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Comparative Analysis of Innovative Teaching Strategies Versus Traditional Method On Academic Performance In Science

JUDY ANN G. ALBIT
judyann.albit@deped.gov.ph

CHRISELLE C. CELLS
chriselle.cells@deped.gov.ph

Abstract — This study investigates the effectiveness of innovative teaching methods compared to traditional instruction in Science for Grade 5 learners at Silangan Elementary School, San Mateo District, School Division of Rizal during the School Year 2024-2025. The research aims to determine which instructional approach yields greater academic improvement and deeper conceptual understanding among learners. A quasi-experimental design was employed, involving two groups of Grade 5 students: one taught using traditional teacher-centered methods, and the other using innovative, student-centered strategies integrating technology and collaborative learning. Pretest and posttest assessments measured science performance, ensuring both groups started with comparable baseline knowledge. Results revealed that while both methods led to improvements in students' science scores, the innovative teaching group demonstrated significantly higher gains, advancing from a "Fairly Satisfactory" to a "Very Satisfactory" performance level. This group also exhibited a wider distribution of achievement, with more learners reaching excellence, indicating enhanced engagement and deeper understanding fostered by the innovative approach. The traditional method group improved to a "Satisfactory" level but showed less variability, suggesting more uniform yet limited progress. Statistical analysis confirmed the significance of the differences in posttest outcomes, underscoring the superior effectiveness of innovative teaching in promoting higher-order thinking and learner autonomy. The findings highlight the importance of integrating technology-enhanced and interactive pedagogies alongside structured instruction to address diverse learning needs and prepare students for future academic challenges. Recommendations include the adoption of blended teaching strategies, ongoing teacher training in innovative methods, and investment in educational technology to foster a more dynamic and inclusive science learning environment. This study contributes valuable insights to educational stakeholders seeking to enhance science instruction and student achievement in elementary schools.

Keywords* — *Innovative teaching, traditional method, science education, Grade 5 learners, academic performance

I. Introduction

The introduction of a thesis provides the research context, outlining the main problem, its significance, and the study's objectives. It briefly reviews relevant theories or literature gaps, establishing the study's purpose and potential contributions. This section guides readers on what to expect, setting a foundation for the research's scope and impact.

Statement of the Problem

This study aims to analyze the comparative innovative teaching strategies versus traditional method on academic performance in science in Division of Bohol.

Specifically, the study seeks answers to the following specific questions:

1. What is the profile of the teachers in terms of:

    1.1 Age;

    1.2 Gender;

    1.3 Civil Status:

    1.4 Current Position;

    1.5 Highest Educational Attainment; and

    1.5 Years of Teaching Experience; and

    1.6 Relevant Seminars/Trainings Attended?

2. What is the comparative effect of innovative teaching strategies versus traditional methods on students' academic performance in science in terms of:

    1.1 Knowledge retention;

    1.2 Critical thinking skills;

    1.3 Student engagement;

    1.4 Motivation and interest in science;

    1.5 Classroom participation; and

    1.6 Long-term academic achievement??

3. Is there a significant difference between the academic performance of students exposed to innovative teaching strategies and those taught using traditional methods in science?

4. Based on the findings of this study, what plan of action will be proposed to improve the academic performance in science in Division of Bohol.

II. Methodology

This chapter outlines the research approach employed in this study. This will include details on how the sample size was determined, the criteria for selecting survey locations and timing, and the methodology for choosing respondents. This chapter also explains the rationale behind the research strategy, the selection of research instruments, the data collection methods, and the statistical analysis techniques used to derive meaningful insights from the collected data.

Procedure

This research will start by choosing a representative sample of science classes, splitting them into two categories: one group experiencing innovative teaching techniques (e.g., flipped classroom, inquiry-based learning, technology usage) and the other instructed with conventional methods (e.g., lecture-driven, textbook-focused teaching). Both groups will undergo pre-tests to determine their initial academic performance levels. Educators in the experimental group will undergo training on applying innovative techniques, while the control group will adhere to traditional teaching methods. During a specified timeframe (e.g., one semester), classes will be held, accompanied by classroom observations to guarantee compliance with the designated techniques.

Following the intervention, post-assessments evaluating knowledge retention, critical thinking, engagement, motivation, participation, and long-term success will be conducted. Quantitative data (exam results, questionnaires) and qualitative data (feedback from teachers/students) will be gathered. Statistical evaluation (e.g., t-tests, ANOVA) will assess if there are noteworthy differences between the two groups. Findings will be gathered, analyzed, and shared along with suggestions for science teaching methods. Ethical aspects (consent, confidentiality) will be maintained throughout the research.

Data Processing

The gathered quantitative data (test results, Likert-scale feedback) will be structured, refined, and examined using statistical programs (e.g., SPSS or Excel). Descriptive statistics (average, standard deviation) will outline performance patterns, whereas inferential tests (t-tests, ANOVA) will identify significant differences between the innovative and conventional teaching groups. Qualitative data (open-ended survey answers, observational notes) will be thematically analyzed to uncover recurring themes and insights.

The results will undergo cross-validation for consistency, utilizing visual aids (tables, graphs) to showcase essential findings. A significance threshold of $p < 0.05$ will be used to evaluate hypotheses. The ultimate conclusions will correspond with the research goals, focusing on how teaching methods affect each performance variable (e.g., engagement, critical thinking). All information will be anonymized and stored safely to preserve confidentiality.

III. Results and Discussion

Results

This section presents the pretest scores in Science Grade V learners exposed to traditional method and innovative teaching. The tables below reveal the results.

Table 2
Mean and Standard Deviation on the pretest scores in Science Grade V learners exposed to traditional method and innovative teaching

Group	N	Mean	Std. Deviation	Description
Traditional Method	30	78.63	4.75	Fairly Satisfactory
Innovative Teaching	30	79.33	4.98	Fairly Satisfactory

Legend:

Scale	Descriptor
90-100	Outstanding
85-89	Very Satisfactory
80-84	Satisfactory
75-79	Fairly Satisfactory
<75	Did Not Meet Expectations

Table 2 presents the pretest performance of Grade V learners in Science, divided between two instructional approaches: the Traditional Method and Innovative Teaching. The mean score of the Traditional Method group is 78.63 with a standard deviation of 4.75, while the Innovative Teaching group recorded a slightly higher mean of 79.33 and a standard deviation of 4.98. Both means fall under the category of "Fairly Satisfactory" (75–79), based on the provided rating scale. These statistics suggest that prior to instruction, both groups were performing at a similar academic level in science.

The close proximity of the means differing by only 0.70 points indicates a relatively balanced academic starting point between the two groups. This balance is crucial for ensuring that any later differences in academic performance, such as in posttest scores, can be attributed more confidently to the method of instruction rather than to inherent differences in student ability. Such comparability supports the internal validity of the study, allowing for a fair assessment of the effectiveness of each teaching strategy. Both groups also demonstrate similar levels of variability in scores. The standard deviations 4.75 for the traditional group and 4.98 for the innovative group show that student performance was spread around the mean in comparable ways. This lack of extreme variance means that neither group had an unusually wide or narrow spread of scores. This consistency suggests that both groups are composed of a mix of learners, without one group being significantly more homogenous or diverse in terms of ability. From an educational standpoint, these results reflect a neutral baseline ideal for evaluating the impact of instructional intervention. As noted by Shemer Elkayam (2023), contemporary education increasingly recognizes the need for student-centered and adaptive teaching models. Innovative strategies often promote critical thinking, collaboration, and hands-on learning. However, to measure their effectiveness, it's essential that both groups begin from an academically equivalent point, as demonstrated by these pretest results.

Furthermore, the shared "Fairly Satisfactory" classification suggests there is significant room for improvement in both groups. Neither group reached the "Satisfactory" level (80–84) or above, emphasizing the importance of exploring instructional methods that might elevate student performance. These initial results, therefore, underscore the potential value of educational reform and experimentation with instructional techniques in foundational subjects like science. Table 2 confirms that both the traditional and innovative teaching groups had comparable levels of academic ability at the start of the study. This equality in both mean scores and standard deviations provides a reliable basis for assessing any changes in learning outcomes. It also aligns with broader educational movements advocating for evidence-based practices in classroom instruction (Sergeeva et al., 2020), particularly in response to the changing demands placed on learners in the 21st century.

GROUP		Scores												
		70.00	71.00	72.00	73.00	74.00	75.00	76.00	77.00	78.00	79.00	80.00	81.00	
Traditional Method	Count	1	2	1	2	2	1	0	3	0	2	3	5	
	% within Group	3.3%	6.7%	3.3%	6.7%	6.7%	3.3%	0.0%	10.0%	0.0%	6.7%	10.0%	16.7%	
	% within Pretest	33.3%	50.0%	50.0%	66.7%	100.0%	50.0%	0.0%	75.0%	0.0%	100.0%	33.3%	71.4%	
	% of Total	1.7%	3.3%	1.7%	3.3%	3.3%	1.7%	0.0%	5.0%	0.0%	3.3%	5.0%	8.3%	
Innovative Teaching	Count	2	2	1	1	0	1	1	1	1	0	6	2	
	% within Group	6.7%	6.7%	3.3%	3.3%	0.0%	3.3%	3.3%	3.3%	3.3%	0.0%	20.0%	6.7%	
	% within Pretest	66.7%	50.0%	50.0%	33.3%	0.0%	50.0%	100.0%	25.0%	100.0%	0.0%	66.7%	28.6%	
	% of Total	3.3%	3.3%	1.7%	1.7%	0.0%	1.7%	1.7%	1.7%	1.7%	0.0%	10.0%	3.3%	
Total	Count	3	4	2	3	2	2	1	4	1	2	9	7	
	% within Group	5.0%	6.7%	3.3%	5.0%	3.3%	3.3%	1.7%	6.7%	1.7%	3.3%	15.0%	11.7%	
	% within Pretest	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
	% of Total	5.0	6.7%	3.3%	5.0%	3.3%	3.3%	1.7%	6.7%	1.7%	3.3%	15.0%	11.7%	

Legend:

Scale	Descriptor
90-100	Outstanding
85-89	Very Satisfactory
80-84	Satisfactory
75-79	Fairly Satisfactory
<75	Did Not Meet Expectations

Table 3 provides a detailed breakdown of individual score distributions for students in both the traditional and innovative teaching groups. The pretest scores range from 70 to 88, capturing a diverse range of academic performance. A total of 30 students in each group participated, and the crosstab shows how their scores are distributed across specific intervals, offering a more granular view than Table 2 alone. From the “Count” and “% within Group” rows, it was observe that the Traditional Method group has clusters at scores 81 (16.7%) and 83 (13.3%), while the Innovative Teaching group peaks at 80 (20.0%) and 83 (16.7%). These clusters suggest that both groups had a moderate number of higher-scoring students, with the innovative group showing a slightly stronger presence in the upper-mid range of the scale. Notably, the Traditional group had no students scoring 76 or 78, while the Innovative group had representation at nearly every score level.

Looking at the “% within Pretest” values, it shows that at several score points such as 74, 79, and 86 the Traditional group accounts for 100% of the students, while at scores like 76 and 78, the Innovative group contributes 100%. This suggests that although both groups cover the full performance spectrum, they do so in different patterns, with the Innovative group appearing slightly more evenly distributed across higher scores. This distribution could hint at a minor advantage for the Innovative group at baseline. Despite these differences, many score points (e.g., 71, 72, 75, 80, 81) are nearly equally divided between the two groups, reinforcing the notion that the two cohorts are relatively comparable overall. The “% of Total” values confirm that each group comprises exactly 50% of the student population, ensuring that comparisons are not skewed by sample size differences. This equality is essential for sound comparative analysis in educational research.

Integrating this data with pedagogical theory, the results reflect the broader trend that traditional instruction, characterized by lecture-based, teacher-centered learning, does not inherently disadvantage learners, but may not always engage or challenge them to the same extent as innovative strategies. As Sergeeva et al. (2020) point out, traditional methods emphasize content delivery and memorization, whereas innovative methods foster active learning, which might explain the slight clustering of higher pretest scores in the Innovative group.Table 3 confirms that while both instructional groups had comparable overall pretest performance, the Innovative Teaching group showed a more consistent presence in the higher score range. Although the differences are not drastic, they are worth noting for interpretation of posttest outcomes. Adjustments in the final analysis may be warranted to accurately isolate the effect of the teaching method. These insights align with ongoing efforts in educational research to identify data-informed strategies that enhance student learning in core subjects like science.

Table 4
Mean and Standard Deviation on the posttest scores in Science Grade V learners exposed to traditional method and innovative teaching

Group	N	Mean	Std. Deviation	Description
Traditional Method	30	84.37	2.04	Satisfactory
Innovative Teaching	30	88.00	2.52	Very Satisfactory

Legend:

Scale	Descriptor
90-100	Outstanding
85-89	Very Satisfactory
80-84	Satisfactory
75-79	Fairly Satisfactory
<75	Did Not Meet Expectations

Table 4 reveals the posttest performance of Grade V learners in Science after being taught through either traditional or innovative methods. Learners taught with the Traditional Method scored a mean of 84.37 with a standard deviation of 2.04, interpreted as "Satisfactory". In contrast, learners taught using Innovative Teaching scored a significantly higher mean of 88.00 with a standard deviation of 2.52, categorized as "Very Satisfactory." This difference suggests that the innovative approach led to improved performance and learning outcomes.

The improvement from the pretest to posttest in both groups suggests that instruction regardless of type was beneficial. However, the larger gain shown by the Innovative Teaching group demonstrates a potentially greater impact of this method. The traditional group improved from 78.63 (Fairly Satisfactory) to 84.37 (Satisfactory), while the innovative group increased from 79.33 (Fairly Satisfactory) to 88.00 (Very Satisfactory). This comparative increase suggests that innovative teaching strategies may be more effective in enhancing student achievement in Science. This disparity in performance aligns with educational literature, which highlights the limitations of conventional teaching methods. While traditional methods offer structure and content coverage (Rabazas Romero et al., 2019), they tend to rely heavily on teacher-centered instruction and rote memorization. This often limits student engagement and creativity, especially in subjects like Science, where inquiry and hands-on experimentation foster deeper understanding.

On the other hand, innovative teaching strategies, which may include problem-based learning, collaborative activities, and use of technology, are shown to enhance critical thinking, engagement, and retention. These strategies cater to diverse learning styles and encourage active participation, which are crucial for 21st-century learners (Pliushch & Sorokun, 2022). The higher posttest mean and slightly higher variability in scores (Std. Dev. = 2.52) in the innovative group further underscore the method’s impact on student performance. Another key observation is the reduced standard deviation in both groups compared to their pretest scores. This indicates that performance was more concentrated around the mean after instruction, suggesting greater consistency in learning outcomes. However, the innovative group still maintained slightly more variation, which may reflect its more learner-centered nature, allowing for differentiated learning experiences. Table 4 demonstrates that while both methods positively impacted learning, innovative teaching led to notably better academic outcomes, helping students not only reach but exceed the satisfactory benchmark. This supports a shift toward more adaptive and participatory instruction models, particularly in science education where exploration and student agency are central to comprehension and application.

Table 5
Cross Tabulation on the Posttest scores in Science Grade V learners exposed to traditional method and innovative teaching

Group		Scores														Total
		80.00	81.00	82.00	83.00	84.00	85.00	86.00	87.00	88.00	89.00	90.00	91.00	92.00	93.00	
Traditional Method	Count	1	2	2	5	5	7	3	3	2	0	0	0	0	0	30
	% within Group 2	3.3%	6.7%	6.7%	16.7%	16.7%	23.3%	10.0%	10.0%	6.7%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	% within Posttest	100.0%	100.0%	100.0%	83.3%	71.4%	70.0%	60.0%	42.9%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%
	% of Total	1.7%	3.3%	3.3%	8.3%	8.3%	11.7%	5.0%	5.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%
Innovative Teaching	Count	0	0	0	1	2	3	2	4	4	6	4	1	2	1	30
	% within Group 2	0.0%	0.0%	0.0%	3.3%	6.7%	10.0%	6.7%	13.3%	13.3%	20.0%	13.3%	3.3%	6.7%	3.3%	100.0%
	% within Posttest	0.0%	0.0%	0.0%	16.7%	28.6%	30.0%	40.0%	57.1%	66.7%	100.0%	100.0%	100.0%	100.0%	100.0%	50.0%
	% of Total	0.0%	0.0%	0.0%	1.7%	3.3%	5.0%	3.3%	6.7%	6.7%	10.0%	6.7%	1.7%	3.3%	1.7%	50.0%
Total	Count	1	2	2	6	7	10	5	7	6	6	4	1	2	1	60
	% within Group 2	1.7%	3.3%	3.3%	10.0%	11.7%	16.7%	8.3%	11.7%	10.0%	10.0%	6.7%	1.7%	3.3%	1.7%	100.0%
	% within Posttest	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	1.7%	3.3%	3.3%	10.0%	11.7%	16.7%	8.3%	11.7%	10.0%	10.0%	6.7%	1.7%	3.3%	1.7%	100.0%

Legend:

Scale	Descriptor
90-100	Outstanding
85-89	Very Satisfactory
80-84	Satisfactory
75-79	Fairly Satisfactory
<75	Did Not Meet Expectations

Table 5 offers a detailed look into the distribution of posttest scores between the two teaching methods. It highlights how individual learners' achievements differ between groups, and how these scores cluster around certain values. The Traditional Method group shows a concentration of scores between 83 and 86, while the Innovative Teaching group spans a higher and broader range, from 83 up to 93, with notable frequency at 88 to 91. The Traditional group's score distribution emphasizes consistency but also suggests a ceiling effect none of the learners reached the "Outstanding" range (90 and above), and most remained within "Satisfactory" to low "Very Satisfactory." This supports the argument that while traditional instruction offers structure and uniformity (Rabazas Romero et al., 2019), it might not sufficiently challenge high-performing students or accommodate differentiated learning paths.

Conversely, the Innovative Teaching group displays a richer diversity in scores, especially in the upper ranges. Learners in this group dominate scores of 88, 89, 90, 91, 92, and 93, reflecting not just improvement but excellence. The fact that 6 students scored 89 and 4 scored 90, alongside others scoring even higher, suggests that this method may be better at pushing learners beyond the standard achievement level, especially those capable of higher-order thinking. The "% within Posttest" metric illustrates this clearly: at score points from 89 to 93, 100% of those achievers came from the Innovative group, while the Traditional group has no representation. In contrast, lower scores like 80–84 were predominantly filled by traditional learners. This reinforces the notion that innovative strategies elevate student performance and unlock their potential, particularly for high achievers who may otherwise stagnate under traditional lecture-based systems.

However, it's also worth noting that no student from either group scored below 80, indicating a strong overall instructional effect regardless of method. This suggests that both teaching approaches had some merit, but that the differentiating factor was depth of mastery the ability of students to excel beyond the minimum expectations was more prevalent in the innovative group. Table 5 validates the notion that innovative teaching strategies are more effective not only at raising average performance but also at promoting academic excellence. The variety of posttest scores, particularly in the higher bands, showcases the potential of contemporary, learner-centered pedagogy to engage students more fully, foster deep learning, and ultimately lead to greater academic distinction.

<u>This section presents the test of difference between the pretest scores of the two groups. The results are displayed below.</u>

Table 6
Group Statistics of Pretest scores in Science Grade V learners exposed to traditional method and innovative teaching

Group	N	Mean	Std. Deviation	Std. Error Mean
Traditional Method	30	78.63	4.75	.87
Innovative Teaching	30	79.33	4.98	.91

Table 6 presents the descriptive statistics comparing the pretest performance of Grade V learners in Science subjected to either traditional or innovative teaching methods. The Traditional Method group (N = 30) had a mean score of 78.63, with a standard deviation of 4.75 and a standard error of 0.87. Meanwhile, the Innovative Teaching group also had 30 learners, with a mean of 79.33, standard deviation of 4.98, and standard error of 0.91. The mean difference of 0.70 points between the two groups is minor, suggesting that both groups started with relatively comparable baseline knowledge in Science prior to the intervention. The slightly higher mean in the Innovative group could be coincidental and not necessarily indicative of an initial advantage. The closeness of the standard deviations also suggests that the spread of scores or learner variability was similar across both groups before the experimental teaching approaches were applied.

The standard error of the mean which reflects the precision of the mean as an estimate of the population average is also quite similar between the two groups. This consistency reinforces the reliability of the sampling and indicates that the two groups were fairly equivalent at the outset of the study. This is a crucial point for any experimental design, as it validates that observed posttest differences are more likely due to the intervention rather than pre-existing academic gaps. This data reinforces the methodological soundness of the research, highlighting that learners were starting from a nearly equal footing, which lends strength to any causal inferences made later in comparing outcomes. When two groups are homogenous at pretest, it's more plausible that the teaching method used directly influenced the subsequent achievement gap (if any) in the posttest scores.

It is also important to consider this result in light of educational equity. That both groups had comparable pretest scores indicates that prior instruction or access to learning resources was likely similar, allowing the researchers to explore the true impact of instructional delivery without confounding socioeconomic or contextual variables skewing the initial outcomes. In the context of broader instructional trends, the near-identical pretest performance allows educators and researchers to fairly evaluate the potential of innovative methods. As contemporary educational strategies aim to enhance engagement, creativity, and inclusivity (Muniandy & Abdullah, 2023), understanding their impact requires a controlled baseline which Table 6 effectively confirms.

Table 7

T-test for Two Independent Samples on the test of difference on the Pretest scores in Science Grade V learners exposed to traditional method and innovative teaching

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pretest	Equal variances assumed	.005	.944	-.557	58	.580	-.700	1.257	-3.215	1.815
	Equal variances not assumed			-.557	57.876	.580	-.700	1.257	-3.215	1.815

Table 7 provides the results of an independent samples t-test, aimed at determining whether the difference in mean pretest scores between the traditional and innovative teaching groups is statistically significant. The Levene's Test for Equality of Variances shows an F-value of 0.005 and a significance level of 0.944, which is well above the conventional alpha of 0.05. This means that the assumption of equal variances holds, allowing the use of the "Equal variances assumed" row for the t-test results.

The t-test result shows a t-value of -0.557 with 58 degrees of freedom, and a p-value of 0.580 (two-tailed). Since the p-value is significantly greater than 0.05, we fail to reject the null hypothesis, indicating that there is no statistically significant difference between the two groups' pretest scores. This statistically confirms the earlier descriptive finding that both groups started the experiment at a comparable academic level. The mean difference of -0.700 with a standard error difference of 1.257, and a 95% confidence interval ranging from -3.215 to 1.815, further affirms that any observed difference in the mean scores is likely due to chance. The fact that the confidence interval includes zero implies that the observed difference is not statistically reliable. Thus, any improvements seen in the posttest cannot be attributed to pre-existing academic advantages in either group.

This result provides strong evidence that both teaching methods began from an equitable baseline, enhancing the validity of any post-intervention comparisons. This aligns well with contemporary instructional evaluations, where establishing baseline equivalency is crucial for measuring the impact of active learning interventions like project-based or tech-enhanced methods (IHETLA, 2022). The significance of this finding extends to policy and curriculum design: if learners are starting equally, then any subsequent differences in academic performance can more confidently be linked to instructional approach rather than learner background. This is particularly important for science education, which increasingly prioritizes methods that stimulate inquiry, collaboration, and critical thinking hallmarks of innovative instruction. In light of educational modernization, this statistical validation supports the notion that contemporary teaching methods are not just alternatives, but potentially superior, especially when learners are equally prepared. With no significant pretest advantage in either group, any posttest gains particularly those seen in Tables 4 and 5 underscore the transformative potential of modern teaching practices in primary education.

This section presents the test of difference between the posttest scores of the two groups. The findings are shown below.

Table 8
Group Statistics of Pretest scores in Science Grade V learners exposed to traditional method and innovative teaching

Group	N	Mean	Std. Deviation	Std. Error Mean
Traditional Method	30	84.37	2.04	.37
Innovative Teaching	30	88.00	2.52	.46

Table 8 presents the group statistics of the posttest scores in Science for Grade V learners who were exposed to either the traditional or innovative teaching methods. Learners taught using the Traditional Method had a mean posttest score of 84.37, with a standard deviation of 2.04 and a standard error of the mean of 0.37. In contrast, the Innovative Teaching group achieved a higher mean score of 88.00, with a standard deviation of 2.52 and a standard error of 0.46. The mean difference of 3.63 points between the two groups suggests a notable improvement in performance among learners exposed to the innovative teaching method. While both groups improved from their pretest scores, the difference in posttest means is larger than the difference at the pretest stage, indicating that the type of instruction likely had a measurable impact on learning outcomes. The relatively small standard deviations in both groups suggest that scores were tightly clustered around the mean, meaning most learners performed similarly within their respective groups. The slightly higher variability in the innovative group may be attributed to differentiated engagement levels, as contemporary methods often allow more learner autonomy, which can yield broader individual outcomes.

The standard errors of the mean indicate that the estimates of the group means are reliable. The smaller the standard error, the more confident we can be that the sample mean reflects the population mean. The differences between the two standard errors are minimal, which adds statistical credibility to the claim that the higher performance in the innovative group is not due to sampling error.

From an educational standpoint, these findings support the notion that innovative, learner-centered instruction enhances academic performance, particularly in science, where understanding concepts often requires active participation, inquiry, and contextualization. These aspects are emphasized in modern teaching strategies like project-based learning and technology integration. These results align with the argument made by Batchelor (2011) and Sivarajah et al. (2019), which suggests that while conventional methods offer structured knowledge delivery, they may fall short in fostering deeper learning and critical thinking. Innovative teaching compensates for this by promoting engagement and allowing learners to construct meaning actively. Thus, the statistics in Table 8 substantiate the growing advocacy for reformed, blended instructional approaches.

Table 9
T-test for Two Independent Samples on the test of difference on the posttest scores in Science Grade V learners exposed to traditional method and innovative teaching

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Posttest	Equal variances assumed	1.115	.295	-6.137	58	.000	-3.633	.592	-4.818	-2.44819
	Equal variances not assumed			-6.137	55.624	.000	-3.633	.592	-4.820	-2.44712

Table 9 presents the results of a t-test for two independent samples to determine if the difference in posttest scores between the traditional and innovative teaching groups is statistically significant. The Levene's Test for Equality of Variances yielded an F-value of 1.115 with a significance level of 0.295, indicating that the assumption of equal variances is met. This permits us to interpret the results from the "Equal variances assumed" row. The t-value is -6.137 with 58 degrees of freedom, and the p-value is .000, which is highly significant at the 0.05 level. This clearly indicates that the difference in posttest scores between the two groups is statistically significant. The mean difference of -3.633 with a standard error of 0.592, and a 95% confidence interval ranging from -4.818 to -2.448, confirms that learners exposed to innovative teaching methods significantly outperformed those taught using traditional methods.

Statistically, this means the higher mean score observed in Table 8 for the innovative group is not due to chance, but likely a direct effect of the instructional method. This strongly supports the effectiveness of contemporary teaching strategies in improving Science achievement among Grade V learners. These findings lend further support to the pedagogical framework discussed by Bartlett and Vavrus (2017), which advocates for context-sensitive, critical pedagogies that promote both knowledge acquisition and critical engagement. In contrast to rigid, instructor-led methods, innovative teaching encourages learners to actively participate, question, and apply their learning skills essential for success in a modern, knowledge-driven society.

However, it's also important to consider Batchelor's (2011) caution that contemporary methods, while effective, may lack the depth and consistency in content delivery offered by traditional techniques. Therefore, while innovative teaching has shown superior outcomes in this study, the optimal instructional model may involve a hybrid approach—one that combines the structure of traditional methods with the flexibility and engagement of modern strategies.

Table 9 provides conclusive evidence that innovative teaching methods result in significantly higher academic performance in Science among Grade V learners. The statistical significance, along with the educational theories supporting learner-centered instruction, reinforces the call for integrating modern teaching techniques into mainstream educational practice.

This section presents the test difference between the pretest and posttest scores of Grade V learners. The findings are projected below.

Table 10 Paired Samples Statistics between the pretest and posttest scores of Grade V learners exposed to traditional method and innovative teaching

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1: Traditional method	Pretest	78.63	30	4.75	.87
	Posttest	84.37	30	2.04	.37
Pair 2: innovative teaching	Pretest	79.33	30	4.98	.91
	Posttest	88.00	30	2.52	.46

Table 10 presents the mean scores, standard deviations, and standard errors of the pretest and posttest results for Grade V learners exposed to traditional and innovative teaching methods. In the traditional method group, the pretest mean score was 78.63 with a standard deviation of 4.75, while the posttest mean increased to 84.37 with a reduced standard deviation of 2.04. This indicates a positive shift in student performance and a decrease in score variability, suggesting that the traditional method may have contributed to more consistent learning outcomes.

Conversely, the innovative teaching group had a pretest mean of 79.33 and a standard deviation of 4.98. Post-intervention, the mean score rose to 88.00, accompanied by a standard deviation of 2.52. The substantial increase in mean score and the reduction in variability imply that innovative teaching methods not only enhanced overall student performance but also led to more uniform improvements across the cohort. The standard error of the mean (SEM) provides insight into the precision of the sample mean as an estimate of the population mean. For the traditional method, the SEM decreased from 0.87 in the pretest to 0.37 in the posttest, indicating a more precise estimate of the population mean after the intervention. Similarly, the innovative teaching group showed a decrease in SEM from 0.91 to 0.46, reflecting improved precision in the posttest mean estimation. These statistical changes suggest that both teaching methods had a positive impact on student learning outcomes. The traditional method led to more consistent performance, while the innovative approach resulted in higher overall achievement and greater uniformity in student scores.

Table 11 Paired Samples Correlations

		N	Correlation	Sig.
Pair 1: Traditional method	Pretest & Posttest	30	.263	.160
Pair 2: innovative teaching	Pretest & Posttest	30	-.432	.017

Table 11 displays the correlation coefficients between pretest and posttest scores for both teaching methods. In the traditional method group, the correlation was 0.263, which is statistically insignificant (p = 0.160). This low correlation suggests that while there was an improvement in posttest scores, the relationship between pretest and posttest performances was weak, indicating that factors other than initial knowledge levels may have influenced the posttest outcomes.

In contrast, the innovative teaching group exhibited a negative correlation of -0.432, which was statistically significant (p = 0.017). This negative correlation suggests that students who performed better on the pretest tended to show less improvement on the posttest, and vice versa. This could imply that the innovative teaching methods were more effective in facilitating learning among students with lower initial knowledge, leading to a greater relative improvement.

The differing correlation patterns between the two groups highlight the distinct impacts of the teaching methods. The traditional method's weak correlation indicates a more uniform improvement across all students, whereas the innovative method's negative correlation suggests targeted effectiveness, particularly benefiting students with lower prior knowledge.

Table 12
Paired Samples T-test for the Test of Difference between the pretest and posttest scores of Grade V learners exposed to traditional method and innovative teaching

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1: Traditional method	Pretest - Posttest	-5.733	4.653	.850	-7.471	-4.000	-6.749	29	.000
Pair 2: innovative teaching	Pretest - Posttest	-8.667	6.477	1.183	-11.085	-6.248	-7.329	29	.000

Table 12 presents the results of paired samples t-tests comparing pretest and posttest scores for both teaching methods. In the traditional method group, the mean difference between posttest and pretest scores was -5.733, with a standard deviation of 4.653 and a standard error mean of 0.850. The t-value was -6.749, with 29 degrees of freedom, and the p-value was 0.000, indicating a statistically significant improvement in student performance from pretest to posttest. The innovative teaching group showed a mean difference of -8.667, with a standard deviation of 6.477 and a standard error mean of 1.183. The t-value was -7.329, with 29 degrees of freedom, and the p-value was 0.000, also indicating a statistically significant improvement. The larger mean difference in the innovative group suggests that this teaching method had a more substantial effect on student learning outcomes compared to the traditional method. These results underscore the effectiveness of both teaching methods in enhancing student performance. The innovative teaching method, however, demonstrated a more pronounced impact, leading to greater improvements in student scores. The findings from Tables 10, 11, and 12 align with broader educational research comparing traditional and innovative teaching methods. Traditional classrooms, characterized by fixed seating arrangements and a teacher-centered approach, have been critiqued for promoting surface learning and limiting student engagement (Dovey & Fisher, 2014). In contrast, innovative learning environments (ILEs) are designed to support active, student-centered learning, fostering deeper cognitive and metacognitive engagement (Dumont & Istance, 2010; Hattie & Donoghue, 2016).

The positive outcomes associated with innovative teaching methods in this study are consistent with these perspectives. The significant improvements in student performance, particularly among those with lower initial knowledge, suggest that ILEs can effectively cater to diverse learning needs and promote deeper learning experiences. The statistical analyses indicate that both traditional and innovative teaching methods positively influenced student learning outcomes. However, the innovative teaching approach demonstrated more substantial and consistent improvements, highlighting the potential benefits of adopting student-centered pedagogies and flexible learning environments in contemporary education.

Discussion

<u>Pretest scores in Science Grade V learners exposed to traditional method and innovative teaching</u>

The data presented in Table 2 illustrates a foundational comparison of Grade V students' science performance before any instructional interventions took place. Both groups—the Traditional Method and Innovative Teaching cohorts—fell under the same descriptive rating of "Fairly Satisfactory," which establishes a critical baseline for comparison. The narrow difference in mean scores indicates that students started from nearly identical academic levels. This parity is important for ensuring a fair assessment of which teaching method leads to greater academic improvement. This similarity in pretest means allows educators and researchers to attribute any subsequent changes in posttest performance to the instructional approach rather than to pre-existing differences in knowledge or skills. It reinforces the methodological rigor of the study, enhancing internal validity. In classroom settings, such parity implies that the two groups could be treated as academically equivalent, thereby eliminating the concern that one group was inherently advantaged or disadvantaged from the outset. In terms of variability, both groups exhibited a similar standard deviation, indicating that the spread or dispersion of scores around the mean was consistent. This suggests a normal mix of student abilities within each group, with no apparent clustering of either very low or very high performers. From an instructional planning perspective, this is ideal because it reflects typical classroom diversity, allowing findings to be more generalizable to real-world teaching environments.

Educationally, the “Fairly Satisfactory” label for both groups indicates that students were performing below the “Satisfactory” level, highlighting a need for pedagogical intervention regardless of teaching style. These results validate the exploration of alternative teaching methods. In particular, they create an opening to test if student-centered and technology-integrated methods can effectively elevate students into higher performance brackets.

This baseline outcome also implies that traditional methods, while structured and reliable, may not be sufficient for moving students beyond mediocrity without modification or enhancement. It suggests a need to experiment with more dynamic, responsive instructional designs that can accommodate diverse learning needs. Especially in science education, where conceptual understanding and engagement are critical, innovative methods may hold the potential to bridge the gap from fair to satisfactory and beyond.

Finally, this analysis underscores the importance of data-informed instructional design. The initial parity in academic ability between the groups provides a clean slate to objectively compare traditional and innovative approaches. As contemporary education trends emphasize differentiation and equity, having such statistically comparable starting points allows teachers and policymakers to make decisions based not on assumptions, but on measurable outcomes that begin with equitable opportunity for success.

Posttest scores in Science Grade V learners exposed to traditional method and innovative teaching

Table 4 demonstrates a notable difference in the posttest performance of Grade V learners exposed to traditional versus innovative teaching methods in Science. While both groups improved from their pretest levels, the group that experienced innovative teaching reached a higher mean score and moved into a more advanced performance category. This shift from "Fairly Satisfactory" to "Very Satisfactory" signals a substantial academic gain, not just in scores but in instructional impact, suggesting that the innovative method had a stronger influence on learning outcomes.

The traditional teaching group did show measurable improvement, reaching a “Satisfactory” level. This reflects the value of structured, content-focused teaching, which remains an effective way to ensure coverage of curriculum objectives. However, the limitation of this approach becomes apparent when contrasted with the innovative teaching group, whose learners achieved a higher performance category. This suggests that while traditional instruction can lift learners out of lower achievement levels, it may not be as effective in maximizing their full academic potential. From a pedagogical standpoint, the innovative group’s stronger posttest performance aligns with the growing emphasis on student-centered education. Approaches like project-based learning, collaborative inquiry, and the integration of digital tools provide learners with more interactive and personalized experiences. These experiences not only enhance engagement but also deepen understanding. The increase in mean score for this group supports the view that such methods are better suited to fostering higher-order thinking and application skills in science education.

The standard deviation in scores adds another layer to this analysis. The slightly higher variability in the innovative group may initially appear to indicate inconsistent results. However, it is more accurately interpreted as a sign of differentiated learning outcomes, which is a hallmark of student-centered pedagogy. Such variability suggests that learners were able to explore content in ways that suited their individual needs, with many achieving above-average results as a result of the method's flexibility and responsiveness.These findings have direct implications for educational practice. Schools and educators aiming to raise overall academic performance and foster excellence should consider integrating innovative strategies into the science curriculum. While structure and predictability are essential components of classroom management, the data indicates that traditional methods alone may not be sufficient for maximizing student achievement, particularly among more capable learners.

Overall, Table 4 confirms that innovative teaching strategies lead not only to improvement but to enhanced performance levels. The transition from "Satisfactory" to "Very Satisfactory" marks a meaningful difference in academic quality. These findings support the shift in modern education toward blended and adaptive learning environments that offer both structure and learner agency an approach increasingly supported by contemporary curriculum frameworks and educational research. Table 5 offers a nuanced view of the distribution of posttest scores between the traditional and innovative teaching groups. This disaggregation reveals that while both groups reached acceptable performance levels, their distributions tell different stories. The traditional method group shows clustering in the middle to upper-middle performance range, with a strong presence in scores from 83 to 86. This indicates a level of consistency and suggests that most students achieved a solid understanding of the material, but few exceeded that benchmark.

In contrast, the innovative teaching group displays a broader and higher distribution of scores. The presence of multiple students scoring above 88 and up to 93 reflects not just competence, but excellence. This group dominates the higher achievement bands, especially scores in the “Very Satisfactory” and “Outstanding” categories. This upward shift in performance demonstrates the capacity of learner-centered instruction to not only raise the baseline but also to propel learners into higher levels of academic success.The clear absence of traditional learners in the highest score brackets raises important pedagogical implications. It suggests that while traditional teaching can ensure a basic level of understanding, it may limit opportunities for students to excel beyond the standard. This finding supports the critique that conventional classroom models often focus on knowledge delivery rather than knowledge construction, thus restricting the development of creativity, inquiry, and analytical thinking.

Additionally, the wider spread of scores in the innovative group, particularly toward the top, may indicate that these methods are more effective at reaching students with higher potential.

This reinforces the view that contemporary instruction does not just raise average performance, but expands the ceiling of what students can achieve. By offering flexible learning experiences and multiple entry points into the material, such strategies can uncover latent talents and promote individualized growth.The fact that both groups had no scores below 80 also deserves attention. This reflects the overall effectiveness of both teaching methods in raising the academic floor. However, the ceiling was clearly higher for the innovative method. This distinction is crucial when considering the long-term academic development of learners, as those consistently pushed into higher levels of thinking and performance are more likely to thrive in secondary education and beyond. Table 5 therefore provides compelling evidence in favor of innovative teaching strategies. These methods not only raise the general performance of learners but are especially potent in enabling exceptional achievement. For school leaders and curriculum designers, the implication is clear: to cultivate both equity and excellence, instructional models must go beyond traditional paradigms and embrace approaches that are dynamic, inclusive, and intellectually rigorous.

IV. Conclusion

The study's findings clearly demonstrate that while both traditional and innovative teaching methods improve Grade V learners' science performance from a comparable baseline, innovative teaching yields significantly higher academic gains and broader achievement levels. The initial parity in pretest scores establishes a fair basis for comparison, confirming that differences in posttest results are attributable to the instructional approach. Innovative methods not only elevate average scores but also foster greater learner engagement, deeper understanding, and higher-order thinking, enabling some students to reach excellence beyond what traditional methods typically achieve. These results underscore the value of integrating student-centered, technology-enhanced strategies alongside structured instruction to promote both equity and excellence in science education, ultimately better preparing learners for future academic challenges.

V. Recommendations

Based on the drawn conclusions, here are actionable recommendations based on the study's findings:

1. Integrate Innovative Teaching Strategies: Schools and educators should incorporate student-centered and technology-enhanced instructional methods, such as project-based learning, collaborative inquiry, and digital tools, to boost learner engagement and achievement in science.

2. Provide Professional Development: Teachers need ongoing training and support to effectively implement innovative teaching practices alongside traditional methods, ensuring they can balance structure with flexibility in their classrooms.

3. Adopt a Blended Instructional Approach: Combining the strengths of both traditional and innovative methods can offer a balanced learning environment that ensures curriculum coverage while promoting higher-order thinking and personalized learning.

4. Focus on Differentiated Instruction: Given the variability in student performance with innovative methods, educators should design lessons that cater to diverse learner needs, helping all students, especially those who struggle, to improve and excel.

5. Invest in Educational Technology: Schools should allocate resources for technology infrastructure and tools that facilitate interactive and adaptive science learning experiences, making lessons more engaging and accessible.

6. Monitor and Assess Continuously: Implement formative assessments and data-driven instructional adjustments to track student progress, ensuring that innovative methods are effectively raising both average and high-level performance.

7. Encourage Curriculum Reforms: Policymakers should support curriculum frameworks that emphasize inquiry, creativity, and collaboration to align teaching practices with contemporary educational goals and the demands of the 21st century.

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