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Teachers' Beliefs and Knowledge in School Science in Relation to Their Classroom Observation Rating

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Abstract

The present study seeks to determine the relationship between teachers' beliefs and knowledge in School Science, students' perceptions of teachers' knowledge, and teachers' self-assessments, in relation to the ratings they received from classroom observations. There were 39 teachers and 390 students surveyed using an adapted research instrument. The findings highlight a nuanced relationship between teachers' beliefs, knowledge, and classroom performance. Although teachers strongly believe in inquiry-based approaches, their subject matter knowledge remains a concern. This gap could hinder the effective teaching of complex science concepts. The lack of a significant relationship between beliefs and observation ratings suggests that external factors—such as evaluation criteria, school resources, and administrative practices may influence classroom performance ratings more than teachers' personal beliefs or knowledge. The alignment between teachers' strengths in instructional adaptability and students' recognition of these strengths reinforces the importance of responsive teaching practices. However, the weak scores in Subject Matter Knowledge (SMK) suggest that professional development should focus on deepening teachers' mastery of scientific content.

Keywords: Teachers' Beliefs, Teachers' Knowledge, Classroom Observation Ratings

Introduction

Teachers' beliefs play a significant role in how they perceive students' learning and in how content needs to be taught and arranged (Wang et al., 2020). Teachers' beliefs shape the classroom environment and instructional decisions, which in turn can impact students' learning (Li et al., 2024). A teacher with strong values in technology may show enthusiasm that boosts students' motivation and engagement (Li Cheng et al.,2020).

Similarly, teachers' knowledge, pedagogical competency, and reasoning skills are critical to expanding student learning outcomes. Teacher quality has a crucial role in predicting student achievement. (Filgona et al., 2020). Higher knowledge of the teacher's delivery of the lesson will result in more student participation and a deeper understanding of the content. This emphasizes the value of teachers' knowledge and the significance of establishing solid constructions of knowledge for literacy education and the quality of instruction. (Troyer, 2022).

Consequently, the K–12 instructional quality criterion, which evaluates a teacher's performance in the classroom, is part of the Professional Rules for Teachers to accurately create professional development programs that are designed to meet each teacher's unique needs. DepEd has highlighted the significance of continuing to undertake regular class observations in order to ensure that all learners under its care receive an effective basic education (Barrogo, 2020).

Although teachers' beliefs and knowledge greatly influence classroom practices and student outcomes, their relation to classroom observation ratings remains unclear. It is also uncertain whether these ratings accurately reflect teachers' beliefs and knowledge in school science or if discrepancies exist.

To bridge this gap, this study investigates the relationship between teachers' ratings in classroom observations and their beliefs and knowledge in School Science.

Objectives of the Study

This study aimed to determine the relationship between Teachers' beliefs and knowledge in School Science, students' perceptions of teachers' knowledge, and teachers' self-assessments, in relation to their performance based on Classroom Observation Ratings.

Literature Review

This study is anchored in the theories of Wallace Bacon (2001), Don Elger (2007), Albert Bandura (1977), and Lee Shulman (1987).

According to Bacon (2001), performance involves meaningful interaction between the individual and the subject matter, which, in the educational context, can influence both teaching and learning outcomes. Elger's Theory of Performance outlines factors such as knowledge, context, and identity that contribute to individual performance, which are relevant in assessing teacher effectiveness. Shulman's Teacher Knowledge Framework highlights the importance of integrating content knowledge with pedagogy. It suggests that effective teachers possess the ability to adapt subject matter to students' learning needs, particularly in science education. Bandura's Social Learning Theory supports the idea that people learn through observation and interaction. This theory informs the study's focus on how students perceive and respond to their teachers' practices, and how teachers, in turn, are influenced by their teaching environment.

Together, these theories served as the foundation of the exploration of how teachers' beliefs and knowledge influence their professional performance in the classroom.

Methodology

The current study utilized a Descriptive Correlational Design using an adapted survey instrument. The respondents of the study were Science teachers and students. There were 39 Science teachers identified using Stratified sampling, and 390 students determined utilizing Quota Sampling.

An adapted survey questionnaire originally developed by Aldridge et al. (1997) and Tuan et al. (2000) was utilized in the study and was subjected to validity testing to ensure its relevance and suitability in the Philippine educational context. The items in the survey questionnaire were also analyzed to test their reliability. Using Cronbach's Alpha, the result of the reliability test for the research instrument used for teacher-respondents revealed a score of 0.965. The survey questionnaires were given face-to-face and through Google Forms.

The researcher ensured that the conduct of the study followed the proper protocol of the division. Ethical considerations were observed, especially for students below eighteen years old. The researcher made sure that the parents' consent would be asked for before conducting the study.

The data gathered were statistically treated using Mean and Standard Deviation and Spearman's rho.

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Results and Discussion

A. The average score reflecting teachers' beliefs in School Science

Table 1. Mean result on the extent of teachers' beliefs in school science.

	Mean	N	SD	Interpretation
Process of Scientific Inquiry	3.92	39	0.422	High Extent
Certainty of Scientific Knowledge	3.492	39	0.5023	High Extent
Process of School Science Inquiry	4.121	39	0.4414	Very High Extent
Certainty of School Science Knowledge	3.82	39	0.506	High Extent

Scale: 1.00 to 1.80 "Very low extent" 1.81 to 2.60 "Low Extent"
2.61 to 3.40 "Moderate Extent" 3.41 to 4.20 "High Extent"
4.21 to 5.00 "Very High Extent"

The findings from the study offer valuable insight into teachers' beliefs about science and how it is taught in schools. Among the four categories assessed, the Process of School Science Inquiry had the highest average score. This suggests that teachers have strong confidence in the structured and guided inquiry methods used in science classrooms. Their positive perception indicates a high level of support for inquiry-based instruction, which is likely seen as effective and appropriate for student learning.

In contrast, the lowest average score was recorded in the category Certainty of Scientific Knowledge. This reflects a degree of uncertainty or openness among teachers regarding the permanence of scientific knowledge. It suggests that many teachers view science as a field that continues to evolve and change with discoveries. Such a perspective may encourage critical thinking in students and help promote a more accurate understanding of how scientific knowledge develops over time.

In summary, teachers appear confident in their instructional methods but remain thoughtfully cautious about the fixed nature of scientific knowledge, which may enhance the quality of science education by fostering both inquiry and adaptability in learning.

B. Students' perceptions of Teachers' Knowledge in School Science, as measured by the average result.

Table 2. Mean result on the extent of students' perception of Teachers' Knowledge in School science

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	Mean	N	SD	Interpretation
Instructional Repertoire	4.124	39	0.2317	High Extent
Representative Repertoire (RR)	4.282	39	0.4364	Very High Extent
Subject matter knowledge	4.074	39	0.3416	High Extent
Knowledge of students' understanding	4.264	39	0.2897	Very High Extent

Scale: 1.00 to 1.80 "Very low extent" 1.81 to 2.60 "Low Extent"
2.61 to 3.40 "Moderate Extent" 3.41 to 4.20 "High Extent"
4.21 to 5.00 "Very High Extent"

As shown in Table 2, the highest average score was for Representative Repertoire (RR). This suggests that students consider their teachers to be very adept at choosing and utilizing a variety of models and teaching tools to make scientific concepts clearer and highlight key points in lessons.

In contrast, Subject Matter Knowledge (SMK) received the lowest average rating. Although students generally acknowledge that their teachers have a solid understanding of the science content, they feel that the teachers' ability to effectively convey and apply these ideas—particularly in demonstrating the relationship between science and technology—is somewhat lacking. The small standard deviation indicates that students' views on their teachers' expertise in subject matter were quite consistent.

C. The extent of teachers' perception of teachers' knowledge in School Science

Table 3. Mean result on the extent of teachers' perception of School Science.

	Mean	N	SD	Interpretation
Instructional Repertoire	4.023	39	0.4760	High Extent
Representative Repertoire (RR)	4.059	39	0.4587	High Extent
Subject matter knowledge	4.018	39	0.4229	High Extent
Knowledge of students' understanding	4.151	39	0.4684	High Extent

Scale: 1.00 to 1.80 "Very low extent" 1.81 to 2.60 "Low Extent"
2.61 to 3.40 "Moderate Extent" 3.41 to 4.20 "High Extent"
4.21 to 5.00 "Very High Extent"

Based on the results shown in Table 3, the highest mean value was recorded under the category Knowledge of Students' Understanding (KSU). This suggests that teachers generally feel confident in evaluating students' current understanding, recognizing areas that need improvement, and monitoring their overall learning progress.

On the other hand, the Subject Matter Knowledge (SMK) category received the lowest mean score while still indicating a positive perception; this relatively lower result implies that some teachers may have limited depth in content knowledge. Such limitations could influence the clarity, accuracy, and effectiveness with which scientific concepts are delivered in the classroom.

D. Relationship of Teachers' Beliefs in School Science towards Perception of Teachers' Knowledge in School Science

Table 4. Correlational Analysis between Teachers' Beliefs in School Science and Teachers' Perceptions of Teachers' Knowledge in School Science.

	r-value	Sig (2-tailed)	Decision	Interpretation
Process of Scientific Inquiry vs Instructional Repertoire	0.509	0.001	Reject H_0	Moderate, Highly Significant
Certainty of Scientific Knowledge vs Instructional Repertoire	0.367	0.002	Reject H_0	Weak, Significant
Process of School Science Inquiry vs Instructional Repertoire	0.524	0.001	Reject H_0	Strong, Highly Significant Relationship
Certainty of School Science Knowledge vs Instructional Repertoire	0.332	0.039	Reject H_0	Weak, Significant
Scientific Inquiry vs Representative Repertoire	0.356	0.026	Reject H_0	Weak, Significant
Certainty of Scientific Knowledge vs Representative Repertoire	0.488	0.002	Reject H_0	Moderate, Significant
Process of School Science Inquiry vs Representative Repertoire	0.662	0.000	Reject H_0	Strong, Highly Significant Relationship
Certainty of School Science Knowledge vs Representative Repertoire	0.366	0.022	Reject H_0	Weak, Significant
Scientific Inquiry vs Subject Matter Knowledge	0.347	0.030	Reject H_0	Weak, Significant

Certainty of Scientific Knowledge vs Subject Matter Knowledge	0.310	0.055	Accept H_0	Weak, No significant relationship
Process of School Science Inquiry vs Subject Matter Knowledge	0.559	0.000	Reject H_0	Moderate, Highly Significant Relationship
Certainty of School Science Knowledge vs Subject Matter Knowledge	0.301	0.062	Accept H_0	Weak, No significant relationship
Scientific Inquiry vs Knowledge of Students' Understanding	0.363	0.023	Reject H_0	Weak, Significant
Certainty of Scientific Knowledge vs Knowledge of Students' Understanding	0.378	0.018	Reject H_0	Weak, Significant
Process of School Science Inquiry vs Knowledge of Students' Understanding	0.641	0.000	Reject H_0	Strong, highly significant
Certainty of Scientific Knowledge vs Knowledge of Students' Understanding	0.323	0.045	Reject H_0	Weak, Significant relationship

Scale:*0.00 to 0.20 "Negligible"* *0.21 to 0.40 "Weak"*
0.41 to 0.60 "Moderate" *0.61 to 0.80 "Strong"*
0.81 to 1.00 "Very Strong"

Teachers who incorporate scientific inquiry into their practice are more likely to apply a broader range of teaching methods and instructional representations. These teachers also tend to have a deeper insight into how students learn and show greater mastery of scientific content. While confidence in scientific knowledge appears to encourage the use of varied teaching strategies and enhance the clarity of instruction, it does not necessarily equate to a more profound understanding of the subject matter.

In summary, the results highlight that both inquiry-based approaches and confidence in teaching science contribute to more adaptive and effective classroom practices, as well as improved awareness of student learning processes.

E. Concordance between students' perception of knowledge in School Science and teachers' perception of knowledge in School Science

Table 5. Presentation of the average results of students' and teachers' perceptions regarding knowledge in School Science.

Students' and teachers' perception of knowledge in Science in the following categories:	**r-value**	**Sig (2-tailed)**	**Decision**	**Interpretation**
Instructional Repertoire (IR)	-0.183	0.129	Failed to Reject Ho	Negligible, Not Sig
Representative Repertoire (RR)	-0.016	0.905	Failed to Reject Ho	Negligible, Not Sig
Subject Matter Knowledge (SMK)	0.268	0.054	Failed to Reject Ho	Weak, Not Sig
Knowledge of Students' Understanding (KSU)	0.078	0.524	Failed to Reject Ho	Negligible, Not Sig

Scale:0.00 to 0.20 "Negligible" 0.21 to 0.40 "Weak"
0.41 to 0.60 "Moderate" 0.61 to 0.80 "Strong"
0.81 to 1.00 "Very Strong"

The findings showed that students and teachers did not significantly agree in any of the assessed areas. For Instructional Repertoire, students tended to view their teachers' use of teaching strategies more positively, whereas teachers were often more critical of their own approaches. A similar difference was seen in the Representative Repertoire domain, where perceptions of content delivery varied. Students frequently regarded teachers as effective, even when teaching aids such as models or demonstrations were not used.

This trend continued in Subject Matter Knowledge, where teachers believed they had strong content mastery, while students sometimes felt otherwise. In the domain of Knowledge of Students' Understanding, contrasting views also emerged about how well students were grasping the lessons. Overall, the results indicate a disconnect between student and teacher perceptions of science instruction, which may influence the quality of classroom communication, teaching practices, and learning outcomes.

F. Correlation between Teachers' beliefs in School Science and their observed teaching performance

Table 6. Mean result of teachers' beliefs and teachers' performance in the classroom observation rating

Students vs Teachers' perception of knowledge in science in terms of the following areas:	Correlation Coefficient	Sig (2-tailed)	Decision	Interpretation
Instructional Repertoire (IR)	-0.025	0.880	Accept the Ho	Negligible, Not Significant
Representative Repertoire (RR)	-0.129	0.432	Accept the Ho	Negligible, Not Significant

Subject Matter Knowledge (SMK)	-0.080	0.629	Accept the Ho	Negligible, Not Significant
Knowledge of Students' Understanding (KSU)	-0.143	0.385	Accept the Ho	Negligible, Not Significant

Scale: 1.00 to 1.80 "Negligible" 1.81 to 2.60 "Weak"
2.61 to 3.40 "Moderate" 3.41 to 4.20 "Strong"
4.21 to 5.00 "Very Strong"

Teachers' beliefs have no significant effect on their performance during classroom observations. Beliefs related to instructional methods, diverse teaching approaches, content knowledge, and understanding of students' learning did not appear to influence how teachers were assessed. Although educators may see these aspects as beneficial to teaching, difficulties in implementing them effectively may limit their impact on observed performance.

Conclusion

While teachers showed strong confidence in inquiry-based science teaching, some uncertainty about scientific knowledge suggests they view science as an evolving discipline, influencing their instructional approach.

Subject Matter Knowledge received the lowest ratings, indicating gaps in content mastery or delivery. However, teachers were strong in understanding student needs and using varied teaching strategies, reflecting sound educational practices. Despite these strengths, no significant relationship was found between teachers' beliefs and their observation ratings. This suggests that external factors—such as classroom environment, school leadership, or evaluation methods—may have a greater influence on performance assessments.

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