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Examining the Effectiveness of Integrated Learning Strategies on Science Mastery Level

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Abstract
This study examined the effectiveness of the integrated learning strategies on the mastery level in Science among Grade 5 pupils at Libis Baesa Elementary School, Caloocan City for the school year 2023-2024. Utilizing a quasi-experimental research design, the study involved Grade 5 pupils divided into a control group and an experimental group. Both groups completed pretests and posttests on the topic of Lunar Characteristics and Lunar Dynamics. The control group followed a conventional learning strategies, while the experimental group was subjected to an integrated learning strategies that focused on student-led and interdisciplinary approaches, engaging them in hands-on and inquiry-based learning. The findings revealed that the integrated learning strategies implemented with the experimental group improved student mastery compared to the conventional learning strategies used with the control group. These provide compelling evidence that the integrated learning strategies effectively enhance academic achievement and mastery in science among participating pupils, emphasizing its potential as valuable educational tools for facilitating comprehensive understanding and skill development. Finally, this study recommended expanding the integrated learning strategies to encompass additional science topics and possibly other subject areas, thereby fostering a more comprehensive and holistic approach to education that integrates diverse concepts and enhances students' interdisciplinary understanding and critical thinking skills.

Keywords: Integrated Learning Strategies, Science, Quasi-Experimental Research Design

Introduction
In the realm of teaching-learning process, the use of suitable learning and teaching strategies is critical in improving learner achievement and performance since it directly improves their engagement and understanding of the subject matter. Employing effective strategies tailored to diverse learning styles and preferences promotes active participation and facilitates the mastery of concepts, thereby optimizing educational outcomes. Vergara and Chua (2020) underscores that an important part of the right to education is to ensure that education is of adequate quality leading to appropriate, reasonable and effective learning outcomes at all levels and in all settings. It requires coherent teaching and learning methods and content that includes strategies which are appropriate to the needs of all learners.As technology continues to advance, the 21st century offers improved prospects in both education and employment. However, the education industry across the world follows traditional modes of teaching and learning, which has resulted

in several bottlenecks such as limited outreach, absenteeism, stunted learning potential and high dropout rates (Taylor and Wilding, 2009 as cited by Munna and Kalam, 2021). Thus, it can be explained that it ultimately contributes to inadequacy or inefficiency in addressing the needs of the current generation. With this, as emphasized by Aguilar et. al., (2017) ineffective teaching strategies can result in poor academic performance because they do not engage students or adequately assess their understanding and mastery of the subject matter.

In the context of the Philippine education, the teacher holds significant responsibility in the education of each Filipino student, presenting a challenge for teachers to impart meaningfulness to their profession. Embracing the role of a second parent within the classroom setting is deemed crucial (Belvez, 2002 as cited by Ariaso, 2020). However, Bibon (2022) highlighted that the Philippines has been constantly battling to improve its academic achievement across major learning disciplines. The decline has been noted in various national and international evaluations, with the congested Basic Education Curriculum (BEC) being cited as a primary factor. The curriculum imposes numerous competencies to be mastered within a limited timeframe, contributing to this decline. Notwithstanding the vigorous observation the Department of Education (DepEd) is imposing changes in the Philippine curriculum, the same academic achievement result is reflected in the subsequent year. Science as one of the learning disciplines demands careful attention and adherence to its overarching goals, which revolve around nurturing scientifically, technologically, and environmentally literate individuals who can contribute effectively to society. This entails fostering critical problem-solving abilities, promoting environmental stewardship, cultivating innovation and creativity, encouraging informed decision-making, and facilitating effective communication (DepEd Curriculum Guide, 2016). Achieving these objectives relies on the development of students' learning and innovation skills, including critical thinking, creative problem-solving, collaboration, and communication (Vergara and Chua, 2020). The implementation of appropriate teaching and learning strategies is integral to realizing these aims within the realm of pedagogy.

In view of the foregoing, Libis Baesa Elementary School is challenged how to carry out effectively the science education particularly in Grade 5 level. Being a small elementary school in the Schools Division of Caloocan City, it cannot be denied that it lacks sufficient resources for science education which leads to insufficient opportunities for hands-on exploration and experimentation, resulting to a disconnection between theoretical concepts and real-world applications. In some cases, it often includes pupils with diverse learning needs and abilities, making it challenging to differentiate instruction effectively. Indeed, the one-size-fits idea leads some pupils behind while failing to challenge others. Hence, effective science education necessitates thoughtful consideration of learning strategies to engage students and promote deep understanding of various scientific concepts. Considering the aforementioned points, the researcher is prompted to adopt/adapt integrated learning strategy that surpasses the conventional science teaching curriculum and is tailored to the specific contextual circumstances impacting Grade 5 pupils. This kind of strategy exposes the pupils to connect different areas of knowledge, skills, and experiences rather placing them in an isolation. This promotes deeper understanding of scientific concepts and how they are applied to the real-world situations. Such creates a cohesive and comprehensive learning experiences among the pupils as it aims to provide a more holistic approach through seeing interconnectedness of knowledge and the relevance of what they learn as they apply it beyond the classroom. Hence, it empowers the pupils to become critical thinkers, problem solvers, and lifelong learners in science.

Consequently, this study examined the effectiveness of the integrated learning strategies on the mastery level in Science among Grade 5 pupils in Libis Baesa Elementary School, Caloocan City for the school year 2023-2024.

Statement of the Problem

This study investigated the effectiveness of integrated learning strategies on the mastery level of Grade 5 pupils in Libis Baesa Elementary School, Caloocan City, focusing on the topic of Lunar Characteristics and Lunar Dynamics during the academic year 2023-2024. Specifically, this study sought answers to the following questions:

1. What are the pretest scores of the control and experimental groups in terms of science mastery level?
2. What is the posttest score of the control and the experimental group in terms of science mastery level?
3. What is the mastery level of the control and experimental group?
4. Is there a significant difference between the pretest and posttest score of the control and experimental group?
5. Does the conduct of integrated learning strategies (experimental group) improve student mastery compared to the conventional learning strategies (control group)?

Hypotheses

The following hypotheses were tested in this study:

1. There is a significant difference between the pretest and posttest score of the control and experimental group.
2. The conduct of the integrated learning strategies (experimental group) improves student mastery compared to the conventional learning strategies (control group).

Methods

This study utilized a quasi-experimental research design. As the name suggests, it uses variation in the main independent variable of interest, essentially mimicking experimental conditions in which some subjects are exposed to treatment and others are not on a random basis (Gopalan, et al., 2020). The participants of the study were the Grade 5 pupils. There were two sections involved throughout the course of the study. One worked on the control group, while the other undertook the experimental group. Though the groups were heterogeneous classes, the latter was still chosen based on either their achievement or performance in science in the previous quarter, which needed improvement. This study utilized a total complete enumeration in selecting its participants. The data was collected from every member or element of the population under study.

As the study involved pre-test and post-test assessments, a teacher-made test was used. The crafted items were based on the subject matter and ensured that they measured or met the learning competencies set. This test was a multiple-choice test comprising 40 questions. This assessment tool was designed to capture the specific learning outcomes targeted by the integrated learning strategies, such as critical thinking skills, interdisciplinary understanding, and collaborative problem-solving abilities. The teacher-made test has undergone face validity, content validity, and construct validity through seeking the expertise of panel members, the research department of the school, and even the master teacher of the science subject. The goal of this was to determine if the items measured the target variable, to ascertain if they represented all aspects of the construct, and to evaluate if they could accurately measure what needed to be measured. All the necessary information in the instrument was checked and approved before it was administered to the participants of the study.

The study commenced by selecting two groups of Grade 5 pupils from similar demographic backgrounds and academic levels. One group served as the experimental group, where integrated learning strategies were implemented, while the other served as the control group, receiving conventional teaching methods. Prior to the intervention, both groups underwent pre-test assessments to establish baseline academic achievement levels. The integrated learning strategies were meticulously designed and integrated into the curriculum, focusing on interdisciplinary connections, project-based learning, and collaborative activities. In this study, the integrated learning strategies emphasized student-led approach and interdisciplinary, encapsulating hands-on and self-discovery aspects. In a student-led approach, students engage directly with the material through activities such as creating models of the moon's surface, simulating lunar phases, and conducting simple experiments to explore lunar gravity. Self-discovery is encouraged through inquiry-based learning, where students pose questions, conduct research, and draw conclusions about lunar phenomena, making the study of the moon both engaging and meaningful. Throughout the intervention period, detailed records of the implementation process were maintained, including lesson plans, teaching materials, and student engagement levels. Following the intervention, post-test assessments were administered to both groups to measure any changes in academic achievement.

Results and Discussions

Table 1: Distribution of Pretest Scores of Control and Experimental Group

		Control Group			Experimental Group		
		Competency 1	Competency 2	Total Score	Competency 1	Competency 2	Total Score
96% - 100%	**mastered**	0	0	0	6	0	0
86% - 95%	**closely approximating mastery**	1	0	0	3	0	0
66% - 85%	**moving towards mastery**	9	9	4	13	2	0
35% - 65%	**low mastery**	20	23	32	15	22	33
16% - 34%	**very low mastery**	7	3	1	0	13	4
5% - 15%	**average**	0	1	0	0	0	0
0% - 4%	**No mastery**	0	0	0	0	0	0

Legend:
Competency 1=Understanding of Lunar Characteristics and Phases (S5ES-IVg-h-7)
Competency 2=Lunar Dynamics and Cultural Influence (S5ES-IVg-h-7)

Within the control group, no students achieved "mastery" (96%-100%) in either Competency 1 (Understanding of Lunar Characteristics and Phases) or Competency 2 (Lunar Dynamics and Cultural Influence). The majority (20 and 23 students respectively) demonstrated "low mastery" (35%-65%) for both competencies. Conversely, the experimental group displayed a more favorable distribution. While none reached "mastery" in Competency 2, 6 students achieved it in Competency 1. Notably, the experimental group had a significantly higher proportion of students "moving towards mastery" (66%-

85%) in Competency 1 compared to the control group. However, "low mastery" remained the dominant category for both competencies within the experimental group (15 and 22 students respectively). Interestingly, no students in either group scored within the "average" (5%-15%) or "no mastery" (0%-4%) ranges for the total score, indicating a baseline level of knowledge in the assessed areas for all participants. The study's findings reveal intriguing insights into the pretest scores of both the control and experimental groups concerning mastery levels in Competency 1 and Competency 2. The data suggests that while there is a notable difference in mastery levels between the control and experimental groups, there is a shared baseline understanding among students in lunar science competencies. This indicates potential for improvement and targeted interventions to enhance mastery levels. These findings underscore the importance of tailored instructional approaches to address specific areas of weakness and promote deeper understanding, thereby, enhancing mastery levels in lunar science competencies. In view of the foregoing, the findings align with the assertion made by Westphale et al. (2022) in which a pre-test score provides information about student performance before intervention, allowing a pragmatic approach to comparing the effects of interventions. By analyzing pre-test scores of both the control and experimental groups, the study identifies a baseline understanding among students in lunar science competencies. This baseline provides a pragmatic basis for comparing the effects of interventions later aimed at enhancing mastery levels. The observed difference in mastery levels between the control and experimental groups suggests that tailored instructional approaches or interventions can indeed have an impact on student performance. Thus, the study underscores that the result of the pre-test bears importance to inform instructional

Table 2: Descriptive Summary of Pretest Scores of Control and Experimental Group

		Control Group			Experimental Group		
	N	**Mean**	**Standard Deviation**	**Mastery level**	**Mean**	**Standard Deviation**	**Mastery level**
Competency 1	37	54.05	16.97	low mastery	70.05	19.78	moving towards mastery
Competency 2	37	55.12	16.05	low mastery	39.09	13.73	low mastery
Total Score	37	55.07	9.02	low mastery	48.24	11.77	low mastery

strategies and interventions, ultimately leading to improved mastery levels in the topic moon phases.
Analyzing pretest scores in Table 2 reveals a clear performance disparity between the control and experimental groups. The control group exhibited "low mastery" across all areas, with mean scores of 54.05 (Competency 1), 55.12 (Competency 2), and a total score of 55.07 (standard deviations ranged from 9.02 to 16.97). Conversely, the experimental group demonstrated a higher baseline understanding in Competency 1, achieving a mean score of 70.05 ("moving towards mastery") with a standard deviation of 19.78. However, their performance in Competency 2 (M= 39.09, SD= 13.73) mirrored the control group's "low mastery" level. The total score for the experimental group (M= 48.24, SD= 11.77) also fell under "low mastery" but displayed greater variability compared to the control group. Almost the same result was found in the study of Waltz (2020) in which before the intervention, pretest scores were similar for both treatment and control groups. In this study, it can be looked into the mastery level in which majority of the students generally exhibit low mastery in both competencies.

Indeed, the pre-test scores offer valuable insights into the students' baseline understanding before any intervention, as emphasized by Kartikeyan et al. (2019). The significant performance gap between the control and experimental groups, particularly in Competency 1, underscores the necessity of considering this initial difference when assessing the effectiveness of the integrated learning strategy. This disparity could potentially influence post-test results, highlighting the importance of addressing it through targeted interventions. Moreover, the high standard deviations, especially noticeable in the experimental group's Competency 1 scores, indicate a wider range of student abilities within this group. This variability suggests that the intervention may have varying impacts on students based on their initial mastery levels. Therefore, teachers must account for these differences in pre-test scores when designing instructional interventions, aiming to bridge performance gaps and promote equitable learning outcomes across all students.The results from the study underscore the importance of considering baseline levels of understanding when implementing instructional interventions. The significant performance gap between the control and experimental groups suggests varying levels of preparedness and prior knowledge among students. By acknowledging and accounting for these differences in pre-test scores, teachers can better design interventions that cater to diverse learning abilities and promote more equitable learning outcomes.

Table 3: Distribution of Posttest Scores of Control and Experimental Group

		Control Group			**Experimental Group**		
		Competency 1	**Competency 2**	**Total Score**	**Competency 1**	**Competency 2**	**Total Score**
96% - 100%	mastered	4	0	0	12	1	0
86% - 95%	closely approximating mastery	6	0	0	6	8	5
66% - 85%	moving towards mastery	22	12	14	15	23	30
35% - 65%	low mastery	4	21	23	4	4	2
16% - 34%	very low mastery	1	2	0	0	0	0
5% - 15%	average	0	1	0	0	0	0
0% - 4%	No mastery	0	0	0	0	0	0

Legend:
Competency 1=Understanding of Lunar Characteristics and Phases (S5ES-IVg-h-7)
Competency 2=Lunar Dynamics and Cultural Influence (S5ES-IVg-h-7)

Examining posttest scores in Table 3 reveals a potential benefit of the integrated learning strategy in Competency 1. The control group demonstrated progress, with 4 students achieving "mastery" and 6 "closely approximating mastery" in Competency 1. However, their performance in Competency 2 remained primarily within the "moving towards mastery" (66%-85%) and "low mastery" (35%-65%) categories. Conversely, the experimental group displayed a significant improvement in Competency 1. A substantial number of students (12) reached "mastery," with many "closely approximating mastery" in both competencies. Notably, 30 students in the experimental group achieved "moving towards mastery" for the total score, suggesting a broader improvement in overall understanding. These results suggest that the integrated learning strategy might be particularly effective for enhancing students' grasp of lunar characteristics and phases (Competency 1) as evidenced by the considerably improved scores in the experimental group. This finding highlights the potential of such interventions to significantly improve academic achievement in targeted areas. And, it resonates with the study conducted by Hraste et al. (2018), where an integrated mathematics/geometry and physical activity program significantly enhanced fourth-grade pupils' learning outcomes compared to traditional teaching methods. Just as the integrated approach in Hraste et al.'s study resulted in improved academic achievement in mathematics and geometry, the integrated learning strategy in the current study appears to have similarly positive effects on students' academic performance in lunar science competencies. Therefore, the findings not only highlight the potential effectiveness of integrated interventions in targeted areas but also emphasize the broader impact such approaches can have on improving academic achievement across various subject domains. Thus, it implies that the integrated learning approach effectively enhances students' comprehension of lunar phenomena. Moreover, the experimental group's performance suggests a broader improvement in overall understanding, as evidenced by the increased number of students moving towards mastery in the total score. These findings underscore the effectiveness of targeted interventions in addressing specific learning objectives, emphasizing the potential of integrated learning strategies to drive significant improvements in academic achievement. As teachers seek to optimize instructional approaches, the results highlight the importance of incorporating such interventions to enhance students' grasp of complex subject matter and promote deeper learning experiences

Table 4: Descriptive Summary of Posttest Scores of Control and Experimental Group

		Control Group			Experimental Group		
	N	Mean	Standard Deviation	Mastery level	Mean	Standard Deviation	Mastery level
Competency 1	37	79.50	15.04	moving towards mastery	84.91	15.45	moving towards mastery
Competency 2	37	55.79	18.85	low mastery	76.16	10.65	moving towards mastery
Total Score	37	62.50	9.95	low mastery	78.65	6.52	moving towards mastery

Analyzing posttest scores in Table 4 reveals positive progress in both groups but highlights a potential benefit for the experimental group. The control group showed improvement in Competency 1, reaching a mean score of 79.50 ("moving towards mastery") with a standard deviation of 15.04. However, their performance remained classified as "low mastery" in Competency 2 (mean: 55.79, SD: 18.85) and overall (total score mean: 62.50, SD: 9.95). The experimental group displayed similar advancement in Competency 1 (mean: 84.91, SD: 15.45; "moving towards mastery"), but achieved a more substantial gain in Competency 2 (mean: 76.16, SD: 10.65), shifting to "moving towards mastery" as well. Notably, the total score for the experimental group rose significantly to a mean of 78.65 (SD: 6.52), placing it within the "moving towards mastery" range. This improvement is particularly noteworthy for Competency 2, where the experimental group initially demonstrated lower performance. These findings suggest that the integrated learning strategy may be particularly effective in promoting learning gains, especially for students who enter the intervention with lower mastery levels. Interestingly, the smaller standard deviation in the experimental group's total score post-intervention (6.52) compared to the control group (9.95) implies a potentially homogenizing effect of the strategy, resulting in a more consistent level of performance among participants.

The aforementioned findings support and align with the insights provided by Amini & Helsa (2018) and Usmeldi & Amini (2019) regarding the effectiveness of integrated learning models in improving learning outcomes, particularly for students with varying levels of motivation and competence. In the current study, both the control and experimental groups showed positive progress post-intervention. However, the experimental group, which experienced the integrated learning strategy, demonstrated a more substantial gain in Competency 2, effectively shifting from lower mastery levels to "moving towards mastery." This improvement echoes the outcomes observed in the cited works, which found that integrated learning models significantly enhance students' competence in natural science compared to conventional methods, regardless of their motivation levels. Furthermore, the smaller standard deviation in the experimental group's total score post-intervention compared to the control group suggests a potentially homogenizing effect of the integrated learning strategy. This implies that the strategy may have helped to mitigate performance disparities among participants, aligning with the notion that integrated learning approaches can cater to the needs of both high and low motivated students, as highlighted by Amini & Helsa (2018) and Usmeldi & Amini (2019). Therefore, the study's findings not only corroborate but also extend the existing literature by providing empirical evidence of the effectiveness of integrated learning strategies in promoting learning gains, particularly for students with varying levels of mastery and motivation in the context of science education.

Table 5: Difference between Pretest Scores of Control and Experimental Group

GROUP		N	Mean Rank	Sum of Ranks	Mann-Whitney U	Asymp. Sig. (2-tailed)
Competency 1	Control Group	37	29.65	1097.00	394.00	0.00
	Experimental Group	37	45.35	1678.00		
	Total	74				
Competency 2	Control Group	37	47.85	1770.50	301.50	0.00
	Experimental Group	37	27.15	1004.50		
	Total	74				
Total Score	Control Group	37	43.28	1601.50	470.50	0.02
	Experimental Group	37	31.72	1173.50		
	Total	74				

Legend:
Competency 1=Understanding of Lunar Characteristics and Phases (S5ES-IVg-h-7)
Competency 2=Lunar Dynamics and Cultural Influence (S5ES-IVg-h-7)

Analyzing the Mann-Whitney U test results in Table 5 reveals statistically significant discrepancies between the control and experimental groups' pretest scores for all assessed areas (Competency 1, Competency 2, and Total Score). The test confirms that the two groups likely originated from distinct

distributions before the intervention. Detailed results show the control group having a lower mean rank (29.65) compared to the experimental group (45.35) in Competency 1. The Mann-Whitney U statistic (394.00) and a highly significant p-value (0.00) further solidify this distinction. A similar pattern emerged in Competency 2, with the control group exhibiting a higher mean rank (47.85) than the experimental group (27.15). The U value (301.50) and p-value (0.00) again confirm a statistically significant difference. Finally, the total score comparison yielded analogous results, with a significant difference (U = 470.50, p = 0.02) between the control group's mean rank (43.28) and the experimental group's (31.72).
The identified disparities in initial mastery levels between the control and experimental groups align with the notion of individual differences among students, as highlighted by Wahyuni et al. (2021). The experimental group, entering the intervention with a stronger understanding of Competency 1, may reflect varying abilities, characteristics, or learning styles among students. Conversely, the control group's higher baseline in Competency 2 suggests different readiness levels to receive teaching in this area. These variations underscore the importance of recognizing and addressing individual differences to effectively tailor instructional interventions to students' diverse needs and abilities, as emphasized by Wahyuni et al. (2021). Additionally, the observed discrepancies in total scores further emphasize these pre-existing group variations, highlighting the impact of individual differences on mastery levels. Therefore, the study's findings not only corroborate the existence of individual differences among students but also underscore the importance of considering these differences when designing educational interventions aimed at promoting learning gains.

Table 6: Difference between Posttest Scores of Control and Experimental Group

GROUP		**N**	**Mean Rank**	**Sum of Ranks**	**Mann-Whitney U**	**Asymp. Sig. (2-tailed)**
Competency 1	Control Group	37	32.93	1218.50	515.50	0.06
	Experimental Group	37	42.07	1556.50		
	Total	74				
Competency 2	Control Group	37	25.50	943.50	240.50	0.00
	Experimental Group	37	49.50	1831.50		
	Total	74				
Total Score	Control Group	37	22.61	836.50	133.50	0.00
	Experimental Group	37	52.39	1938.50		
	Total	74				

Legend:
Competency 1=Understanding of Lunar Characteristics and Phases (S5ES-IVg-h-7)
Competency 2=Lunar Dynamics and Cultural Influence (S5ES-IVg-h-7)

Analyzing the Mann-Whitney U test results in Table 6 reveals mixed findings regarding the effectiveness of the integrated learning strategy. For Competency 1 (Understanding of Lunar Characteristics and Phases), the test yielded a U value of 515.50 and a p-value of 0.06. This suggests no statistically significant difference between the control and experimental groups' post-intervention scores. In simpler terms, both groups performed similarly in Competency 1 after the intervention. However, the results for Competency

2 (Lunar Dynamics and Cultural Influence) paint a different picture. The experimental group achieved a significantly higher mean rank (49.50) compared to the control group (25.50), with a U value of 240.50 and a highly significant p-value (0.00). This indicates that the integrated learning strategy had a positive impact on students' understanding in this area. The Total Score analysis aligns with the findings for Competency 2. The experimental group again displayed a significantly higher mean rank (52.39) compared to the control group (22.61), with a U value of 133.50 and a p-value of 0.00. This suggests an overall improvement in academic achievement within the experimental group. The integrated learning strategy appears to be particularly effective in enhancing students' understanding of Competency 2 (Lunar Dynamics and Cultural Influence) and may have had a more limited impact on Competency 1. The significant improvement in the Total Score further supports the potential of the strategy to improve science learning outcomes.

The foregoing discussions highlight the differential impact of the integrated learning strategy across different competency areas. While the strategy may have had a more limited effect on Competency 1, it appears to be particularly effective in enhancing students' understanding of Competency 2. This underscores the importance of tailoring instructional interventions to address specific learning objectives and areas of weakness. Additionally, the significant improvement in the Total Score within the experimental group indicates the potential of the integrated learning strategy to enhance science learning outcomes overall. The data underscores the importance of understanding the unique patterns of strengths and weaknesses among students, as highlighted by Ottone-Cross et al. (2018). By recognizing the varied impacts of the integrated learning strategy across competencies, teachers can develop interventions that leverage students' strengths while targeting areas of weakness. This tailored approach to instruction aligns with the findings of Gallego et al. (2018), who emphasize the significance of tailoring instruction to each student's needs to produce significant learning gains. Moreover, the significant improvement within the experimental group suggests the potential of the integrated learning strategy to enhance science learning outcomes overall. This finding corroborates the idea that tailored instructional approaches, designed to address specific learning objectives and areas of weakness, can lead to improved academic achievement in science education. Therefore, educators can utilize these insights to design more targeted and effective instructional approaches, leveraging students' strengths while addressing areas of weakness, ultimately promoting deeper understanding and enhancing academic achievement in science education.

Tables 7 to 10 illustrate the within-group comparison of pretest and posttest scores for the control and experimental group using the Wilcoxon Signed Ranks Test. The Wilcoxon test is used to compare two related samples to assess whether their population mean ranks differ.

Analyzing the Wilcoxon Signed Ranks Test within the control group (Tables 7 & 8) reveals improvement in some areas but not others.

Table 7: Competency Pretest and Posttest Ranks for Control Groups

		N	Mean Rank	Sum of Ranks
Competency 1(Postest) - Competency 1 (Pretest)	Negative Ranks	1[a]	18.50	18.50
	Positive Ranks	35[b]	18.50	647.50
	Ties	1[c]		
	Total	37		
Competency 2(Posttest) - Competency 2 (Pretest)	Negative Ranks	11[d]	19.55	215.00
	Positive Ranks	22[e]	15.73	346.00

	Ties	4[f]		
	Total	37		
Total Score (Posttest) - Total Score (Pretest)	Negative Ranks	3[g]	19.67	59.00
	Positive Ranks	31[h]	17.29	536.00
	Ties	3[i]		
	Total	37		

a. Competency 1(Postest) < Competency 1 (Pretest)
b. Competency 1(Postest) > Competency 1 (Pretest)
c. Competency 1(Postest) = Competency 1 (Pretest)
d. Competency 2(Posttest) < Competency 2 (Pretest)
e. Competency 2(Posttest) > Competency 2 (Pretest)
f. Competency 2(Posttest) = Competency 2 (Pretest)
g. Total Score (Posttest) < Total Score (Pretest)
h. Total Score (Posttest) > Total Score (Pretest)
i. Total Score (Posttest) = Total Score (Pretest)

Table 8: Wilcoxon Signed Ranks Test for Control Group

	Competency 1(Postest) - Competency 1 (Pretest)	**Competency 2(Posttest) - Competency 2 (Pretest)**	**Total Score (Posttest) - Total Score (Pretest)**
Z	-4.962[b]	-1.175[b]	-4.094[b]
Asymp. Sig. (2-tailed)	.000	.240	.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

For Competency 1 (Understanding of Lunar Characteristics and Phases), a positive trend emerged in Table 7. Most participants (n = 35) achieved higher posttest scores, reflected by the mean rank (18.50) and sum of ranks (647.50) for positive differences. The significant Z statistic (-4.962) and asymptotic significance (p = 0.000) in Table 8 confirm a statistically significant improvement in Competency 1 scores. Competency 2 (Lunar Dynamics and Cultural Influence) presented a less clear picture (Table 7). While more participants showed positive ranks (n = 22) compared to negative ranks (n = 11), suggesting some improvement, the change was not substantial. This aligns with the non-significant Z statistic (-1.175) and p-value (0.240) in Table 8, indicating the changes in Competency 2 scores did not reach statistical significance. The Total Score mirrored the pattern observed in Competency 1. Table 7 displayed a positive trend with a higher number of participants achieving improvement (n = 31). The significant Z statistic (-4.094) and asymptotic significance (p = 0.000) in Table 8 further solidify this, indicating a statistically significant improvement in the overall total score for the control group.

In conclusion, the control group demonstrated a notable improvement in Competency 1 and overall scores (Total Score). However, the changes in Competency 2 scores were not statistically significant, suggesting the conventional method may not have had a consistent or strong enough effect in this specific area for the control group. The implications of these findings suggest that while the conventional method employed resulted in a discernible enhancement in Competency 1 and overall performance, it fell short in inducing significant improvements in Competency 2 within the control group. The interpreted data highlighting the deficiency in Competency 2 improvement within the control group suggests a potential limitation of conventional learning strategies in addressing specific competency domains. This aligns with Isakovna's (2021) assertion that teaching methods play a crucial role in achieving educational goals, particularly in fostering skill development and student growth. The need to reassess or augment conventional methodologies to ensure a more comprehensive and balanced skill development across different competencies resonates with Isakovna's emphasis on tailoring educational strategies to meet the diverse learning needs inherent within various disciplines. Therefore, these insights underscore the significance of adapting teaching approaches to effectively address the nuanced challenges and objectives within different competency domains.

Table 9: Competency PreTest and Posttest Ranks for Experimental Groups

		N	Mean Rank	Sum of Ranks
Competency 1(Postest) - Competency 1 (Pretest)	Negative Ranks	8[a]	10.81	86.50
	Positive Ranks	23[b]	17.80	409.50
	Ties	6[c]		
	Total	37		
Competency 2(Posttest) - Competency 2 (Pretest)	Negative Ranks	0[d]	0.00	0.00
	Positive Ranks	36[e]	18.50	666.00
	Ties	1[f]		
	Total	37		
Total Score (Posttest) - Total Score (Pretest)	Negative Ranks	0[g]	0.00	0.00
	Positive Ranks	37[h]	19.00	703.00
	Ties	0[i]		
	Total	37		

a. Competency 1(Postest) < Competency 1 (Pretest)
b. Competency 1(Postest) > Competency 1 (Pretest)
c. Competency 1(Postest) = Competency 1 (Pretest)
d. Competency 2(Posttest) < Competency 2 (Pretest)
e. Competency 2(Posttest) > Competency 2 (Pretest)
f. Competency 2(Posttest) = Competency 2 (Pretest)
g. Total Score (Posttest) < Total Score (Pretest)
h. Total Score (Posttest) > Total Score (Pretest)
i. Total Score (Posttest) = Total Score (Pretest)

Table 10: Wilcoxon Signed Ranks Test for Experimental Group

	Competency 1(Postest) - Competency 1 (Pretest)	Competency 2(Posttest) - Competency 2 (Pretest)	Total Score (Posttest) - Total Score (Pretest)
Z	-3.177[b]	-5.239[b]	-5.306[b]
Asymp. Sig. (2-tailed)	.001	.000	.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Employing the Wilcoxon Signed Ranks Test on the experimental group's pre- and post-test scores (Tables 9 & 10) revealed a positive impact of the integrated learning strategy across all assessed areas (Competency 1, Competency 2, and Total Score). Table 9 details a trend of improvement in Competency 1. More participants achieved higher posttest scores (n = 23) compared to those with lower scores (n = 8), reflected by the respective mean ranks (17.80 and 10.81). The significant Z statistic (-3.177) and p-value (0.001) in Table 10 further confirm this statistically significant improvement. An even stronger positive effect was observed in Competency 2. All participants in the experimental group exhibited improvement (n = 36 with positive ranks), with a mean rank of 18.50 (Table 9). This aligns with the highly significant Z statistic (-5.239) and p-value (less than 0.001) in Table 10. The Total Score mirrored the pattern of Competency 2. All participants showed improvement (n = 37 with positive ranks) with a mean rank of 19.00 (Table 9). The significant Z statistic (-5.306) and p-value (less than 0.001) in Table 10 solidify this finding, indicating a statistically significant overall improvement in academic achievement for the experimental group.

The test results reveal a positive and statistically significant enhancement in students' understanding of both Competency 1 and Competency 2, attributable to the integrated learning strategy. This finding is indicative of a substantial improvement in students' proficiency across multiple domains of knowledge. The integration of various learning strategies, as emphasized by Kurniasih (2019), likely contributes to this multifaceted understanding, enabling students to engage with the material in diverse ways and develop a comprehensive grasp of complex concepts. Additionally, the effectiveness of integrated learning strategies in promoting higher-order thinking skills, as demonstrated by Heong et al. (2019), further bolsters students' capacity to analyze, synthesize, and apply knowledge across Competency 1 and Competency 2. Consequently, the positive impact observed in the test results underscores the efficacy of integrated learning approaches in fostering a deeper understanding of academic content and facilitating holistic learning experiences for students. Indeed, the findings unveil a notable implication in which the integrated learning strategy has wielded a substantial and statistically discernible influence on the students' comprehension of Competency 1 and Competency 2. This bears profound significance, indicating a marked enhancement in their overall science scores. The implication suggests that the integration of diverse learning approaches has the potential to foster a comprehensive understanding of multiple competencies simultaneously, thereby amplifying academic performance in the broader subject domain. This insight underscores the efficacy of pedagogical methods tailored to encompass a holistic approach, fostering a deeper grasp of complex concepts and yielding tangible improvements in students' educational outcomes.

Conclusions

The study demonstrated the effectiveness of the integrated learning strategies implemented with the experimental group. Following the intervention, significant improvements were observed in both Competency 1 (Lunar Characteristics) and Competency 2 (Lunar Dynamics), indicating the strategies' capacity to enhance student understanding across multiple science concepts. Particularly noteworthy was the substantial increase in mastery levels in Competency 2, where students initially exhibited weaker comprehension. These results emphasized the integrated learning strategies' effectiveness, specifically in areas where students had lower initial mastery, underscoring its potential to bridge knowledge gaps and foster comprehensive understanding. Distinct outcomes between the control and experimental groups following the intervention were revealed. While the control group showed modest advancements in mastery levels, particularly in Competency 1, the experimental group demonstrated significant improvements across both Competency 1 and, notably, Competency 2. This disparity underscores the effectiveness of the integrated learning strategies employed with the experimental group, effectively addressing areas of weaker initial mastery. In sum, the study provided compelling evidence that the integrated learning strategies effectively enhance mastery in science among participating students, emphasizing its potential as a valuable educational tool for facilitating comprehensive understanding and skill development.

Recommendations

This study proposes the expansion of integrated learning strategies to cover additional science topics and potentially extend to other subject areas. Such an approach would cultivate a more comprehensive and holistic educational experience, integrating diverse concepts and strengthening students' interdisciplinary understanding and critical thinking skills. Furthermore, comprehensive and ongoing professional development opportunities for teachers are recommended to enhance their pedagogical skills and deepen their grasp of integrated learning strategies. This would ensure that educators are well-equipped with the necessary knowledge and resources to effectively implement these approaches in the classroom, thus optimizing student learning outcomes. Additionally, exploration of innovative methods to integrate technology-enhanced learning tools and resources into integrated learning strategies is suggested. This initiative aims to provide students with interactive and engaging learning experiences that harness the capabilities of digital technologies to facilitate exploration, experimentation, and discovery in science education. By leveraging technology, students' motivation, engagement, and achievement in the subject can be enhanced, ultimately enriching their learning journey.

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