

Teachers' Level of Efficiency and the Challenges of Inquiry-Based Teaching in Science: Basis for Teachers' Training Program

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Abstract— This study assessed the efficiency of Grades 4–6 Science teachers and the challenges they faced in implementing inquiry-based teaching in coastal schools in the District of Orion during the 2024–2025 school year. Utilizing a descriptive-correlational research design, it examined teachers' profiles, perceived challenges, and effectiveness in inquiry-based instruction among 24 respondents, including Science teachers and school heads. Findings revealed that teacher efficiency was influenced by self-discipline, critical thinking, problem-solving, and learner engagement. Challenges included the adequacy and usability of curriculum materials and the need for pedagogical support. A strong positive correlation ($r=0.680$, $p<0.001$) was found between teachers' efficiency and the challenges faced, suggesting more effective teachers managed difficulties better. The study recommends comprehensive training to enhance teachers' skills in inquiry-based teaching and suggests future longitudinal research to evaluate long-term impacts on teacher effectiveness and student achievement.

Keywords— level of proficiency, challenges of inquiry-based teaching, teachers' training program.

I. INTRODUCTION

Inquiry-based learning (IBL) is a student-centered approach that fosters knowledge through questioning, exploration, and evidence-based reasoning, mirroring authentic scientific inquiry in education. It promotes critical thinking, creativity, collaboration, and communication, positively impacting student motivation and academic performance (Kotsis, 2024; Arifin et al., 2025). Technology and scaffolding support differentiated learning in tackling complex scientific issues (Kamarudin & Mat Noor, 2024; Teig, 2021).

IBL implementation varies from structured inquiry with specific questions to open inquiry with complete student independence (Jobs, 2024). However, challenges such as inadequate training, limited resources, and restrictive curricula persist (Docherty-Skippen et al., 2020a; Brand, 2020). In the Philippines, initiatives like the Special Science Elementary School Project aim to boost scientific literacy and support inquiry-based instruction (Ederon, 2024; Magno, 2020). Evaluating teacher effectiveness and challenges can enhance inquiry-based science teaching and improve students' critical thinking skills.

The study focuses on how the challenges of inquiry-based teaching affect the efficiency of Grades 4–6 Science teachers in coastal schools in Orion during School Year 2024–2025. It explores teachers' demographics, the challenges related to resources and pedagogy, and evaluates their effectiveness in self-discipline and critical thinking. Additionally, the study examines potential differences in teacher efficiency based on profiles and the relationship between teaching challenges and efficiency, aiming to inform a targeted teacher-training program.

II. METHODS

The study utilized a quantitative, descriptive-correlational research design to investigate the challenges associated with inquiry-based teaching and to assess the effectiveness of Grades 4–6 Science teachers in coastal schools within the District of Orion for the 2024–2025 school year. It detailed the profiles of the respondents, evaluated their implementation of inquiry-based teaching, and analyzed the relationships among teachers' characteristics, teaching practices, and the challenges they faced, all without manipulating any variables.

The research adopted total population sampling, including all qualified Grades 4–6 Science teachers and master teachers from the selected schools who were directly involved in inquiry-based science instruction. This methodology allowed the researcher to gather comprehensive data on current classroom practices, identify significant patterns and relationships, and explore potential opportunities for enhancing inquiry-based teaching.

III. RESULTS AND DISCUSSION

PART I – Population of the Study

The respondents were Grades 4–6 Science teachers, Master Teachers, and School Heads from five purposively selected public elementary schools in the

coastal area of the District of Orion, Bataan: Camachile, Capunitan, Pablo Roman, Puting Buhangin, and Sta. Elena. The schools were chosen based on their coastal location, accessibility, involvement in inquiry-based science teaching, and similar environmental and socioeconomic conditions. The study focused on these settings because coastal communities provide meaningful contexts for investigating marine ecosystems, climate awareness, and disaster preparedness. Since the qualified teacher population was relatively small, universal sampling was used to include all Grade 4–6 Science teachers, ensuring comprehensive data collection and reliable findings regarding the effectiveness and challenges of inquiry-based teaching.

Table 1. *Profile of the Respondents*

Profile	Frequency	Percentage
Age		
29 years old and below	1	4.17
30 to 39 years old	2	8.33
40 to 49 years old	15	62.50
50 to 59 years old	5	20.83
60 years old and above	1	4.17
Educational Attainment		
Bachelor's Degree	6	25.00
with MA Units	15	62.50
Master's Degree	2	8.33
with Doctorate Units	1	4.17
Years of Experience		
5 to 9 years	3	12.50
10 to 14 years	3	12.50
15 to 19 years	2	8.33
20 to 24 years	6	25.00
25 years and above	10	41.67
Training in Teaching Methods and Strategies		
Online Courses & Certifications	3	12.50
Workshops & Seminars	9	37.50
Professional Development Programs	6	25.00
Self-Study	5	20.83
Peer Learning & Mentorship	1	4.17
Relevant Training in Inquiry-Based Teaching		
Without	18	75.00
With	6	25.00
Position		
Teacher	19	79.17
School Head	5	20.83

Number of Cases = 24

Among the 24 respondents, most were experienced teachers aged 40 to 49, holding graduate degrees and at least 20 years of teaching experience. Although they attended workshops, 75% lacked specific training in inquiry-based teaching, with few participating in

mentoring or peer collaboration. These findings emphasize the need for a sustained training program to enhance experienced teachers' practices, pedagogical knowledge, and support for effective inquiry-based science instruction.

Part II. Level of Efficiency

Indicators	Teacher	School Head	Mean	SD	DI
Self-Discipline	3.68	3.74	3.69	0.38	Very High
Critical Thinking	3.72	3.58	3.69	0.43	Very High
Problem-Solving Skills	3.66	3.84	3.70	0.40	Very High
Engagement	3.66	3.78	3.69	0.42	Very High
Exploration	3.67	3.72	3.68	0.48	Very High
Evaluation	3.59	3.58	3.59	0.49	Very High
Efficiency	3.05	3.70	3.67	0.38	Very High

Legend: 3.25-4.00 Strongly Agree (Very High); 2.50-3.24 Agree (High); 1.75-2.49 Disagree (Low); 1.00-1.74 Strongly Disagree (Very Low)

It describes the level of efficiency of teachers in inquiry-based teaching in terms of self-discipline, critical thinking, problem-solving skills, engagement, exploration, and evaluation.

The table shows that teachers and school heads rated all indicators of inquiry-based teaching efficiency as Very High, with overall means ranging from 3.59 for evaluation to 3.70 for problem-solving skills and an overall efficiency mean of 3.67. School heads generally gave higher ratings than teachers,

particularly for problem-solving skills, engagement, self-discipline, and exploration, while teachers rated critical thinking slightly higher; the comparatively lower evaluation score suggests an area for further improvement.

Part III. Challenges of Inquiry-based Teaching

It describes the challenges of inquiry-based teaching in terms of adequacy, availability, and usability of curriculum materials and resources, pedagogical knowledge, and support for inquiry activities.

Challenges on Inquiry-based Instruction

Indicators	Teacher	School Head	Mean	SD	DI
Curriculum Materials and Resources	3.28	3.28	3.28	0.45	Very High
Pedagogical Knowledge	3.45	3.58	3.48	0.49	Very High
Support for Inquiry Activities	3.31	3.68	3.38	0.52	Very High
Overall Status	3.35	3.51	3.38	0.45	Very High

Legend: 3.25-4.00 Strongly Agree (Very High); 2.50-3.24 Agree (High); 1.75-2.49 Disagree (Low); 1.00-1.74 Strongly Disagree (Very Low)

The findings indicate that all identified challenges in inquiry-based instruction were rated Very High, with pedagogical knowledge receiving the highest mean (3.48), followed by support for inquiry activities (3.38) and curriculum materials and resources (3.28), resulting in an overall mean of 3.38.

School heads generally perceived greater challenges than teachers, particularly regarding support for inquiry activities and pedagogical knowledge, highlighting the need for improved professional development, instructional resources, and institutional support.

Part IV. Comparison between the Level of Efficiency and Profile of the Respondents

Part IV presents the differences in the level of efficiency when teachers are grouped according to their profiles.

Level of Efficiency vis-à-vis Age

Variables	Group	Mean	Mean Rank	H	Sig.	Decision on Ho	Interpretation
Self-Discipline	30 to 39 years old	3.35	5.25	8.67	0.07	Failed to Reject	Not Significant
	40 to 49 years old	3.62	10.87				
	50 to 59 years old	3.96	18.80				
Critical Thinking	30 to 39 years old	3.25	5.25	7.61	0.11	Failed to Reject	Not Significant
	40 to 49 years old	3.69	12.37				
	50 to 59 years old	4.00	18.00				
Problem-Solving Skills	30 to 39 years old	3.35	5.50	7.92	0.09	Failed to Reject	Not Significant
	40 to 49 years old	3.62	11.17				
	50 to 59 years old	4.00	18.50				
Engagement	30 to 39 years old	3.10	4.75	7.69	0.10	Failed to Reject	Not Significant
	40 to 49 years old	3.63	11.47				
	50 to 59 years old	4.00	18.00				
Exploration	30 to 39 years old	3.35	6.00	6.42	0.17	Failed to Reject	Not Significant
	40 to 49 years old	3.59	11.57				
	50 to 59 years old	4.00	17.50				
Evaluation	30 to 39 years old	3.40	7.75	7.14	0.13	Failed to Reject	Not Significant
	40 to 49 years old	3.47	10.93				
	50 to 59 years old	4.00	18.50				
Overall	30 to 39 years old	3.30	5.50	9.52	0.06	Failed to Reject	Not Significant
	40 to 49 years old	3.60	10.87				

	50 to 59 years old	3.99	20.60				
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at .05 level of Sig.

The result of the analysis using the Kruskal-Wallis H-test shows that no significant differences were found in teachers' efficiency across age groups because all P

-values exceeded 0.05. Although teachers aged 50–59 had the highest ratings, the differences were not statistically significant.

Level of Efficiency vis-à-vis Educational Attainment

Variables	Group	Mean	Mean Rank	H	Sig.	Decision on H_0	Interpretation
Self-Discipline	Bachelor's Degree	3.67	10.42	3.37	0.34	Failed to Reject	Not Significant
	with MA Units	3.72	13.47				
	Master's Degree	3.90	16.25				
Critical Thinking	Bachelor's Degree	3.53	9.83	6.16	0.10	Failed to Reject	Not Significant
	with MA Units	3.81	14.80				
	Master's Degree	3.60	8.25				
Problem-Solving Skills	Bachelor's Degree	3.65	10.92	3.20	0.36	Failed to Reject	Not Significant
	with MA Units	3.74	13.53				
	Master's Degree	3.90	14.50				
Engagement	Bachelor's Degree	3.67	11.00	2.81	0.42	Failed to Reject	Not Significant
	with MA Units	3.69	12.80				
	Master's Degree	4.00	18.00				
Exploration	Bachelor's Degree	3.67	10.67	3.71	0.29	Failed to Reject	Not Significant
	with MA Units	3.69	13.13				
	Master's Degree	4.00	17.50				
Evaluation	Bachelor's Degree	3.58	12.92	1.78	0.62	Failed to Reject	Not Significant
	with MA Units	3.63	13.10				
	Master's Degree	3.60	10.75				
Overall	Bachelor's Degree	3.63	11.42	2.38	0.50	Failed to Reject	Not Significant
	with MA Units	3.71	13.63				
	Master's Degree	3.83	12.00				

at .05 level of Sig.

The result of the analysis using the Kruskal-Wallis H-test shows that no significant differences were found in teachers' efficiency across educational-attainment groups because all P -values ranged from 0.10 to 0.62,

exceeding the 0.05 significance level. Although teachers with master's degrees generally obtained higher ratings in several indicators, these differences were not statistically significant.

Level of Efficiency vis-à-vis Years of Experience

Variables	Group	Mean	Mean Rank	H	Sig.	Decision on Ho	Interpretation
Self-Discipline	5 to 9 years	3.77	10.50	2.67	0.62	Failed to Reject	Not Significant
	10 to 14 years	3.63	13.00				
	15 to 19 years	3.50	11.75				
	20 to 24 years	3.55	9.50				
	25 years and above	3.81	14.90				
Critical Thinking	5 to 9 years	3.63	8.83	3.27	0.51	Failed to Reject	Not Significant
	10 to 14 years	3.67	12.83				
	15 to 19 years	3.60	11.25				
	20 to 24 years	3.47	10.33				
	25 years and above	3.87	15.05				
Problem-Solving Skills	5 to 9 years	3.77	9.83	0.92	0.92	Failed to Reject	Not Significant
	10 to 14 years	3.67	13.17				
	15 to 19 years	3.65	12.25				
	20 to 24 years	3.60	11.67				
	25 years and above	3.76	13.65				
Engagement	5 to 9 years	3.60	10.67	1.85	0.76	Failed to Reject	Not Significant
	10 to 14 years	3.73	14.00				
	15 to 19 years	3.80	13.00				
	20 to 24 years	3.57	10.00				
	25 years and above	3.75	14.00				
Exploration	5 to 9 years	3.83	11.67	1.84	0.77	Failed to Reject	Not Significant
	10 to 14 years	3.67	13.00				
	15 to 19 years	3.30	9.50				
	20 to 24 years	3.50	10.67				
	25 years and above	3.83	14.30				
Evaluation	5 to 9 years	3.90	13.83	0.43	0.98	Failed to Reject	Not Significant
	10 to 14 years	3.67	13.83				
	15 to 19 years	3.50	11.50				
	20 to 24 years	3.47	11.50				
	25 years and above	3.56	12.50				
Overall	5 to 9 years	3.75	11.00	1.11	0.89	Failed to Reject	Not Significant
	10 to 14 years	3.67	14.17				
	15 to 19 years	3.56	12.75				
	20 to 24 years	3.53	10.42				
	25 years and above	3.76	13.65				

at .05 level of Sig.

No significant differences were found in teachers' efficiency across groups based on years of experience because all p-values ranged from 0.51 to 0.98, exceeding the 0.05 significance level. Although

teachers with 25 or more years of experience generally received higher ratings, the differences in all indicators were not statistically significant.

Level of Efficiency vis-à-vis Training in Teaching Methods and Strategies

Variables	Group	Mean	Mean Rank	H	Sig.	Decision on Ho	Interpretation
Self-Discipline	Online Courses & Certifications	3.73	9.00	4.13	0.39	Failed to Reject	Not Significant
	Workshops & Seminars	3.67	11.83				
	Professional Development Programs	3.77	14.50				
	Self-Study	3.76	15.30				
Critical Thinking	Online Courses & Certifications	3.63	8.83	4.41	0.35	Failed to Reject	Not Significant
	Workshops & Seminars	3.73	12.83				
	Professional Development Programs	3.77	15.17				
	Self-Study	3.70	12.90				
Problem-Solving Skills	Online Courses & Certifications	3.73	9.17	5.35	0.25	Failed to Reject	Not Significant
	Workshops & Seminars	3.62	11.56				
	Professional Development Programs	3.87	16.25				
	Self-Study	3.76	13.70				
Engagement	Online Courses & Certifications	3.50	9.50	3.18	0.53	Failed to Reject	Not Significant
	Workshops & Seminars	3.70	12.67				
	Professional Development Programs	3.78	13.92				
	Self-Study	3.80	14.10				
Exploration	Online Courses & Certifications	3.83	11.67	2.86	0.58	Failed to Reject	Not Significant
	Workshops & Seminars	3.61	11.78				
	Professional Development Programs	3.77	14.83				
	Self-Study	3.76	13.20				
Evaluation	Online Courses & Certifications	3.67	10.83	5.39	0.25	Failed to Reject	Not Significant
	Workshops & Seminars	3.39	10.11				
	Professional Development Programs	3.77	15.58				
	Self-Study	3.80	15.70				
Overall	Online Courses & Certifications	3.68	10.00	5.86	0.21	Failed to Reject	Not Significant
	Workshops & Seminars	3.62	10.44				
	Professional Development Programs	3.79	15.75				
	Self-Study	3.76	15.90				

at .05 level of Sig.

No significant differences were found in teachers' efficiency based on the type of training in teaching methods and strategies, as all p -values ranged from 0.21 to 0.58 and exceeded the 0.05 significance level.

Although participants in professional-development programs and self-study generally obtained higher ratings, these differences were not statistically significant.

Level of Efficiency vis-à-vis Relevant Training

Variables	Group	Mean	Mean Rank	U	Sig.	Decision on Ho	Interpretation
Self-Discipline	Without	3.67	11.56	37.00	0.24	Failed to Reject	Not Significant
	With	3.75	15.33				
Critical Thinking	Without	3.66	12.03	45.50	0.54	Failed to Reject	Not Significant
	With	3.83	13.92				
Problem-Solving Skills	Without	3.66	11.69	39.50	0.30	Failed to Reject	Not Significant
	With	3.78	14.92				
Engagement	Without	3.66	12.03	45.50	0.54	Failed to Reject	Not Significant
	With	3.77	13.92				
Exploration	Without	3.53	11.72	40.00	0.30	Failed to Reject	Not Significant
	With	3.75	14.83				
Evaluation	Without	3.64	11.83	42.00	0.39	Failed to Reject	Not Significant
	With	3.78	14.50				
Overall	Without	3.67	11.44	35.00	0.20	Failed to Reject	Not Significant
	With	3.75	15.67				

The result of the analysis using the Mann Witney U-test indicates that no significant differences were found in teachers' efficiency between those with and without relevant training, as all p -values ranged from

0.20 to 0.54 and exceeded the 0.05 significance level. Although teachers with relevant training obtained slightly higher mean scores and mean ranks across all indicators, the differences were not statistically significant.

Level of Efficiency vis-à-vis Position

Variables	Group	Mean	Mean Rank	U	Sig.	Decision on Ho	Interpretation
Self-Discipline	Teachers	3.72	12.00	38.00	0.49	Failed to Reject	Not Significant
	School Head	3.58	14.40				
Critical Thinking	Teachers	3.66	12.58	46.00	0.91	Failed to Reject	Not Significant
	School Head	3.84	12.20				
Problem-Solving Skills	Teachers	3.66	11.63	31.00	0.21	Failed to Reject	Not Significant
	School Head	3.78	15.80				
Engagement	Teachers	3.67	11.95	37.00	0.41	Failed to Reject	Not Significant
	School Head	3.72	14.60				
Exploration	Teachers	3.59	12.03	38.50	0.47	Failed to Reject	Not Significant

	School Head	3.58	14.30				
Evaluation	Teachers	3.66	12.32	44.00	0.79	Failed to Reject	Not Significant
	School Head	3.71	13.20				
Overall	Teachers	3.72	12.08	39.50	0.57	Failed to Reject	Not Significant
	School Head	3.58	14.10				

at .05 level of Sig.

No significant differences were found in teachers' efficiency according to position, as all p -values ranged from 0.21 to 0.91 and exceeded the 0.05 significance

level. Although school heads had higher mean ranks in most indicators, the efficiency ratings of teachers and school heads were statistically comparable.

Part V. Correlation of Level of Efficiency and Status of Challenges

Relationship between Variables

Indicators	R	Sig.	Decision on Ho	Interpretation
Curriculum Materials and Resources → Level of Efficiency	.579**	0.003	Reject	Significant
Pedagogical Knowledge → Level of Efficiency	.765**	<.001	Reject	Significant
Support for Inquiry → Level of Efficiency	.628**	0.001	Reject	Significant
Overall Status of Challenges → Level of Efficiency	.680**	<.001	Reject	Significant

Legend: r : $\pm 0.80-1.0$ Very Strong; $\pm 0.60-0.79$ Strong; $\pm 0.40-0.59$ Moderate; $\pm 0.20-0.39$ Weak; $\pm 0.00-0.19$ Very Weak

The finding shows significant positive relationships between all challenge indicators and teachers' level of efficiency, with curriculum materials and resources having a moderate correlation ($r = .579, p = .003$), support for inquiry having a strong correlation ($r = .628, p = .001$), and pedagogical knowledge having the strongest relationship ($r = .765, p < .001$). The overall correlation was also strong and significant ($r = .680, p < .001$); therefore, all null hypotheses were rejected, indicating that higher reported challenge levels were associated with higher measured efficiency, although this relationship does not establish causation.

IV. CONCLUSION AND RECOMMENDATIONS

The study found that factors like age, education, teaching experience, and formal training did not significantly impact teachers' implementation of inquiry-based teaching, leading to acceptance of the null hypothesis regarding teacher profile differences. This suggests that effectiveness relies more on factors

like beliefs, self-efficacy, resource access, mentoring, administrative support, and collaboration. Positive relationships were identified between teaching efficiency and resources, pedagogical knowledge, support for inquiry, and challenges, leading to the rejection of the null hypothesis about efficiency and challenges. This highlights the need for improved resources, professional development, and ongoing support systems.

- Teachers should use structured time-management strategies, including clear time limits, task segmentation, timers, checklists, and progress trackers, to manage each phase of inquiry-based lessons effectively.
- Teachers should use questioning strategies such as QFT, brainstorming, mind mapping, Think-Pair-Share, chalk talks, question posters, and word walls to help learners formulate meaningful scientific questions.
- Teachers should design real-world, collaborative problem-solving tasks that require learners to analyze situations, test hypotheses, apply

scientific concepts, and develop higher-order thinking skills.

- Teachers should model effective questioning and use prompts, graphic organizers, real-world examples, collaborative discussions, and exit slips to strengthen learners' self-questioning and critical-thinking abilities.
- Teachers should provide sufficient time and resources for learners to repeat experiments, analyze results, revise procedures, and improve their conclusions through continuous investigation.
- Teachers should use formative assessments such as concept maps, peer evaluations, reflective journals, and feedback activities to evaluate learners' inquiry skills and improve instruction.
- Schools should provide basic science equipment, inquiry-oriented lesson materials, experiment kits, multimedia resources, and a sustainable budget supported by school funds and community partnerships.
- Schools should provide continuous, hands-on professional development that models inquiry strategies, promotes reflection, strengthens teachers' self-efficacy, and extends beyond one-time workshops.
- Schools should establish formal mentoring and coaching programs in which experienced educators provide sustained guidance, feedback, and support for teachers implementing inquiry-based learning.
- Educational institutions should provide updated, standards-aligned, inquiry-based curriculum materials and train teachers to use them effectively in accordance with current curriculum requirements and scientific developments.
- Future researchers should conduct longitudinal and mixed-methods studies to examine long-term effects on teachers and learners, while also exploring AI tools, virtual laboratories, resource availability, training, and institutional support.

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