively teach science, exhibiting enthusiasm and confidence in their approach.

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Furthermore, quality science teachers dedicate additional time beyond their professional obligations to ensure that students grasp the fundamental principles of science (Tsanwani et al., 2014). Understanding the application of educational procedures of science, teachers play a crucial role in fostering the interests and attitudes of students toward pursuing science subjects in the future. These procedures include assessment methods, organizing students into groups, and using rewards. Measuring teachers' performance is widely conducted by assessing students' academic accomplishments globally, where most assessments employ written examinations (Shah et al., 2011).

Primary Science Education in the Philippines

The primary objective of science education in the Philippines is to cultivate scientific literacy among students, equipping them with the necessary knowledge and skills to become engaged and knowledgeable individuals able to make well-informed judgments and decisions regarding the practical implementation of scientific knowledge, particularly those with potential social, health, or environmental impacts (Department of Education, 2016). The Kindergarten to Grade 12 (K to 12) Science curriculum modified by the Department of Education (DepEd) adopts a student-centered approach that prioritizes inquiry-based and evidence-based learning to develop explanations. The curriculum incorporates a spiral progression approach, wherein the concepts and skills in Biology, Physics, Chemistry, and Earth Sciences are systematically introduced and developed across different grade levels. It allows for an incremental increase in complexity, enabling students to cultivate a more profound comprehension of fundamental principles within these disciplines. Based on DepEd, one way to evaluate students' academic achievement is through the Mean Percentage Score (MPS). It is the students' raw score, denoting the proportion of accurately answered items in an examination relative to the overall number of items. For instance, if a student obtains an MPS of 50% in a subject, they have accurately responded to 20 out of the 40 test items.

The Philippines participated in the Programme for International Student Assessment (PISA) administered by the Organization for Economic Co-operation and Development (OECD). For PISA 2022, Filipino students performed way below the OECD average in science. This is a similar result when the country participated in PISA 2018 (OECD, 2023). Only 23% of the students attained a basic proficiency in science. This indicates that only one out of four students can discern the accurate rationale behind well-known scientific occurrences and validate conclusions (Chi, 2023; OECD, 2023). This result underscores the pressing need to address the existing concerns and disparities in achieving a high standard of basic education in the Philippines. This suggests a need for a more comprehensive understanding of the content of the K to 12 curriculum standards (Hernando-Malipot, 2023).

Research Gap

The acknowledgment that teaching competencies influence students' development of scientific literacy to empower them to engage in a thoughtful and informed manner makes the teachers' role an essential aspect of science education (Bal-Taştan et al., 2018; Bietenbeck, 2011; Rockstroh, 2013). Effective science teachers are crucial in fostering a scientifically literate individual, which, in turn, benefits society by enabling informed decision-making, critical thinking, and active engagement with scientific issues. However, below-average achievement of students in science, especially in the country, is observed, as implied by international achievement tests (Chi, 2023; OECD, 2023). This issue has prompted the study to examine and evaluate the competencies that influence the teaching performance in association with the academic achievement of students in science in the locality.

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Research Aim and Research Questions

This study aimed to assess the teaching competencies influencing science teachers' performance and their association with the academic achievement of their students in primary science education. The study further aimed to explore the significant differences in the teaching competencies influencing the teachers' performance based on demographics. The following research questions guided the conduct of this study:

1. What are the teaching competencies influencing the teaching performance of primary science teachers?
2. Are there significant differences in the teaching competencies of the teachers when grouped according to their profiles?
3. What is the academic achievement of primary students in science?
4. Is there a correlation between the teaching competencies and students' academic achievement in science?

Research Methodology

General Background

A quantitative approach was used to assess the teaching competencies influencing the science teachers' performance and students' academic achievement. This approach is distinguished by its systematic and uniform approaches to gathering data, enabling the quantification of particular variables and the implementation of statistical methods for analysis (Creswell, 2009). The study specifically used a descriptive survey that allowed the determination of the teachers' perceived level of influence of the teaching competencies. It is a research technique in which information is gathered from the respondents through a questionnaire (Aggarwal & Ranganathan, 2019). The study was conducted during the last quarter of 2023.

Sample

The study was conducted at Tinoc District, Division of Ifugao, Philippines. There were 58 primary science teachers who participated. The selection process utilized total enumeration, involving all the teachers handling science subjects from Grades 3 to 6 levels from the 16 primary schools in the district. Even though all the science teachers were involved, the small number of participants reflects the districts' small numbers of schools, low student population, and few grade level sections. Based on the Philippine K to 12 Science Curriculum, the teaching of science as an independent and formal subject starts at the Grade 3 level. There is no stand-alone science subject for Grades 1 and 2. The science teacher participants were also selected for the purpose of evaluating the teaching competencies influencing their performance and their students' academic achievement in the locality, as structured in this study. Table 1 shows the demographic profiles of the teachers. Regarding gender, the sample population comprises 36% males and 64% female teachers. Based on age, 19% were 20 to 30, 45% were 31 to 40, and 36% were 41 to 50 years old. Regarding the highest educational attainment, 71% of the teachers have finished their bachelor's degree, while 29% have undertaken their master's degree. There were no involved teachers with doctorate degrees among the participants. Based on the years in service, 60% have 1 to 10, 33% have 11 to 20, and 7% have 21 to 30 years of experience.

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Table 1
Demographic Profiles of the Primary Science Teachers

Profiles	*N*	%
1. Gender		
a. Male	21	36
b. Female	37	64
2. Age		
a. 20 - 30 years old	11	19
b. 31 - 40 years old	26	45
c. 41 - 50 years old	21	36
3. Highest Educational Attainment		
a. Bachelor's degree	41	71
b. Master's degree	17	29
4. Number of Years in Service		
a. 1 - 10 years	35	60
b. 11 - 20 years	19	33
c. 21 - 30 years	4	7

As shown in Table 2, there were 284 students involved in the study across the Grades 3 to 6 levels. They were the primary students taught by the science teachers during the study's conduct. The data regarding science MPS of these students was the basis of the academic achievement used in correlational analysis with the teaching competencies. The student population comprised 19% from Grade 3, 25% from Grade 4, and 28% for Grades 5 and 6.

Table 2
Primary Students across Grade Levels

Students	*N*	%
Grade 3	55	19
Grade 4	71	25
Grade 5	79	28
Grade 6	79	28

Instrument

The study used a modified questionnaire based on the Philippine Professional Standards for Teachers (PPST) developed by the Department of Education (2017). This set of standards outlines the requisite information, skills, and principles teachers should possess to achieve proficiency, improve student learning outcomes, and ultimately deliver high-quality education. Some survey item statements were also based on the Winchester Public Schools Teacher Performance Evaluation System (TPES) constructed by Dr. James Stronge. It is utilized to gather and display data to determine teachers' performance assessed according to well-stated job requirements (Stronge, 2012). Using the PPST and TPES, the study developed 36-item statements that were categorized into five teaching competencies. These are personal skills, management skills, educational planning, teaching effectiveness, and professionalism. The

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survey questionnaire was validated by three school heads: two school principals and one department head. The validation indicated that all the items were valid, with an overall Aiken's validity coefficient of .856. Furthermore, pilot testing involving 20 teachers from a different district determined that the item statements have excellent reliability with an overall Cronbach's alpha of .959. The questionnaire was divided into two distinct sections. The first section required the teachers' profile regarding their gender, age, highest educational attainment, and years in service. The second part consisted of 36-item statements regarding the teaching competencies. A 4-point Likert scale was used to denote the influence of the teaching competencies, specifying that 4 = Strongly Agree (SA), 3 = Agree (A), 2 = Disagree (D), and 1 = Strongly Disagree (SD). On the other hand, students' academic achievement in science was determined by collecting the MPS data from their respective class advisers.

Procedures

The study was proposed to the researchers' affiliated institution for approval, outlining the study's objectives, methodology, and significance. The study's proposal was also submitted and sought approval from the institution's research ethics committee. A permission request letter was sent to the DepEd Ifugao Schools Division Office to conduct the study within the Tinoc District. It included permission requests for validation from school heads, pilot testing of the questionnaire, and gathering of the students' MPS. Upon approval, the questionnaire's validation was succeeded by pilot testing. Meanwhile, a consent letter was given to the selected teachers. It informed the study's overview, aim, and duration and commitment of their participation. The possibility of experiencing distress or emotional discomfort as a potential risk while answering the survey was presented, highlighting their right to withdraw from the study without facing any negative consequences. The letter also presented the probable conduct of relevant teacher training as a benefit of the study. The teachers' voluntary participation and confidentiality of their data were emphasized. The researchers' contact information was included for direct communication if concerns occurred during the study. Once the questionnaire was finalized, the researchers personally administered the survey to the science teachers. It was to answer queries from the teachers about the study and to ensure a higher retrieval rate of the questionnaires. The MPS of students were also personally gathered by the researchers. All data gathered were compiled in a spreadsheet and kept by the researchers. The treated and tabulated data from the teacher and students were treated with utmost confidentiality. Tabulation, analysis, and presentation of the results concluded the procedure.

Data Analysis

Descriptive and inferential statistics were used to organize and analyze the responses obtained from the teachers and students' academic performance. Frequency, percentage, and mean were used to analyze the teachers' responses. Statistical limits served to describe the results of the means, with 3.26 - 4.00 = Strongly Agree (SA), 2.51 - 3.25 = Agree (A), 1.76 - 2.50 = Disagree (D), and 1.00 - 1.75 = Strongly Disagree (SD). Likewise, the computed mean of students' academic achievement was described using the MPS quartile distribution. It describes the academic achievement as 76% - 100% = Superior, 51% - 75% = Upper Average, 26% - 50% = Lower Average, and 0% - 25% = Poor. The t-test was employed to assess whether a significant difference exists in the level of effect of the teaching competencies when categorized by gender and highest degree of education. Analysis of Variance (ANOVA) was utilized to compare significant differences in the teachers' profiles regarding age and years of service. The Pearson-product-moment correlation (PPMC) was used to examine the correlation between teaching competencies and students' academic achievement in science.

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Research Results

As shown in Table 3, professionalism is the top teaching competency influencing the teaching performance of primary science teachers. It was followed by teaching effectiveness, personal skills, educational planning, and management skills. Results also showed that regardless of rank, all teaching competencies perceived strong agreement from the teachers.

Table 3
Teaching Competencies Influencing the Science Teachers' Performance

Teaching Competencies	*M*	*SD*	Descriptive Equivalent	Rank
A. Personal Skills	3.69	0.47	Strongly Agree	3
B. Management Skills	3.66	0.50	Strongly Agree	5
C. Educational Planning	3.68	0.47	Strongly Agree	4
D. Teaching Effectiveness	3.71	0.48	Strongly Agree	2
E. Professionalism	3.81	0.39	Strongly Agree	1

In Table 4, results indicate no significant differences regarding the personal skills, management skills, and educational planning competencies influencing the teacher's performance when grouped according to gender. There are also no significant differences in the perceived level of effect of teaching effectiveness and professionalism among the female and male teachers.

Table 4
Teaching Competencies Influencing the Teachers' Performance According to Gender

Teaching Competencies	Male		Female		*t*-value	*p*-value
	M	*SD*	*M*	*SD*		
A. Personal Skills	3.67	0.50	3.71	0.46	-0.949^{ns}	.189
B. Management Skills	3.65	0.51	3.67	0.49	-0.314^{ns}	.380
C. Educational Planning	3.75	0.44	3.64	0.49	0.670^{ns}	.078
D. Teaching Effectiveness	3.72	0.49	3.71	0.47	0.233^{ns}	.408
E. Professionalism	3.75	0.43	3.84	0.37	-1.844^{ns}	.053

Note: * = significant ($p < .05$); ns = not significant ($p > .05$)

Table 5 reflects that when the teachers were grouped according to age, there is a significant difference in the perceived level of effect of personal skills on the teaching performance of the teachers. However, there are no significant differences in the management skills and educational planning competencies. There are also no significant differences regarding teaching effectiveness and professionalism across the teachers' ages.

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Table 5
Teaching Competencies Influencing the Teachers' Performance According to Age

Teaching Competencies	20-30 y/o		31-40 y/o		41-50 y/o		*f*-value	*p*-value
	M	*SD*	*M*	*SD*	*M*	*SD*		
A. Personal Skills	3.66	0.48	3.69	0.48	3.71	0.45	3.214*	.043
B. Management Skills	3.74	0.44	3.62	0.51	3.68	0.50	0.067^{ns}	.985
C. Educational Planning	3.82	0.39	3.69	0.47	3.60	0.51	2.056^{ns}	.145
D. Teaching Effectiveness	3.82	0.40	3.64	0.51	3.74	0.46	1.778^{ns}	.178
E. Professionalism	3.95	0.21	3.76	0.43	3.79	0.41	0.954^{ns}	.454

Note: * = significant ($p < .05$); ns = not significant ($p > .05$)

Table 6 indicates no significant differences in the perceived competency of personal skills, management skills, and educational planning when the teachers were grouped according to their highest educational attainment. The same observation is seen in teaching effectiveness and professionalism in their teaching performance regardless of their bachelor's or master's degree.

Table 6
Teaching Competencies Influencing the Teachers' Performance According to Highest Educational Attainment

Teaching Competencies	Bachelor's Degree		Master's Degree		*t*-value	*p*-value
	M	*SD*	*M*	*SD*		
A. Personal Skills	3.74	0.45	3.67	0.50	1.453^{ns}	.280
B. Management Skills	3.70	0.46	3.59	0.57	0.164^{ns}	.876
C. Educational Planning	3.68	0.47	3.68	0.49	0.468^{ns}	.653
D. Teaching Effectiveness	3.72	0.47	3.69	0.40	0.385^{ns}	.768
E. Professionalism	3.83	0.38	3.76	0.43	0.218^{ns}	.824

Note: * = significant ($p < .05$); ns = not significant ($p > .05$)

Results in Table 7 show no significant differences in the perceived effect of personal skills, management skills, and educational planning in teachers' teaching performance according to the number of years in service. Likewise, there is no significant difference in their teaching effectiveness and professionalism across the teachers' 1 - 30 years of teaching.

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Table 7
Teaching Competencies Influencing the Teachers' Performance According to Years in Service

Teaching Competencies	1 - 10 years		11 - 20 years		21 - 30 years		*f*-value	*p*-value
	M	*SD*	*M*	*SD*	*M*	*SD*		
A. Personal Skills	3.66	0.48	3.76	0.46	3.69	0.48	2.467^{ns}	.085
B. Management Skills	3.69	0.46	3.65	0.51	3.42	0.65	0.354^{ns}	.875
C. Educational Planning	3.68	0.47	3.74	0.44	3.38	0.58	1.964^{ns}	.148
D. Teaching Effectiveness	3.72	0.47	3.75	0.46	3.43	0.63	1.356^{ns}	.285
E. Professionalism	3.84	0.37	3.77	0.42	3.67	0.48	0.432^{ns}	.830

Note: * = significant ($p < .05$); ns = not significant ($p > .05$)

The collected data of science MPS among the Grade 3, 4, 5, and 6 students is reported in Table 8. This MPS data indicated the student's academic achievement in science as assessed by the primary teachers. Notably, the data showed that all grade levels garnered an MPS close to 50%, indicating that the students have lower average science achievement levels. Consequently, it resulted in an overall science MPS of below-average level of achievement of 50.25%.

Table 8
Overall Mean Percentage Score of the Primary Students in Science

Grade Levels	*N*	MPS, %	Descriptive Equivalent
A. 3	55	50.20	Lower Average
B. 4	71	50.23	Lower Average
C. 5	79	50.28	Lower Average
D. 6	79	50.30	Lower Average
	Overall MPS	50.25	Lower Average

Table 9 determines the correlation results, indicating no significant association between the teaching competencies influencing the teachers' performance and the students' academic achievement in science. There is no correlation between the teachers' personal skills, management skills, educational planning, teaching effectiveness, and professionalism and their students' MPS in science.

Table 9
Correlation Between the Teaching Competencies and Mean Percentage Score

Teaching Competencies	*r*-value	*p*-value
A. Personal Skills	.0417^{ns}	.7357
B. Management Skills	.1017^{ns}	.4092
C. Educational Planning	.0437^{ns}	.7238
D. Teaching Effectiveness	-.0215^{ns}	.8622
E. Professionalism	.0265^{ns}	.8303

Note: * - significant ($p > .05$); ns - not significant ($p > .05$)

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Discussion

Professionalism is ranked as the most perceived teaching competency that influences the teaching performance of primary science teachers. This is consistent with Darling-Hammond et al.'s (2017) affirmation that professional development for teachers is viewed as a way to help them reach a certain level of professional growth, improve their knowledge and proficiency, and provide a platform for behavior modification. Nonetheless, teachers must never forget that the elements of professional development should be structured so that teachers can demonstrate their qualifications in terms of knowledge, skills, and attitudes, as Nessipbayeva (2012) shared. This is while being able to comprehend the various needs of students. Professionalism among the teachers indicated their adherence to a set of standards and code of conduct within the academe. Precisely, in this study, the standards were measured in terms of attendance, punctuality, submitting requirements, wearing proper attire and uniforms, and effective communication with their colleagues. Their interest in improving themselves in their quality of teaching and their active participation in school activities were also included. Professionalism is a quality that every teacher must possess since they are perceived as the models of the students.

The teachers' perceptions of personal skills, management skills, educational planning, teaching effectiveness, and professionalism determined to be the same regardless of gender, agrees with Wood (2012) and Islahi and Nasreen (2013), showing no significant difference in the teaching styles between male and female teachers. This implies that both teachers have the same perception of the influence of their teaching competencies. Regarding age, the non-significant determination of management skills, educational planning, teaching effectiveness, and professionalism among the teachers is similar to the result of Sivasakthi Rafammal and Muthumanickam (2012), where age, either young, mature, or old, does not make any difference to teacher effectiveness. A significant difference in personal skills reveals diversity in how the teachers approach their work and handle various aspects of teaching. This confers with Chiang and Wang (2014), indicating that older teachers tended to make their own decisions. This may be reflected in the viewpoint that teachers generally lose the enthusiasm to teach as they grow old. Results indicated the non-significance in the educational attainment among the teachers. It does not reflect that of Kowalczuk-Waledziak et al. (2017), Tucker and Fushell (2013), and Sahlberg (2015), signifying that obtaining a higher degree has a beneficial influence. It conveys that the teaching competencies do not vary, even if the teachers have a bachelor's or master's degree. However, this may reflect Klassen and Tze (2014) and Ronfeldt et al. (2013), positing that more needs to be known about how graduate education affects teachers. There are also no significant differences in the teachers' perceptions of the teaching competencies according to their years in service. This entails that the teachers' perception of their competencies does not vary significantly based on longitude of experience. It does not agree with Unal and Unal (2012) and Sadik and Akbulut (2015), who denote that teachers with more years of teaching experience are more effective in teaching and sound in their teaching skills. This result suggests that the teachers, no matter how long their years in service were in teaching, still have excellent personal skills, management skills, educational planning, teaching effectiveness, and professionalism.

The general non-significance among the teaching competencies of the science teachers regarding their gender, age, highest educational attainment, and years in service suggests a degree of consistency and uniformity in their skills and capabilities. In the study's context, the teachers strongly agreed that they had displayed behaviors appropriate to professional status in their workplace. They have shown an enthusiastic outlook towards teaching. They possessed clear voices and proper intonations and observed proper grooming. They exhibited confidence, leadership, creativity, and initiative in their teaching responsibilities. The teachers showed efficiency in their routines, allowed maximum participation of their students, and prepared supportive learning experiences. They designed appropriate learning objectives,

course materials, student activities or tasks, and evaluation instruments, such as rubrics. They were able to properly assess students' needs and abilities in order to address learning difficulties. Utilization of varied teaching methods and strategies, various motivational techniques, and praising students' achievements were done. The teachers have evaluated the effectiveness of their teaching practices in terms of objectives and implemented various motivational techniques in the teaching-learning process.

Meanwhile, the study found that the MPS of the students in science is 50.25%. This value is close to the quartile range of 26 – 50%, indicating a lower average. It is most likely congruent with the PISA 2022 result, where the scientific literacy among Filipino students was significantly lower compared to the other participating nations, as Chi (2023) and OECD (2023) reported. This highlights the circumstances surrounding the country's K to 12 curricula, as Hernando-Malipot (2023) relayed. The low average achievement portrays the students' low scientific literacy. It can be inferred that the students lack the fundamental knowledge, skills, and understanding necessary to engage and interpret scientific information critically. They may struggle to comprehend scientific principles, understand the nature of scientific inquiry, and assess science-related information. This deficiency can hinder their ability to participate in an increasingly complex and technology-driven world, limiting their capacity to make informed decisions on issues with scientific relevance.

In this study, the lack of correlation between the competencies influencing the science teachers' performance and the students' MPS stipulates that students' academic achievement and level of engagement were not influenced by the teachers' personal skills, management skills, educational planning, teaching effectiveness, and professionalism. This contrasts that of Abudu and Gbadamosi (2014), SACE (2010), and Moeini et al. (2018), implying a correlation between the teachers' abilities and effectiveness and students' achievement. It does not mirror that quality science teachers affect students' science learning, as Spaull (2013) and Tsanwani et al. (2014) asserted. This result suggests that the effectiveness of teachers, as measured by their competencies, does not align with or predict the academic success of students in science. However, it is important to recognize that student achievement is a multifaceted outcome influenced by various interconnected elements. While teaching competencies are undoubtedly crucial, the lack of correlation could stem from various factors, underscoring the complexity of educational outcomes and highlighting the need to explore additional factors that contribute to students' science achievement beyond the teachers' competencies.

Conclusions, Implications, and Limitations

The effectiveness of a science teacher in enhancing scientific literacy depends on their competence and ability to inspire and engage their students in the subject. This study assessed the teaching competencies influencing primary science teachers' teaching performance relative to their students' academic achievement in science. It has been identified that teachers strongly agreed that professionalism is the main teaching competency influencing their performance in science education. Likewise, the teachers strongly agreed regarding the other competencies of personal skills, teaching effectiveness, educational planning, and management skills. In general, it was determined that there are no significant differences among the teaching competencies that influenced the performance of science teachers regarding their gender, age, highest educational attainment, and years in service. The students' academic achievement in science is evaluated as below average, indicating a lower performance expectation. Conclusively, the study found no correlation between the teaching competencies and students' academic achievement in science. These findings offer significant perspectives on the elements that impact the quality of primary science education. Understanding teaching competency is essential for developing informed pedagogical approaches that empower teachers to create engaging and successful student learning experiences and academic achievement.

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Based on the study's findings, the science teachers' competence implies a multifaceted proficiency beyond mere knowledge of scientific content. They possess the skills to design and deliver practical science lessons, adapting their approach to diverse learning styles. Their pedagogical skills are evident through implementing diverse teaching methods fostering student engagement and understanding. They have better personal qualities, are responsible, and excel in teaching and classroom management. They can create an atmosphere conducive to learning by effectively promoting student participation and managing behavior. They actively seek opportunities to enhance their teaching techniques and integrate relevant technologies. The lack of correlation between teaching competencies and academic achievement suggests that despite possessing the necessary skills and knowledge, teachers may face challenges in translating their competencies into tangible improvements in students' academic performance. Addressing this disassociation requires a comprehensive examination of assessment methods, curriculum design, and the broader educational context to ensure that teaching competencies align with and positively impact student learning outcomes.

Although the research has yielded valuable findings, various factors and limitations are to be considered when evaluating the constraints of this study. The coronavirus disease (COVID-19) pandemic has caused abrupt academic constraints in the district, affecting teaching and learning over the past few years. Even though regular classes had already been pursued, the pandemic may have affected teachers' responses and students' performances. Moreover, with the small number of science teacher participants in the district, the result does not represent a larger population. Nonetheless, the researchers still perceive that a competent, passionate, and knowledgeable science teacher plays a vital role in shaping students' scientific literacy, attitudes, and abilities regarding understanding and appreciating the world through a scientific lens.

Declaration of Interest

The authors declare no competing interest.

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