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Improving Least Learned Competencies in Physics of Grade 9 Science Learners through Differentiated Instruction

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A B S T R A C T

This study took place at Cataingan National High School in Cataingan, Masbate, during the school year 2022-2023. Its primary aim was to assess a specific problem in Physics, specifically focusing on the topic of projectile motion. The study was conducted to implement an intervention using Differentiated Instruction, an instructional strategy aimed at enhancing projectile motion as one of the least learned competencies in the subject. The research employed a quantitative research method, combining descriptive and quasi-experimental approaches. Data analysis tools included mean, mean percentage score, standard deviation, independent t-test, paired t-test, Likert scale, and weighted mean.Twenty-five students were selected for both the control group and the experimental group, all of whom were enrolled in Science 9 during the fourth quarter when the lesson on projectile motion was covered. The control group received instruction using conventional teaching methods, while the experimental group was exposed to Differentiated Instruction. Through hypothesis testing, the study sought to determine the significant effect of the Differentiated Instruction on students' academic performance. Results indicated that Differentiated Instruction effectively improved students' performance, particularly in areas related to the least mastered skills in Science 9. This suggests that Differentiated Instruction can serve as an effective teaching method during the learning process.

Keywords: Differentiated Instruction, Quasi-Experimental, Academic Performance, Projectile Motions

1. INRODUCTION

The persistent issue of academic underachievement continues to challenge educational systems worldwide. To address this, the Department of Education (DepEd) emphasized inclusive learning under the K to 12 Basic Education Curriculum, ensuring equal opportunities for all learners. Despite these efforts, struggles in various academic areas persisted, particularly in Physics topics like projectile motion. Locally, in SDO Masbate Province, consistently low NAT ratings in Science reflected these challenges, with an MPS of 31.30 during S.Y. 2016-2017, marking it as the lowest among all learning areas. This concerning trend extended to Grade 9 students, where difficulties in mastering Physics competencies were evident during the modular learning approach.

In the fourth quarter of S.Y. 2021-2022, when projectile motion was covered, the MPS dropped to 23%, the lowest among all competencies for the year. Such performance underscored students' struggle to grasp foundational concepts, which affected their overall comprehension and retention. Research by Brown (2019) highlighted that students often focused on memorization rather than understanding key concepts, leading to confusion, especially in differentiating topics like acceleration and velocity. Additionally, Kanowitz (2019) emphasized the need for specific topic-centered teaching approaches to address these learning gaps effectively.The low achievement levels in Physics within Cataingan National High School mirrored the broader challenges faced by the division. Students' difficulties in understanding projectile motion and its practical applications reflected gaps in instructional approaches and engagement strategies during modular learning.Recognizing the diverse learning needs of students, differentiated instruction offered a promising strategy. By tailoring teaching methods to accommodate students' unique abilities, backgrounds, and learning styles, this approach sought to enhance comprehension and retention. This study focused on examining the feasibility of employing differentiated instruction as an intervention to improve Grade 9 students' understanding of projectile motion in Science. Through targeted strategies, it aimed to address the challenges encountered and contribute to improving academic performance in this crucial subject area.

1.1 Statement of the Problem

This study aimed to determine the effectiveness of differentiated instruction in improving Grade 9 students' understanding of projectile motion in Science at Cataingan National High School during the fourth quarter of S.Y. 2022-2023. Specifically, it sought to: (1) assess the academic performance of the control and experimental groups on the topic of projectile motion before and after the implementation of differentiated instruction; (2) evaluate the effectiveness of the intervention in addressing the students' least learned competencies; and (3) explore the students' perceptions of differentiated instruction as a teaching method, providing insights into its impact on their learning experience.

2. METHODS

2.1 Research Design

The study employed descriptive and pretest-posttest quasi-experimental designs. Two classes were divided into experimental and control groups, with the experimental group exposed to differentiated instruction as an intervention. This included lesson plans, differentiated activities, and guided questions, while the control group followed the same lesson plans without modifications. Both groups completed pre-tests before the intervention and post-tests afterward. The activity sheets, pre-tests, post-tests, and lesson plans were validated by master teachers in the Science Department. Descriptive research, which aims to depict events or specific groups, was utilized to understand students' perceptions of the intervention. A Likert scale, a rating tool for measuring opinions, attitudes, and perceptions, was used to quantify feedback. The researchers adapted the Student's Perception Survey, based on Andujar et al. (2012), which consisted of ten statements rated on a four-point scale to assess students' views on the teaching strategy.

2.2 Data Sources

The study's data sources included pre-test and post-test results from 50 Grade 9 students, with 25 from G9-Olive (experimental) and 25 from G9-Mocha (control). It also gathered the experimental group's perceptions after the differentiated instruction intervention.

2.3 Research Procedure

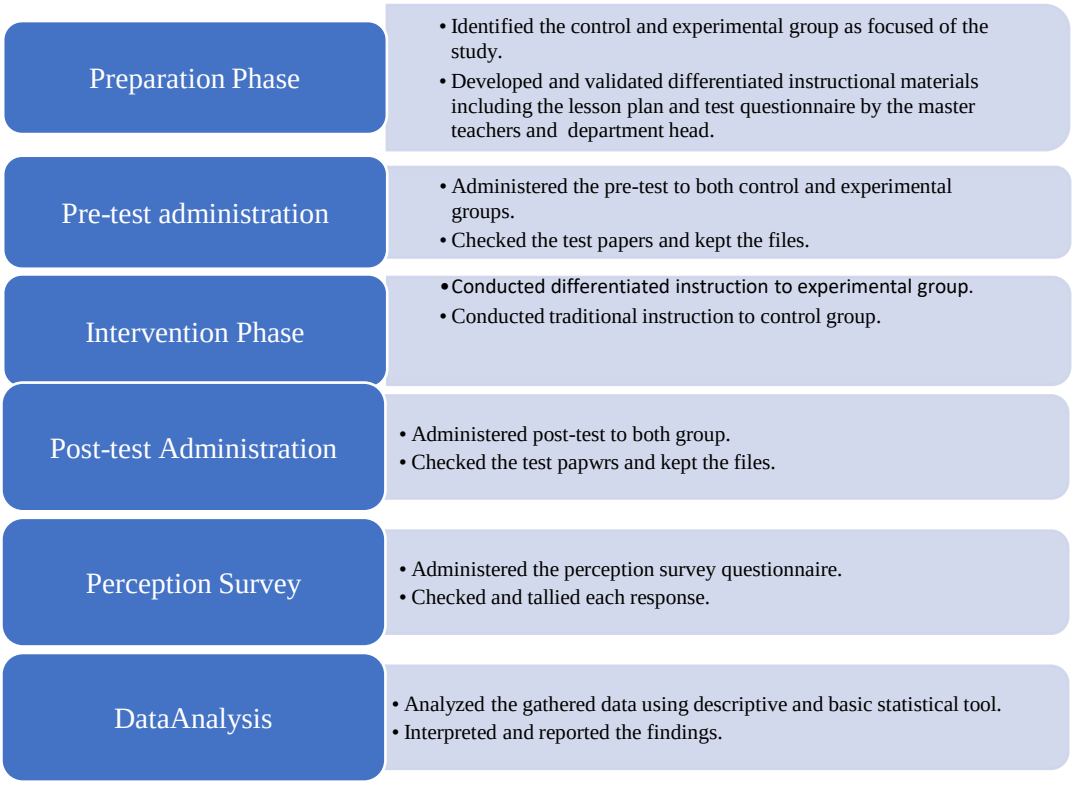

Figure 1. Flowchart of the Research

3. RESULTS AND DISCUSSION

3.1 Descriptive Analysis of Academic Performance

Table 1. The academic performance of control and experimental groups before the conduct of Differentiated Instruction

Section	Pre-test	N	Mean	MPS	SD	t-value	p-value	Interpretation
Olive	Control Group	25	2.60	26%	1.98	-0.86	0.40	**Not Significant**
Mocha	Experimental Group	25	2.12	21.20%	1.72			

**Note: No. of items is 10*

Table 1 showed the achievement levels before using the differentiated method. The data included the mean and MPS of students who took a pretest on projectile motion. The control group, Grade 9 Olive, had an MPS of 26%, while the experimental group, Grade 9 Mocha, scored 21.20%. Both scores were below the national standard of 75%. The p-value for both groups was 0.40, meaning there was no significant difference between them. Overall, both groups had concerning results, indicating a need for intervention to improve their academic performance. Studies by Adebayo & Adigun (2018) and Jotia & Matlale (2011) showed that lack of resources and poor teaching methods negatively impacted student performance and affected their ability to complete tasks effectively.

Table 2. The academic performance of the control and experimental groups after the conduct of Differentiated Instruction

Section	**Pre-test**	**N**	**Mean**	**MPS**	**SD**	**t-value**	**p-value**	**Interpretation**
Olive	Control Group	25	3.44	34.40%	1.91	10.51	<0.001	**Significant**
Mocha	Experimental Group	25	8.28	82.80%	1.24			

**Note: No. of items is 10*

The independent t-test was used to determine if there was a significant difference between two sample sets, focusing on the calculated t-value. A t-value greater than 5 indicates a substantial difference between the groups. In this case, the main difference was their exposure to the differentiated teaching method. The experimental group showed a t-value higher than 5 when comparing pretest and posttest results, suggesting a significant difference.According to the data in Table 2, Grade 9 Mocha, which experienced Differentiated Instruction, achieved the highest MPS of 82.80%, while Grade 9 Olive, which did not receive this instruction and relied on modules, had an MPS of 34.40%. This indicates that students exposed to Differentiated Instruction performed better than those who were not. The results highlight the significant impact of the intervention on student performance.Additionally, the p-value was recorded at <0.001, indicating a statistically significant result. This finding led to the rejection of the null hypothesis and acceptance of the alternative hypothesis. Supporting this conclusion, Campillo-Ferrer (2021) conducted similar data analysis and found that Differentiated Instruction positively affected students, as reflected in their favorable perceptions of the approach.

3.2 Is the intervention effective towards improving least learned competency in physics?

Table 3. T-test for pretest and posttest score of students in conduct of Differentiated Instruction under the experimental and control groups

Variables	**t-value**	**df**	**p-value**	**Interpretation**
Experimental Group (Pretest vs Posttest)	-12.52	24	<0.001	**Significant**
Control Vs Experimental Group (Postest vs Posttest)	10.51	24	<0.001	**Significant**

The paired t-test was used to determine if there was a relationship between two variables: the intervention (Differentiated Instruction) and the least learned competencies of students. The p-value was crucial in this analysis; if it was less than the significance level of 0.05, the null hypothesis, which stated that no relationship existed between the two variables, could be rejected.Table 3 illustrated the significant results of the pretest and posttest for the Grade 9 classes using Differentiated Instruction. The paired t-test yielded a t-value of -12.52 for the experimental group, with a p-value of <0.001. This indicated a significant difference between the pretest and posttest scores, suggesting that Differentiated Instruction effectively addressed least learned competencies.The p-value being less than 0.001 confirmed a relationship between the intervention and student performance. Nouri (2016) found that Differentiated Instruction promoted effective and active learning, particularly for low achievers. This approach allowed students to learn at their own pace, encouraged engagement with material, utilized class time efficiently, fostered stronger student-teacher interactions, and gave students more control over their learning. The relationship between these variables was further explored in subsequent analyses.

3.3 What are the Perceptions of the students with regards to teaching method?

Table 4. Perception Survey of Experimental Group on their insights of Differentiated Instruction experience

Statements	**4**	**3**	**2**	**1**	**Total Response**	**WM**	**Interpretation**
1. The DI helped me understand the lesson on Projectile motion.	15	10			25	3.60	Strongly Agree
2. The presentation of the concepts using DI is clear and fitted to my needs.	9	16			25	3.36	Agree
3. I could easily understand the lesson using DI teaching.	15	7	3		25	3.48	Agree
4. I believe the DI is effective way to learn difficult lesson.	20	5			25	3.80	Strongly Agree
5. I feel motivated in DI.	17	8			25	3.68	Strongly Agree
6. The time and effort I spent in the DI learning was worthwhile.	12	10	3		25	3.36	Agree
7. I become more active learner in DI learning.	14	11			25	3.56	Strongly Agree
8. I believe this method guided me toward better understanding of the content.	11	10	4		25	3.28	Agree
9. I devoted myself on the instructional (Learning Activity Sheet) and class activities in the DI method.	16	5	4		25	3.48	Agree
10. Generally, I am happy and satisfied with this DI learning experience.	18	7			25	3.72	Strongly Agree
Total						3.53	Strongly Agree

The study focused on the idea that the least learned competency in projectile motion improved through the Differentiated Instruction method. As discussed in previous sections, specific questions were analyzed using the Likert scale, resulting in a weighted mean (Table 4). The analysis indicated that Differentiated Instruction positively impacted students' learning, particularly in enhancing their least learned competency in projectile motion. This conclusion was supported by a weighted mean in the range of 3-4, with 4 indicating "strongly agree." Lesley University (2022) supported this finding, stating that "students are able to learn more deeply and retain material better" through Differentiated Instruction.

CONCLUSION

This study concluded that Differentiated Instruction improves the least learned competencies of students in projectile motion. The study aimed to evaluate the effect of Differentiated Instruction as a strategy to enhance academic performance in projectile motion at Cataingan National High School, Cataingan, Masbate, Philippines, during the 2022-2023 school year. Results indicated that the experimental group outperformed the control group based on their post-test results. Therefore, the researchers concluded the following:

1. Before the intervention, students in both the control and experimental groups demonstrated poor performance in projectile motion competencies. They exhibited limited conceptual knowledge, comprehension, and analytical skills related to the topic. The academic performance of both groups prior to implementing Differentiated Instruction was comparable. This finding suggests that targeted interventions are necessary to address foundational gaps in students' understanding.

2. The analysis revealed a significant difference in academic performance on projectile motion between classes that received Differentiated Instruction and those that did not, as evidenced by a p-value of <0.001. This outcome underscores the importance of adopting differentiated strategies to cater to diverse learning needs and enhance student engagement.

3. Although projectile motion is a challenging topic in physics, students enjoyed the Differentiated Instruction approach, as reflected in their positive feedback from the perception survey regarding their learning experience. This indicates that incorporating varied instructional methods can improve student motivation and satisfaction, leading to better educational outcomes.

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