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FLIPPED APPROACH IN ENHANCING SCIENCE PROFICIENCY OF GRADE 11 STUDENTS

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ABSTRACT

This study examined the effectiveness of the flipped classroom approach in improving the science proficiency of Grade 11 students in General Science. A quasi-experimental non-equivalent control group pretest–posttest design involved 58 students, where the intervention group used flipped instruction and the control group received conventional lecture-based teaching. A validated pretest and posttest assessed students' science proficiency in both groups. The intervention group showed a significant improvement, with a mean gain of 5.07 points ($p < 0.001$), while the control group had a smaller but significant gain of 0.79 points ($p = 0.0356$). Posttest results indicated that the intervention group outperformed the control group, demonstrating stronger learning gains. Overall, the findings show that the flipped classroom approach effectively enhances science proficiency and promotes deeper understanding and active learning among students. Based on these findings, the study concludes that integrating flipped instruction in senior high school science classes may improve academic outcomes. Educators are therefore encouraged to adopt this strategy to strengthen teaching and learning effectiveness.

Keywords: Flipped Classroom, Science Proficiency, Grade 11 Students, Quasi-Experimental Design

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INTRODUCTION

Education in the 21st century must transcend the simple transmission of knowledge and instead foster the development of learners who can analyze, evaluate, and apply information in complex contexts. Traditional teacher-centered instruction often falls short in achieving this goal, particularly in science education where critical thinking, problem solving, and conceptual understanding are essential. Globally, numerous studies have demonstrated the effectiveness of the Flipped Approach in enhancing student engagement, motivation, and academic performance. Strelan, Osborn, and Palmer (2020), through a meta-analysis, found that students in flipped classrooms significantly outperformed those in traditional settings, particularly in science, technology, engineering, and mathematics (STEM) disciplines. Similarly, Gillette et al. (2018) reported improvements in higher-order thinking skills, self-directed learning, and long-term retention among students exposed to flipped instruction.The success of flipped learning is further supported by broader research on active learning. Freeman et al. (2014), in a meta-analysis of 225 studies, revealed that students in active learning environments achieved higher examination scores and had lower failure rates compared to those in lecture-based classes. These findings reinforce the theoretical foundation of the Flipped Approach, which promotes interaction, collaboration, and continuous assessment, key elements in improving science proficiency.

In the Philippines, the Department of Education (DepEd) has emphasized competency-based instruction through the implementation of the Strengthened Senior High School (SSHS) Curriculum under the K to 12 Program (DepEd, 2025). This curriculum aims to deepen mastery of essential competencies, promote critical thinking, and align learning outcomes with higher education and workforce demands.The Flipped Approach aligns closely with these goals, as it creates opportunities for students to actively demonstrate competencies through in-class problem-solving and collaborative tasks. Several local studies support its effectiveness. De Vera and Cabigon (2021) found that flipped instruction improved student engagement and academic performance in Grade 11 science classes. Villalobos (2022) reported enhanced analytical thinking and problem-solving skills among senior high school students using flipped methods in Physics, while Alvisado (2022) observed improved critical thinking and conceptual understanding in Chemistry classes.

In Zambales, the implementation of the SSHS Curriculum has begun in selected schools, including Taltal National High School (TNHS). However, science proficiency remains a concern. School records indicate that only 41% of Grade 11 students achieved passing scores in General Science during the first quarter, suggesting difficulties in meeting competency standards.This trend reflects broader findings in the region. Ortega (2023) reported that students in several Zambales public high schools performed below expected mastery levels in science, largely due to reliance on traditional lecture-based instruction

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and limited opportunities for active learning.

The results of this study are beneficial to various stakeholders as they provide valuable insights into how the flipped approach enhances science learning, promotes scientific literacy, strengthens science process skills, and fosters independent and active learning among students. The findings support teachers, school administrators, curriculum planners, and education program specialists in adopting evidence-based, technology-integrated instructional strategies, improving curriculum delivery, and guiding decisions on professional development and resource allocation. Furthermore, the study benefits learners, parents, practice teachers, the community, and future researchers by promoting flexible and learner-centered environments, strengthening home–school partnerships, encouraging innovative teaching practices, and serving as a foundation for further research in flipped and multimedia-supported learning.

This study aimed to assess the impact of the flipped approach on enhancing the science proficiency of Grade 11 students in General Science under the Strengthened Senior High School (SSHS) Curriculum at Taltal National High School.

METHODOLOGY

Research Design:

This study employed a quantitative quasi-experimental design utilizing a non-equivalent control group pretest–posttest procedure to determine the effect of the flipped classroom approach on the science proficiency of Grade 11 students in General Science. This design is appropriate in educational contexts where random assignment is not feasible due to pre-existing class groupings (Creswell & Creswell, 2018). It involved comparing an experimental group exposed to the flipped approach and a control group receiving traditional instruction, with pretest scores used to establish baseline equivalence and control for selection bias (Fraenkel, Wallen, & Hyun, 2019).

Respondents and Location

The population of this study consisted of 56 Grade 11 students enrolled in the General Science subject at Taltal National High School, with two intact classes serving as the experimental and control groups. The participants were selected based on existing class groupings, making them suitable for a quasi-experimental design. Selection criteria included students who were officially enrolled in General Science, had regular attendance, and were present during both the pretest and posttest administration, while those with extended absences or incomplete participation were excluded. The study was conducted at Taltal National High School in Zambales, Philippines, a school implementing the Strengthened Senior High School Curriculum under the K to 12 Program.

Instrument

Data collection was carried out using a researcher-made pretest and posttest, which served as the main

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instrument in measuring students' science proficiency. The test consisted of multiple-choice items aligned with the third-quarter learning competencies in the General Science curriculum and assessed various cognitive domains such as remembering, understanding, applying, analyzing, and evaluating based on Bloom's Taxonomy. Although the test did not undergo pilot testing, it was content validated by school expert validators to ensure clarity, relevance, and alignment with curriculum standards. The same test was administered for both pretest and posttest to ensure comparability and consistency in measuring students' learning gains.

Data Collection

This study employed a purely quantitative, quasi-experimental research design, specifically a non-equivalent control group pretest-posttest design, to examine the impact of the flipped classroom approach on the science proficiency of Grade 11 students in General Science, using two intact groups: an intervention group and a control group. Before data collection, the researcher coordinated with the school administration, secured necessary approvals, and obtained informed consent from parents or guardians as well as assent from the student participants to ensure ethical compliance. The pretest was administered to both groups as a baseline measure, followed by a four-week intervention period and a posttest using the same instrument, with all data encoded, anonymized, and analyzed quantitatively to determine learning gains and instructional effectiveness.

RESULT AND DISCUSSION

Table 1 shows the frequency and percentage distribution on the pre-test scores of the intervention group of Grade 11 students before the implementation of the flipped approach.

Table 1
Frequency and Percentage Distribution on the Pre-test Scores of the Intervention Group of Grade 11 Students before the Implementation of the Flipped Approach

Descriptive Equivalent	Score Range	Pre-test Scores of the Experimental Group	
		Frequency (f)	Percentage (%)
Excellent	33-40	12	41.38
Very Good	25-32	13	44.83
Good	17-24	4	13.79
Fair	9-16	0	0.00
Poor	0-8	0	0.00
Total		**29**	**100.00**
Mean		**30.69 or 31**	
Interpretation		**Very Good**	

The pre-test results reveal that most Grade 11 students performed at a high level, with the majority classified as *Very Good* and *Excellent*, and only a few in the *Good* category. The mean score of 30.69 (≈31) indicates an overall *Very Good* baseline performance prior to the intervention. This suggests that students already had strong prior knowledge, which should be considered when evaluating the impact of

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the audio-video instructional materials.

Similar studies support the effectiveness of the Flipped Approach in improving learning outcomes. Hew and Lo (2018) found that students in flipped classrooms demonstrated higher academic achievement and engagement compared to traditional methods, while Kazu and Kurtoğlu Yalçın (2022) reported improvements in performance, self-directed learning, and motivation. These findings affirm that the Flipped Approach can enhance student engagement, participation, and overall academic success.

Table 2 shows the frequency and percentage distribution on the pre-test scores of the control group of Grade 11 students before the instructional period.

Table 2
Frequency and Percentage Distribution on the Pre-test Scores of the Control Group of Grade 11 Students before the Instructional Period

Descriptive Equivalent	Score Range	Pre-test Scores of the Experimental Group	
		Frequency (f)	Percentage (%)
Excellent	33-40	11	37.93
Very Good	25-32	17	58.62
Good	17-24	1	3.45
Fair	9-16	0	0.00
Poor	0-8	0	0.00
Total		**29**	**100.00**
Mean		**31.38 or 31**	
Interpretation		**Very Good**	

Most students performed at a high level, with 58.62% classified as *Very Good* and 37.93% as *Excellent*, while only 3.45% fell under the *Good* category and none in the lower ranges. The group's mean score of 31.38 (≈31) indicates an overall *Very Good* performance.

The results indicate that the control group demonstrated a high level of science proficiency prior to the intervention, establishing a comparable baseline with the experimental group and supporting the validity of subsequent comparisons (Fraenkel, Wallen, & Hyun, 2019). Consistent with Philippine-based studies, the Flipped Classroom Approach has been shown to significantly enhance students' academic performance, critical thinking, and language skills (Fulgueras & Bautista, 2020; Luna et al., 2025; Cagas & Salvaña, 2025), suggesting its potential to further improve learning outcomes beyond students' initial high level of competence.

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Table 3 shows the frequency and percentage distribution on the post-test scores of the intervention group of Grade 11 students after the implementation of the flipped approach.

Table 3
Frequency and Percentage Distribution on the Post-test Scores of the Intervention Group of Grade 11 Students after the Implementation of the Flipped Approach

Descriptive Equivalent	Score Range	Pre-test Scores of the Experimental Group	
		Frequency (f)	Percentage (%)
Excellent	33-40	21	72.41
Very Good	25-32	8	27.59
Good	17-24	0	0.00
Fair	9-16	0	0.00
Poor	0-8	0	0.00
Total		**29**	**100.00**
Mean		**35.76 or 36**	
Interpretation		**Excellent**	

The results show that most students (72.41%) achieved *Excellent* scores, while the remaining 27.59% were in the *Very Good* range, with no learners falling into lower categories, resulting in a mean score of 35.76 (≈36) interpreted as *Excellent*. These findings indicate that the Flipped Approach significantly improved students' science proficiency, enhancing their engagement, conceptual understanding, and problem-solving skills through pre-class preparation and active in-class learning.

The significant improvement in post-test scores, with 72.41% of students achieving *Excellent* and a mean of 35.76 (≈36), supports existing evidence that the Flipped Classroom enhances science proficiency and learning outcomes (Hew & Lo, 2018; Chen et al., 2019). This is further reinforced by local findings in the Philippines, which demonstrate that the approach improves students' ability to apply concepts and solve problems, indicating its effectiveness in increasing engagement and deeper understanding beyond pre-test levels (Obias, 2023).

Table 4 shows the frequency and percentage distribution on the post-test scores of the control group of Grade 11 students after the instructional period.

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Table 4
Frequency and Percentage Distribution on the Post-test Scores of the Control Group of Grade 11 Students after the Instructional Period

Descriptive Equivalent	Score Range	Pre-test Scores of the Experimental Group	
		Frequency (f)	Percentage (%)
Excellent	33-40	15	51.72
Very Good	25-32	14	48.28
Good	17-24	0	0.00
Fair	9-16	0	0.00
Poor	0-8	0	0.00
Total		**29**	**100.00**
Mean		**32.17 or 32**	
Interpretation		**Very Good**	

The results show that 15 students (51.72%) scored in the "Excellent" range (33–40) while 14 students (48.28%) were in the "Very Good" range (25–32), with no students falling under the lower performance categories and a mean score of 32.17 (Very Good). Overall, the findings indicate that standard classroom instruction was effective in developing strong science proficiency among students, as reflected in consistently high post-test performance.

The post-test results of the control group revealed that learners demonstrated strong science proficiency under standard teaching practices, consistent with studies showing that well-structured traditional instruction can still effectively develop conceptual understanding and mastery of scientific concepts (Foldnes, 2017; Hew & Lo, 2018; Chen, Lui, & Martinelli, 2019; Strelan, Owston, & Brown, 2022). Local and international literature further supports that even without innovative interventions such as the Flipped Approach, students can achieve high levels of proficiency when instruction is guided by the curriculum and supported by active classroom engagement and exercises (Cagas & Salvaña, 2025; Luna, Romero, Cusi, Jarapa, & Kusuma, 2025).

Table 5 presents the t-test to test difference on the pre-test and post-test scores of the intervention group of Grade 11 students.

Table 5
T-test to Test Difference on the Pre-test and Post-test Scores of the Intervention Group of Grade 11 Students

Group	Test	N	Mean	Std. Deviation	Std. Error Mean
Intervention Group	Pre-test Scores	29	30.69	5.02	0.93
	Post-test Scores	29	35.76	3.48	0.65
Control Group	Pre-test Scores	29	31.38	3.72	0.69
	Post-test Scores	29	32.17	3.61	0.67

T-test for Equality of Means							
G	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
IG	-6.372	28	0.00000068	5.069	0.796	3.439	6.699
CG	-2.208	28	0.0356	0.793	0.359	0.058	1.528
Decision: Reject Ho (Significant)							

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Table 5 compares the pre-test and post-test scores of both groups and shows that the intervention group improved significantly, with their mean score rising from 30.69 to 35.76 and a t-value of -6.372 (p = 0.00000068), indicating a very strong and statistically significant effect of the instructional strategy. Meanwhile, the control group also showed a slight but significant improvement from 31.38 to 32.17 (t = -2.208, p = 0.0356), suggesting that while both groups learned over time, the gains were much more noticeable in the group exposed to the intervention compared to those who experienced regular classroom instruction.

The stronger improvement seen in the intervention group is consistent with recent studies showing that innovative, student-centered instructional approaches tend to produce higher academic gains because they promote deeper understanding, engagement, and motivation (Donohue & Bornfreund, 2023). Likewise, Kim and Reeves (2021) found that learners exposed to enhanced instructional methods often outperform those in traditional settings due to greater cognitive involvement and more opportunities for meaningful practice, supporting the effectiveness of the intervention used in this study.

Table 6 presents the t-test to test difference on the post-test scores of intervention and control groups of Grade 11 students.

Table 6
T-test to Test Difference on the Post-test Scores of the Intervention and Control Groups of Grade 11 Students after the Implementation of Flipped Approach

T-test for Equality of Means (Welch's)							
Unequal variances assumed	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
	3.853	56	0.000303	3.586	0.931	1.729	5.443
Decision: Reject Ho (Significant)							

The results of the independent-samples Welch's t-test show a significant difference in post-test scores between the intervention group, which used the flipped-classroom approach, and the control group, which used traditional instruction (t = 3.853, df = 56, p = 0.000303), leading to the rejection of the null hypothesis and confirming a meaningful difference between the two groups. The intervention group also outperformed the control group by a mean difference of 3.586 points (SE = 0.931), with a 95% confidence interval of 1.729 to 5.443, indicating that the improvement is both statistically significant and educationally meaningful.

These findings suggest that the flipped-classroom approach positively influenced the academic performance of Grade 11 students, aligning with recent studies that report significant gains in achievement and engagement when compared to traditional instruction (Zainal Abidin, Benić, & Asefuaba, 2024; Zhang, Cheung, & Cheung, 2021; Cagas & Salvaña, 2025). By allowing students to

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access lessons before class and using class time for interactive and collaborative activities, the approach supports deeper understanding and active learning, which contributes to improved outcomes; thus, the null hypothesis is rejected and the alternative hypothesis is accepted.

CONCLUSION AND RECOMMENDATION

Based on the results of the study, it can be concluded that both the intervention and control groups began with a strong baseline proficiency in General Science, indicating that the learners already had good foundational knowledge prior to the instruction. The Flipped Classroom Approach significantly improved the science proficiency of the intervention group, as shown by higher post-test scores, greater mastery of concepts, and more consistent performance, while the control group only showed modest gains that may be attributed to regular classroom learning. The significant difference between the two groups' post-test results confirms that the flipped approach is more effective than traditional instruction in enhancing Grade 11 students' science proficiency and aligns with existing national and international research on student-centered, active learning strategies. Overall, the study concludes that the Flipped Classroom Approach is a highly effective instructional strategy that can be confidently recommended for broader implementation in senior high school science instruction.

In view of the findings and conclusion of the study, it is recommended that science teachers adopt the Flipped Classroom Approach in teaching General Science, supported by well-designed pre-class materials and structured in-class activities to promote deeper conceptual understanding among learners. School administrators are also encouraged to provide continuous professional development programs that will equip teachers with the necessary skills in creating multimedia resources, facilitating collaborative learning, and managing engagement in a flipped classroom setting. In addition, strengthening technological infrastructure through improved access to digital devices, internet connectivity, and learning management systems is essential to ensure effective implementation of flipped learning across schools. Finally, curriculum developers and future researchers are encouraged to integrate flipped-learning strategies into instructional materials and conduct further studies with larger populations to explore its impact on other learning outcomes such as critical thinking, motivation, and long-term retention.

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