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Differentiated Instruction and Mathematical Performance of Students

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Abstract
This study investigated the effect of Differentiated Instruction (DI) on the performance in Mathematics of students at Governor Mariano E. Villafuerte Community College, Siruma Campus, for the academic year 2024-2025. Specifically, it determined the following: (1) the status of the mathematics performance of First year students; (2) design of the Differentiated Instruction; (3) level of the mathematics performance of the first-year students after the implementation of DI; (4) the significant difference between the mathematics performance before and after using Differentiated instruction; and (5) the extent of effectiveness of DI on the mathematics performance of students. The results of this study have the potential to offer advantages to a wide range of individuals and parties involved in the community especially the students, teachers, parents, administrators of educational institutions, dean of the college, commission on higher education region V officials, curriculum developers and other researchers. This study employed descriptive-comparative and research and development. The data gathering tool used was a researcher-made test while the statistical used were Mean, Performance Level, Standard Deviation, Weighted Mean, t-Test for Dependent Samples and Cohen's D Effect.

Keywords: Differentiated Instruction, Mathematical Performance

1. Introduction

Differentiated instruction is a global issue in education because it is not always practiced effectively in classrooms worldwide. This approach acknowledges that students have different learning styles and abilities, but teachers struggle to provide individualized support due to large class sizes or limited resources. This can result in some students falling behind or becoming disengaged from their learning. Acknowledging the wide range of learners and fostering inclusion among students is a praiseworthy objective and an essential need in education. It fosters a cohesive and encouraging classroom atmosphere where every student, regardless of background, may succeed academically.

In the context of mathematics, performance among students has emerged as a critical area of concern for educators, parents, and policymakers alike. In recent years, various studies have highlighted persistent disparities in math achievement, influenced by factors such as socioeconomic status, access to quality educational resources, instructional practices, and individual learning differences. These discrepancies not only affect students' immediate academic success but also have long-term implications for their career prospects and overall confidence in their mathematical abilities.

In exploring the complex dynamics of educational approaches, the interplay of differentiated instruction and the mathematical performance of students emerges as a critical area of focus. This pedagogical strategy, which makes learning experiences to meet the diverse needs, abilities, and interests of each student, plays a significant role in fostering mathematical understanding and achievement.

In many developed countries, such as the United States, Canada, and parts of Europe, differentiated instruction has been integrated into teacher training programs and classroom practices. For instance, in the U.S., the No Child Left Behind Act (2001) and the Every Student Succeeds Act (2015) have emphasized the importance of personalized learning to ensure that all students, regardless of their abilities, achieve academic success (Estaiteyeh, 2023). Similarly, countries like Finland and Singapore, known for their high-performing education systems, have adopted DI as a core strategy to foster inclusive and equitable education (Maulana et al., 2023).

On a broader scale, the principles of differentiated instruction align with the global commitment to inclusive and equitable education as emphasized by the United Nations' Sustainable Development Goal. The Sustainable Development Goals (SDGs) emphasize the importance of providing inclusive and equitable quality education for all individuals (United Nation, 2015). This includes increasing access to free and quality education as well as ensuring that there are enough qualified teachers, particularly in developing countries. Sustainable Development Goal 4 aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. This goal supports the reduction of disparities and inequities in education, both in terms of access and quality. It recognizes the need to provide quality education for all, and most especially vulnerable populations, including poor children, children living in rural areas, persons with disabilities, indigenous people and refugee children.

Despite these international efforts, challenges remain in developing countries, including the Philippines, where educational disparities persist. The Philippine education system has long struggled with issues in mathematics instruction, as evidenced by the country's poor performance in international assessments. Based on the Program for International Student Assessment (PISA) 2018 International Report, Filipino students achieved an average score of 353 in mathematical literacy, significantly lower than the Organization for Economic Co-operation and Development (OECD) average of 489 points.

Similarly, according to the trends in International Mathematics and Science Study (TIMSS) 2019, the Philippines achieved a mathematics score 297 in 2019. These numbers highlight the pressing need to tackle kids' self-assurance in mathematics and use efficient tactics to improve math instruction in the Philippines. The selection of differentiated instruction is crucial in facilitating rapid student recovery, bridging learning disparities, and enhancing academic achievement. The concept of differentiated instruction acknowledges students' individual talents and untapped potential, which must not be disregarded. Although the Philippines mainly comprises indigenous peoples, it has significant intellectual capabilities.

One of the critical challenges faced by first-year college students in the Philippines is the lack of foundational skills and understanding. Many students struggle with basic mathematical concepts and operations, which hinders their ability to tackle more advanced topics. This can lead to lower grades, reduced confidence, and disengagement from the subject. Consequently, many students struggle with math concepts due to gaps in their foundational knowledge from earlier education. This lack of understanding hinders their ability to grasp more complex topics, leading to low grades and a lack of confidence in the subject. Schools need to address this issue by providing additional support and guidance to help students improve their math skills. The persistent struggle of first-year college students with mathematics presents a significant challenge that requires immediate and sustained intervention.

However, the effective implementation of differentiated instruction in Philippine schools faces several obstacles. Many teachers may not have the time or support to create individualized lesson plans for each student, leading to a one-size-fits-all approach that does not cater to the diverse needs of learners. Acknowledging the wide range of learners and fostering inclusion among students is a praiseworthy objective and an essential need in education. It fosters a cohesive and encouraging classroom atmosphere where every student, regardless of background, may flourish. This teaching method, which includes everyone, aligns with the worldwide ideals of inclusive education and is necessary for providing pupils with the necessary abilities to thrive in a more varied and interconnected world.

Additionally, large class sizes and overcrowded classrooms make it even more challenging for teachers to provide personalized instruction. To address this issue, schools need to prioritize teacher training and provide resources to support the implementation of differentiated instruction, ensuring that all students receive the support they need to succeed. The Commission on Higher Education (CHED) recognizes the importance of flexible curriculum delivery. According to the Commission on Higher Education (2016), the sample or suggested course syllabi can be used as guides, and public and private HEIs may adopt the sample or suggested course syllabi in the teaching and in the delivery of the content of the new GEC. For record purposes, the HEIs shall inform the CHED Regional Offices (CHEDROs) of their implementation of the new GEC. The course begins with an introduction to the nature of mathematics as an exploration of patterns (in nature and the environment) and as an application of inductive and deductive reasoning.

In accordance with the pertinent provisions of Republic Act No. 7222, otherwise known as the Higher Education Act and by virtue of Commission en banc Resolution No 231-2017, section 4, states that:
The HEIs are allowed to design curricula suited to their own contexts and missions provided that they can demonstrate that the same leads to the attainment of the required minimum set of outcomes, albeit by a different route. In the same vein, they have latitude in terms of curriculum delivery and in terms of specification and deployment of human and physical resources as long as they can show that the attainment of the program outcomes and satisfaction of program educational objectives can be assured by the alternative means they propose.

This approach aligns with differentiated instruction which used to facilitate students' engagement in both independent and collaborative tasks to strengthen their understanding of mathematical principles. Teachers provide customized education that considers the unique needs of each student (Boushey and Moser, 2015). By implementing adaptive and dynamic math groups, influenced by continuing evaluations, the educational system guarantees that teaching coincides with individual growth, so contributing to the promotion of educational justice and preparing students for the global labor market.

Studying Differentiated Instruction and its effect on students' math performance is crucial as it can help identify effective teaching strategies that cater to diverse learning styles and abilities. Implementing personalized instruction, teachers can better address the individual needs of students, potentially leading to increased engagement and understanding in math concepts. Understanding the effects of Differentiated Instruction on students' mathematical performance can also help in bridging achievement gaps and ensuring all students have equal opportunities to succeed.

2. Theoretical Framework

The theoretical framework provides the theories related to the study, which matches its goals, purposes, and objectives. Theories help the researcher understand how they support and relate to the variables being investigated. This study is anchored on Piaget's Constructivism Theory cited by Afurobi, et al. (2017), Vygotsky's Zone of Proximal Development (ZPD) cited by Small (2017), Gardener's Multiple Intelligences Theory cited by Sener and Cokcaliskan (2018), and Walberg's Theory on Performance cited by Elger (2015).

Piaget's Social constructivism, as elucidated by Afurobi et al. (2017), positions differentiated instruction not merely as a pedagogical strategy but as a philosophical process. It champions learner-centered, constructivist-guided approaches where students freely express their unique thinking power while actively engaging with their social environment. This approach promotes learner centered, constructivist-guided strategies, wherein the educational environment is tailored to accommodate the diverse needs, interests, and abilities of each student. In a classroom influenced by this philosophy, educators act as facilitators, encouraging students to explore, question, and collaborate. As they engage with peers, they are not passive recipients of knowledge but active participants in their learning journey, encouraged to express their unique perspectives.

In this study, Piaget's Social constructivism theory could be applied by encouraging students to work together in groups, discuss and share their thinking processes, and learn from each other's strategies. Creating a social learning environment where students can engage in meaningful discussions and learn from one another, educators can help facilitate the construction of mathematical knowledge and improve overall student performance in math. Additionally, incorporating collaborative projects and peer feedback mechanisms can further enhance this interactive learning experience, allowing students to take ownership of their learning. Students are more likely to develop critical thinking skills and deepen their understanding of mathematical concepts.

Moreover, Vygotsky's Zone of Proximal Development (ZPD) cited by Small (2017), a socio-constructivist theory put forward, serves as the foundational premise of differentiated instruction. Emphasizing the social environment's pivotal role in learning, the ZPD theory contends that differentiated instruction aims to create an environment where learners can solve problems guided by teachers or more skilled peers. This aligns with the broader philosophy that meaningful learning necessitates teacher scaffolding, collaboration with peers, and tasks slightly beyond students' comfort levels.

In the context of mathematics teaching, the challenges of meeting diverse learner needs, underscore the relevance of differentiated instruction. It is emphasized that learners in mathematics possess distinct interests, abilities, and learning needs, making differentiated instruction a valuable approach that positively influences the classroom atmosphere and mathematics achievement. Tailoring instructional strategies to accommodate varying proficiency levels and learning styles, teachers can foster a more inclusive environment that encourages all students to engage with mathematical concepts. This adaptive teaching method not only boosts individual confidence and competence in mathematics but also promotes collaboration and peer support among students.

Additionally, the incorporation of Gardner's Multiple Intelligences Theory as noted by Sener and Cokcaliskan (2018), broadens the perspective on differentiated instruction. Gardner's theory recognizes various intelligences, ranging from logical- mathematical to existential. This theory encourages teachers, to engage students through materials structured to address different intelligences. Differentiating learning materials based on students' varied intelligences, differentiated instruction not only enriches the learning experience but also enhances personal motivation.

This theory collectively contributes to the understanding of how differentiated instruction, tailored to students' diverse needs and intelligences, can positively impact mathematical performance. Recognizing the social and collaborative nature of learning, leveraging the zone of proximal development, and acknowledging the varied intelligences of students, differentiated instruction aims to create an inclusive and effective learning environment, potentially enhancing mathematical achievement. Incorporating diverse teaching strategies that resonate with individual learning styles, educators can foster a deeper engagement with mathematical concepts. This approach not only boosts students' confidence in their abilities but also promotes a lasting motivation to excel in mathematics.

Lastly, Walberg’s Theory on Performance as cited by Elger (2015), or e Theory of Performance (ToP) develops and relates six foundational concepts to form a framework that can be used to explain performance as well as performance improvements. To perform is to produce valued results. A performer can be an individual or a group of people engaging in a collaborative effort. Developing performance is a journey, and level of performance describes location in the journey. Current level of performance depends holistically on 6 components: context, level of knowledge, levels of skills, level of identity, personal factors, and fixed factors. Three axioms are proposed for effective performance improvements. These involve a performer’s mindset, immersion in an enriching environment, and engagement in reflective practice.

When applied to the study of Differentiated Instruction and Mathematical performance of students, this theory suggests that tailored teaching methods that accommodate diverse student needs can lead to improved mathematical performance. Individualizing instruction based on students' abilities, interests, and learning styles, teachers can create a more engaging and effective learning environment, ultimately helping students achieve greater success in mathematics. This connection highlights the potential impact of Differentiated Instruction on enhancing student performance in math.

3. Conceptual Framework

This study's conceptual framework is the input-process-output of the effects of Differentiated Instruction on the Mathematical performance of first year students.

In the input phase, the research evaluated the status of the students' mathematics performance along with the nature of mathematics, mathematics as a language, problem, reasons, and solutions in mathematics, and statistics and data. This was done through a Pre-Test wherein participants engage with foundational concepts that are crucial for understanding the broader implications of mathematics in various contexts. Furthermore, the students' mathematical performance was described and discussed along the mentioned aspects.

In the process phase, the Differentiated Instruction activities were designed to foster collaboration through structured peer learning, where students could support each other's understanding. Small group discussions were strategically formed to encourage diverse perspectives and enhance critical thinking. Additionally, board work was integrated to visually reinforce concepts and ensure active participation among all students. Observations of classroom experiences during the implementation were systematically documented to evaluate the effectiveness of the differentiated strategies and to inform future improvements.

In the output phase, the level of the mathematics performance of the Grade first year students were determined after the implementation of DI through a Post test conducted. The significant differences between the mathematics performance before and after using Differentiated instruction were also compared. Moreover, the extent of effectiveness of DI on the mathematics performance of first year college students was also determined. The results indicated a notable improvement in the students' mathematical skills, suggesting that Differentiated Instruction effectively addresses diverse learning needs.

The feedback loop involved gathering input from teachers on the effectiveness of the differentiated instruction strategies employed to improve the students' mathematical performance. This feedback was then used to make any necessary adjustments to the recommendations and ensure that they met the intended goals of the study. Additionally, regular discussions were held to facilitate collaboration among educators, allowing them to share best practices and insights related to the implementation of these strategies. This iterative process not only enhanced the teaching methods but also fostered a greater sense of community and support among the teachers involved.

4. Methodology

This section discussed the methodology and procedures involved in the conduct of this study. Specifically, it entailed the research design, research instrument as well as the statistical treatment of data.

Method Used
This study employed the descriptive-comparative and research and development to address the issues raised within its scope.

Statistical Tools

To analyze and interpret the data, the researcher employed Standard Deviation, Mean, Performance Level, Weighted Mean, T-test for dependent samples mean, Coefficient of correlation, and Coefficient of Determination to easily tally the data gathered through an online calculator/software.

Mean.
This was used to determine the status of mathematical performance of students.

Standard Deviation (SD).
This was used to determine the variability of the students' mathematical performance.

Performance Level (PL).
This was used to determine the level of mathematical performance of students.

Weighted Mean.
This was used for the scale type of questions to measure how the respondents agreed on their evaluation.

t-test for Dependent Samples.
This was used whether the difference between before and after is statistically significant or not.

Cohen's D.
This tool was used to measure the extent of effect of the developed Differentiated Instruction material in Mathematics.

5. Results and Discussions

Status of Mathematics Performance refers to the current state of proficiency and achievement in mathematics among students, often measured through standardized tests or assessments. Table 2 shows the status of mathematics performance of the students along with the competencies in nature of mathematics, mathematics as a language, problem, reasons, and solutions, and statistics and data.

The mean score suggests that, on average, students scored below half of the possible points in the mathematical performance assessment. The standard deviation indicates that there was heterogeneity in student scores, with some students scoring significantly higher or lower than the mean. The performance level falling below the passing threshold reinforces the assessment that a significant proportion of students did not meet the expected level of proficiency in mathematics. This indicates a potential need for additional support and resources to help students improve their mathematical skills and understanding. The results of the mathematical performance assessment highlight a concerning level of performance among the students, with the majority failing to meet the expected standards.

The results of this study align with the findings of Alburan (2021), who demonstrated that students taught through differentiated instruction outperformed those in traditional learning environments. This reinforces the idea that tailored teaching methods can significantly improve student learning outcomes. Similarly, Bal (2016) emphasized that differentiated instruction fosters a more engaging and immersive learning experience, which may explain why students exposed to such approaches exhibit higher performance levels. However, despite the recognized benefits of differentiation, the challenges highlighted by Lavania and Nor (2020) suggest that its implementation remains hindered by limited teacher training and institutional constraints. This could explain the inconsistencies in student performance observed in this study, as differentiated instruction may not have been applied consistently or effectively across all learning areas.

Furthermore, the study of Bonesronning et al. (2022) highlighted the positive impact of small-group instruction on mathematical performance, supporting the idea that peer-assisted learning could be an effective intervention to address students' difficulties.

However, Wester (2020) cautioned that small-group discussions, if not paired with whole-class instruction, may limit students' ability to fully grasp critical mathematical concepts. This suggests that while collaborative learning is beneficial, it must be strategically integrated with direct instruction to maximize student learning. Ultimately, the findings of this study, when examined alongside existing literature, highlight both the potential and the limitations of differentiated instruction in improving student mathematical performance, emphasizing the need for a balanced and well-supported implementation strategy.

This underscores the importance of identifying areas of weakness, providing targeted interventions, and implementing strategies to improve student outcomes in mathematics. Further analysis, such as identifying specific areas of difficulty or conducting a root cause analysis, could help provide more insights into the reasons behind the low performance and inform the development of effective interventions to support students in achieving success in mathematics. The implications of this performance data suggest several avenues for potential intervention and improvement in the students' mathematical ability. This might point to a need for enhanced pedagogical strategies that address specific areas where students struggle, such as conceptual understanding, problem-solving skills, or test-taking strategies. Furthermore, the moderate standard deviation hints at variability in individual performances, which could indicate the presence of both high achievers and those who face considerable challenges. Educators may consider differentiated instruction to cater to diverse learning needs within the classroom.

This is supported by Vygotsky's Zone of Proximal Development Theory (Small, 2017) which emphasizes the importance of social interaction and guidance in the learning process, highlighting that students often perform better when supported by more knowledgeable peers or instructors. Relating this to the current study, which indicates that students are exhibiting a fair performance level, it suggests that the learning environment may not be fully leveraging collaborative or scaffolded instructional approaches. By integrating principles from the ZPD, educators could enhance student performance by strategically pairing learners with varying skill levels for peer-to-peer support or providing tailored interventions that bridge knowledge gaps.

The Design of Differentiated Instruction refers to an educational approach that tailors teaching methods, resources, and assessment strategies to meet the diverse needs of students. This approach fosters an inclusive classroom environment where every student can thrive. The design of the DI involves peer learning, small group discussions, and board work.

This study examines the mathematics performance of first-year students following the implementation of Differentiated Instruction (DI) strategies. By tailoring teaching methods to accommodate diverse learning styles and abilities, the research aims to evaluate how DI impacts student engagement and academic achievement in mathematics which is shown in Table 3.

The data presented in the table indicates that students' performance in statistics and data did not significantly improve after the implementation of Differentiated Instruction. It is important to note that a mean score indicates that, on average, students struggled to perform well on the competency. This indicates that the overall performance of students, after the implementation of DI, did not meet the expected level of proficiency in statistics and data.

This suggests that while students may have made some progress in their understanding of the material, it was not enough to significantly impact their overall performance level. This outcome has important implications for both the teaching methodology and the students' learning outcomes. It raises questions about the effectiveness of the DI approach in improving students' mastery of statistics and data. It may be necessary to reassess the teaching methods and strategies used in order to better address the needs of the students and help them achieve a higher level of understanding and proficiency in the subject. Overall, the results indicate that while there was some improvement in students' performance in statistics and data following the implementation of DI, it was not enough to move them out of the Failed category.

The result is linked to Alisio (2020) who emphasizes the importance of integrating real-world applications in teaching statistics to enhance student engagement and understanding. This connection underscores the challenges observed in the current study, where students exhibited only good performance in statistics and data competencies, highlighting a potential gap in practical application within the curriculum. Similarly, Roman and Villanueva (2019) focused on the role of active learning strategies in boosting students' analytical skills and overall performance in statistics.

In the context of the post-test performance in mathematics, Gardner's MI theory, although the students did not achieve the expected outcomes, their results reflected a slight improvement over previous assessment. This modest progress suggests that, while traditional instructional approaches may not have fully engaged the diverse intelligences of all students, the implementation of varied teaching strategies could have contributed to fostering some level of understanding and interest in mathematics.

Furthermore, the overall level of students' performance after the implementation of DI. It resulted to a mean score of 39.31, a standard deviation of 7.19, and a performance level of 65.52 interpreted as failed. The results presented in Table 3 provide a quantitative assessment of student performance following the implementation of differentiated instruction (DI).

It can be analyzed that the mean score shows that, on average, students scored significantly below a passing rate. This average score indicates that the majority of students did not achieve the learning objectives set forth in the curriculum post-implementation of DI. The standard deviation indicates some variability in student performance, with scores clustered without significant deviation around the mean. A standard deviation close to the mean implies that most students' scores are concentrated around the average score, showing relatively little dispersion. Additionally, the performance level underscores the inadequacy of the learning outcomes following the implementation of DI. Although this score is higher than the mean and potentially frames a relative improvement, it still falls short of expectations and indicates that foundational learning gaps remain unaddressed.

Taken together, these metrics suggest that the current forms of DI might require reassessment and refinement. Understanding why the implementation did not yield better performance outcomes is crucial; factors could include insufficient training for educators in DI practices, lack of resources, inadequate support systems for students, or perhaps ineffective assessment methods that don't truly capture student understanding. While the mean score and standard deviation reveal some insights into the patterns of student performance, the overall interpretation of these results suggests that further analysis and adjustments to the differentiated instruction approach are necessary. To realize the potential benefits of DI, stakeholders must identify the barriers to effective implementation and work collaboratively towards more impactful educational strategies that uplift student performance across the board.

This is consistent with the study of Aguhayon et al. (2020) who examined factors influencing student performance and highlighted the importance of engagement and motivation in achieving academic success. Their findings resonate with the current research, which indicates that students though performing at a failed, an improvement was also seen on their performance. Similarly, Bhagat et al. (2016) emphasized the role of instructional strategies in enhancing student comprehension and performance. Their insights align with the present study's results, suggesting that effective teaching methods are critical to helping students elevate their performance from fair to higher levels.

This is linked in Gardner's Multiple Intelligences Theory which posits that individuals possess different types of intelligence, such as linguistic, mathematical, spatial, and interpersonal, among others (Sener & Çokçaliskan, 2018). In the context of a study showing good performance levels among students, Gardner's theory highlights the importance of tailored instructional methods that consider students' unique intelligence potentially leading to improved performance outcomes. Similarly, Walberg's Theory on Performance emphasizes the interplay of personal, home, and school factors in influencing student achievement.

Differentiated instruction involves modifying content, processes, and products based on individual learners' needs, thereby enhancing engagement and understanding. The research evaluates changes in student performance, highlighting how personalized approaches can lead to improved outcomes in mathematics education.

Based on the table, the performance of the students in mathematics along with four competencies before and after the implementation of DI had a mean of 24.03 and 39.31 resulted to t-statistics value of 17.66 and t-critical value of 2.00 at 0.05 alpha interpreted as significant.

The performance of students in mathematics, as quantified by the mean scores before and after the implementation of Differentiated Instruction (DI), indicates a substantial improvement. The mean score rose before DI was implemented. This increase shows that DI may have positively influenced students' engagement and understanding of mathematical concepts, contributing to better performance across the measured competencies. The t-statistics value significantly exceeds the t-critical value at a 0.05 significance level, which affirms the statistical significance of the difference between the two performances. In this context, the calculated t-statistics demonstrates that the likelihood of observing such a large difference due to random chance is exceedingly low, indicating that the variation in student performance can be attributed to the newly adopted teaching methodology rather than random fluctuation.

It can be inferred that the significant improvement in mean scores indicates that the implementation of DI has had a profound effect on student learning outcomes in mathematics. This outcome suggests that the tailored educational approaches employed under DI could cater more effectively to diverse learning styles and competencies, resulting in heightened student motivation and comprehension. The considerable t-statistics value reinforces the notion that educational strategies designed to accommodate individual student needs can lead to marked enhancements in academic performance. This evidence advocates for the continued and expanded use of DI, as it not only demonstrates a significant elevation in student achievement but also aligns with contemporary pedagogical practices that prioritize personalized learning experiences.

The results of the study align with the findings of Ismajli and Imami Morina (2018), who explored the effect of differentiated instruction strategies on student performance in various subjects, including mathematics. This supports the notion that the implementation of Differentiated Instruction in the current study has similarly enhanced students' understanding and engagement in mathematics. By applying these strategies, as evidenced by the significant rise in mean scores and the substantial t-statistics value, the research indicates that the application of DI can lead to improved educational outcomes.

Furthermore, the results resonate with Walberg's Theory on performance, which posits that student performance is heavily influenced by instructional strategies and classroom environments (Elger, 2015). According to Walberg, effective teaching methodologies can enhance student motivation and learning, resulting in better academic performance. The substantial improvement in mean scores post-implementation of Differentiated Instruction, supported by the t-statistics demonstrating low probabilities of chance, aligns with Walberg's assertions that a well-structured instructional framework significantly impacts learning outcomes. Thus, the findings affirm that adopting differentiated strategies in mathematics education can create a more conducive learning environment.

Addressing diverse learning styles and varying levels of student ability, the research aims to evaluate whether these personalized approaches lead to improved comprehension and performance in mathematical concepts. The findings would provide insights into the effectiveness of differentiated instruction as a pedagogical strategy in enhancing educational outcomes in mathematics.

It can be gleaned from the table that the level of effectiveness of the DI on the performances of the students before and after the implementation had a mean score of 24.03 and 39.31 and SD of 6.16 and 7.25. This resulted to Cohen's d of 0.352, interpreted as small effect.

The analysis of the data indicates a significant increase in the effectiveness of the differentiated instruction (DI) approach on student performance, as evidenced by the mean scores before and after implementation. The results show a considerable improvement in student engagement and understanding, reflected in the upward shift of the mean scores. Despite the positive change, the effect size, measured by Cohen's d, suggests that the improvement is small. This indicates that while differentiated instruction has beneficial effects, other factors may also play a crucial role in shaping student performance outcomes.

The implications of these findings suggest that while differentiated instruction can enhance student performance, educators should be mindful that the effect may not be as pronounced as hoped. This signifies the necessity for ongoing evaluation and possibly integration of additional instructional strategies to support all learners effectively. Understanding that a small effect size may indicate limitations of DI alone prompts educators to consider a holistic approach that combines various teaching methodologies to enhance overall educational effectiveness.This is linked to the findings with the research conducted by Balita (2023), which also emphasizes the positive impact of DI on student performance. The significant improvement in mean scores observed in your results mirrors Balita's findings, reinforcing the idea that DI strategies effectively allow students to engage with the material in ways that are suited to their individual learning styles. Furthermore, Balita's examination of performance distribution complements the analysis of the increased standard deviation, suggesting that while DI can elevate average performance.

Additionally, your results resonate with Social Constructivism Theory, which posits that learners construct knowledge through interactions within a social context (Afurobi et al., 2017). The successful implementation of DI reflects the core tenets of this theory, as it encourages collaborative learning experiences and recognizes the importance of varied instructional methods in facilitating understanding.

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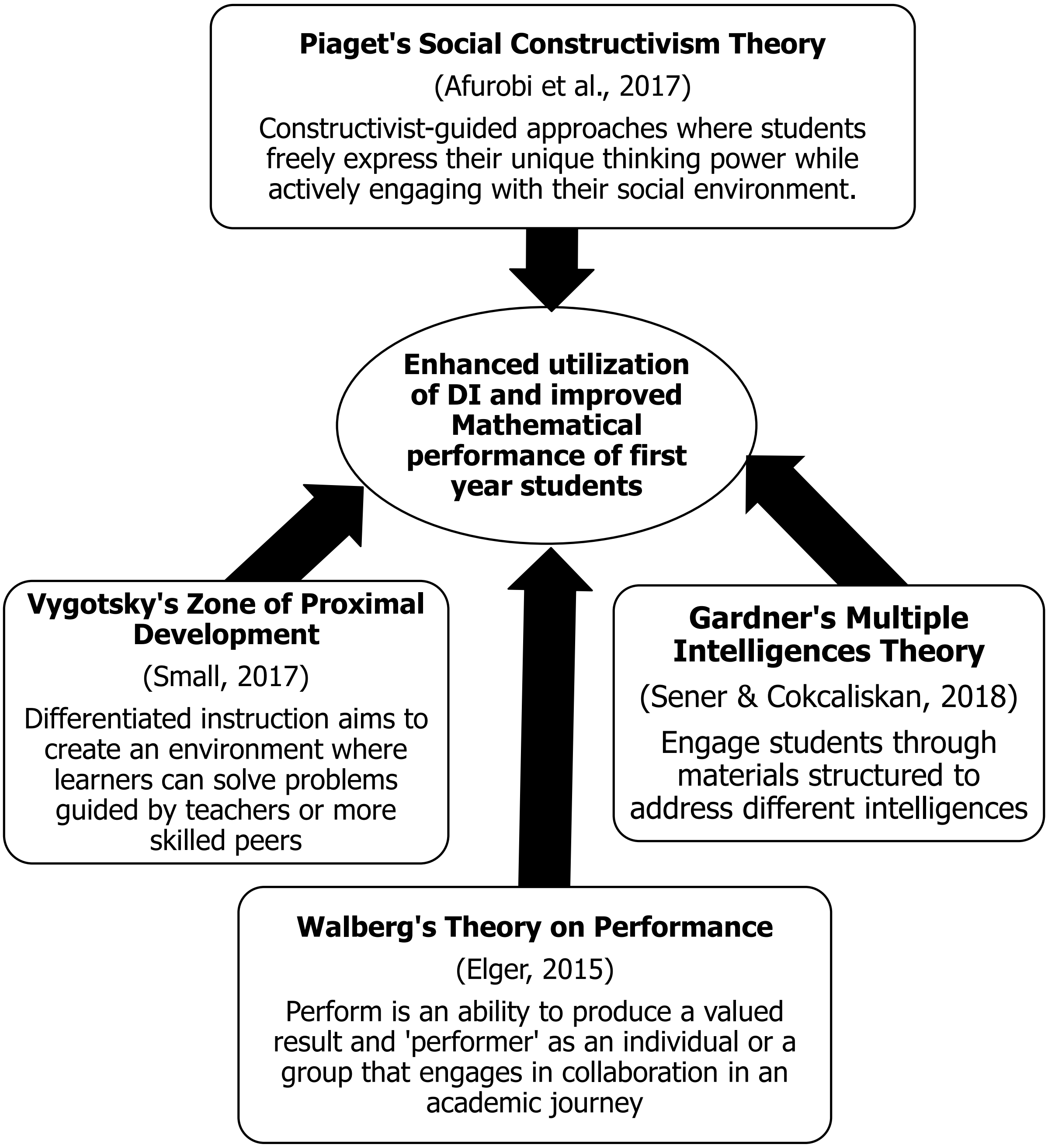

Figure 1

THEORETICAL PARADIGM

The figure shows the effects of different theories on the utilization of DI and Mathematical performance of students.

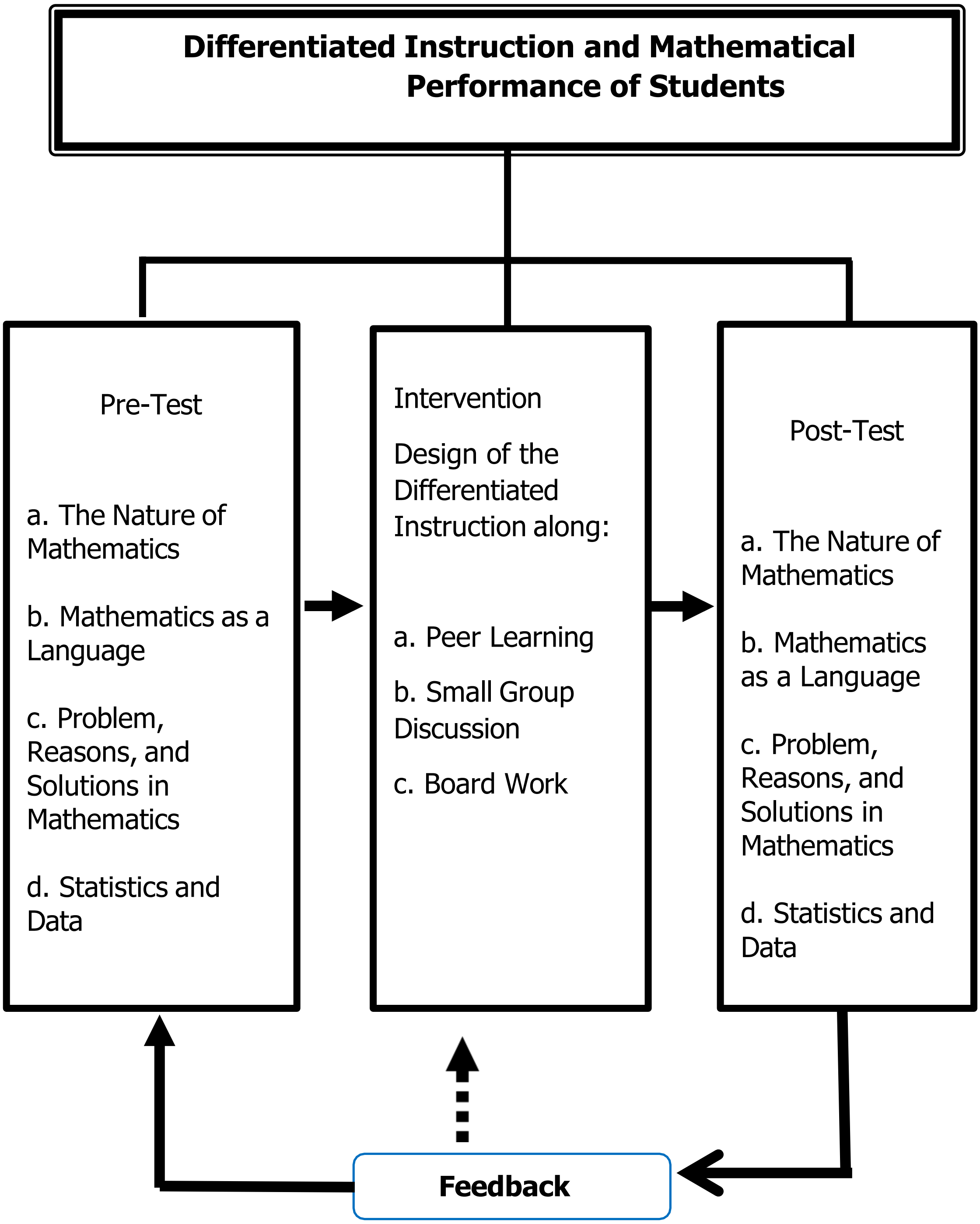

Figure 2

CONCEPTUAL PARADIGM

The process of crafting Differentiated Instruction strategies.

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List of Tables

Table 2
Status of Students' Mathematics Performance

Topics	Ni	Mean	SD	PL	Int
The nature of mathematics	15	6.30	2.77	42.00	F
Mathematics as a language	15	5.77	2.01	38.47	F
Problem, reasons, and solutions in mathematics	15	6.28	2.82	41.87	F
Statistics and data	15	5.69	2.41	37.93	F
Overall	**60**	**24.03**	**6.11**	**40.07**	**Failed**

Legends:

Ni : Number of items
SD : Standard deviations
PL : Performance level
Int. : Interpretation of Performance Level

Range	Interpretation
99-100	Excellent (**E**)
93-98	Very Good (**VG**)
87-92	Good (**G**)
80-86	Fair (**Fr**)
75-79	Passed (**P**)
74 below	Failed (**F**)

Source: Governor Mariano E. Villafuerte Community College-Siruma

Table 3
Mathematics Performance of Students after the Implementation of Differentiated Instruction

Competencies	Ni	Mean	SD	PL	Int
The nature of mathematics	15	9.67	2.74	64.47	**F**
Mathematics as a language	15	9.70	2.76	64.67	**F**

Problem, reasons, and solutions in mathematics	15	10.28	2.37	68.53	**F**
Statistics and data	15	9.66	2.74	64.40	**F**
Overall	**60**	39.31	7.19	65.52	**Failed**

Table 4
Mathematics Performance Before and After using the Differentiated Instruction

Performances	Ni	Mean	T-stat	t-crit	Interpretation
The Nature of Mathematics	15	Before 6.30 After 9.67	9.38	2.0	Significant
Mathematics as a Language	15	Before 5.77 After 9.70	12.51	2.0	Significant
Problem, Reasons, and Solutions in Mathematics	15	Before 6.28 After 10.28	12.72	2.0	Significant
Statistics and Data	15	Before 5.69 After 9.67	11.80	2.0	Significant
Overall	**60**	**Before 24.03** **After 39.31**	**17.66**	**2.00**	**Significant**

Legends:

Ni: Number of items
t-stat: t-statistical value
t-critical value at 0.05
t-crit: alpha

Table 5
Effectiveness of the Differentiated Instruction on Mathematics Performance of Students

Performances	Ni	Mean	SD	Cohen's d	Interpretation
Before	60	24.03	6.16	0.352	Small
After	60	39.31	7.25		

Legends: Cohen's D Effect Size Classification
Range Interpretation
> 1.30 Very Large 0.81-1.30 Large
0.51-0.80 Moderate
0.21-0.50 Small
0.00-0.20 Ignored

Source: Maximus Tamur @researchgate.net

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