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Differentiated Learning Activities: Effects on Students Motivation and Involvement in Teaching Mathematics

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ABSTRACT

This quasi-experimental study investigates the effects of differentiated instruction on student motivation and involvement in mathematics education. By comparing pretest and posttest mean scores, the research reveals that both traditional and differentiated teaching methods improve student learning; however, differentiated instruction shows a significantly greater increase in performance. Students exhibited positive attitudes towards mathematics, particularly in readiness and engagement, with a notable enhancement in motivation following the implementation of differentiated strategies. The findings suggest that educators should incorporate innovative teaching methods, such as Learning Centers and Flexible Grouping, to foster a more inclusive and engaging classroom environment. Ultimately, this study highlights the potential of differentiated instruction to enhance student appreciation for mathematics and provide actionable insights for effective teaching practices. A pretest/posttest questionnaire, adapted from the Division Unified Quarterly Pretest and Posttest materials, was used to assess student performance. The study utilized various statistical tools, including mean percentage scores, frequency and percentage, t-tests, weighted means, and ANCOVA, to analyze the data. both the experimental and conventional teaching methods resulted in an increase in mean scores from pretest to posttest, indicating that both approaches were effective in improving student learning. However, the experimental method demonstrated a larger mean score gain compared to the conventional method, suggesting a greater improvement in student learning outcomes. In contrast, a statistically significant difference was found between the pretest and posttest mean scores for the Experimental method, suggesting that this method was more effective in improving student performance. The study found a statistically significant difference in students' motivation and involvement before and after the implementation of differentiated instruction. This significant difference suggests that differentiated instruction had a positive impact on student motivation and engagement.

Keywords: differentiated learning, motivation, involvement, academic performance and mathematical ability.

INTRODUCTION

Differentiated learning activities, which involve tailoring instructional methods and materials to meet the diverse needs, strengths, and preferences of individual learners, are the focus of this study. It examines their impact on students' motivation and involvement in mathematics education, addressing the limitations of traditional, one-size-fits-all teaching methods. By fostering inclusive and engaging classroom environments, differentiated instruction aims to enhance students' active participation and deeper understanding of mathematical concepts. This research investigates how customized learning activities can promote a greater appreciation for mathematics while providing educators with valuable insights to create more effective and engaging teaching practices.

The Grade 4 mathematics MPS at Coleto Elementary School in Bislig City Division is the lowest among the eight subjects in the first two-quarters of SY 2024-2025. The MPS measures 43.38% and 42.77%, respectively. The quarterly GPA also demonstrates that most pupils are in the Satisfactory grade range, with progress and achievement in mathematics at 80-84. Teachers also observed a recurring pattern of disengagement and low motivation among students, mainly when traditional, one-size-fits-all teaching methods were employed. Many students thrived with textbook-based lessons and worksheets. In contrast, others became withdrawn and struggled to engage, highlighting a significant gap between instructional approaches and the diverse learning needs of students. Local studies conducted in the region, such as those by Collie et al. (2019), reveal a concerning trend of disengagement, where students feel overwhelmed by the pace of instruction and struggle to connect with mathematical concepts in ways that resonate with their learning styles. This persistent disconnect underscores the urgent need for differentiated instruction strategies to enhance motivation and involvement in mathematics learning. Moreover, the principles of inclusive education emphasize the importance of creating learning environments that accommodate the diverse needs of all students, ensuring that no child is left behind. By addressing this gap, the study aimed of developing more engaging and effective mathematics instruction, empower teachers with evidence-based strategies, and guide school administrators in promoting inclusive education practices that support the diverse needs of learners. This study holds significant value in advancing mathematics education by exploring the effects of differentiated learning activities on student motivation and involvement. It offers valuable insights into creating engaging and effective learning experiences tailored to students' diverse needs. The research bridges the gap between theory and practice by empowering teachers with practical strategies and fostering inclusive classrooms, contributing to improved academic outcomes and promoting positive change within local educational settings. Specifically, this seeks to answer the following questions: What are the pretest and posttest mean scores gained by the students during both methods of teaching? Is there a significant difference in the mean scores of the students on the pretest and posttest using the two teaching methods? What is the level of students’ motivation and involvement in terms of? readiness; engagement, and interests? Is there a significant difference in the level of students' motivation and involvement before and after using differentiated instruction?

THEORETICAL/CONCEPTUAL FRAMEWORK

This study explored the effectiveness of differentiated learning activities on student motivation and involvement in mathematics education. At its core, the research aims to understand how tailored instruction can address students' diverse needs, fostering a more engaging and inclusive learning environment. By integrating various educational theories, the study seeks to provide a comprehensive framework for enhancing students' academic experiences and outcomes. Sociocultural Theory, developed by Vygotsky (1978), which highlights the social nature of learning. This theory emphasizes that cognitive development occurs through interactions with more knowledgeable individuals within the learner’s Zone of Proximal Development (ZPD). To complement this, Gardner’s Theory of Multiple Intelligences (Gardner, 2011) supports the idea that intelligence is not a single, fixed construct but consists of various distinct intelligences, such as linguistic, logical-mathematical, and interpersonal. Additionally, Self-Determination Theory (SDT) focuses on fulfilling basic psychological needs—autonomy, competence, and relatedness to enhance intrinsic motivation (Deci & Ryan, 2013). Together, these theories provide a robust framework for understanding how differentiated instruction can promote motivation and involvement in mathematics, addressing both social interactions and individual learning preferences.

Framework of this study further illustrates the relationship between differentiated instruction and academic performance, with pretest/posttest serving as the primary measure of its impact. This framework emphasizes that by implementing differentiated instruction—incorporating hands-on activities, interactive games, problem-solving tasks, and considerations of mathematical ability—educators can positively influence students' academic outcomes in mathematics. The central idea is that tailoring instruction to meet individual student needs and preferences will lead to more engaging learning experiences and improved performance.

The framework visually represents the flow of the study, beginning with differentiated instruction as the independent variable. This approach is designed to accommodate diverse learning styles and abilities through various activities. It demonstrates how differentiated instruction is expected to impact the dependent variable: academic performance. This impact was assessed using a pretest/posttest design, allowing for a comparison of student performance before and after the implementation of differentiated instruction. This study is also supported by several legal frameworks, including Republic Act (RA) 9155, which promotes learner-centered education, and Executive Order No. 356, which encourages innovative teaching practices to meet diverse learner needs. Various Department of Education (DepEd) Orders advocate for inclusive education and differentiated instruction to cater to students with different abilities and learning styles. Additionally, Republic Act No. 11650 Mandates Individualized Education Plans (IEPs) for learners with disabilities, while Republic Act No. 10533 promotes a responsive curriculum that accommodates various learning styles. DepEd Order No. 021, s. 2019 requires differentiated instruction based on multiple intelligences, and DepEd Order No. 018, s. 2020 emphasizes flexible learning options due to the COVID-19 pandemic. Together, these legal foundations highlight the necessity of implementing tailored teaching strategies to foster inclusive and supportive educational environments for all students. Specifically, this seeks to answer the following questions: What are the pretest and posttest mean scores gained by the students during both methods of teaching? Is there a significant difference in the mean scores of the students on the pretest and posttest using the two teaching methods? What is the level of students' motivation and involvement in terms of: readiness; engagement, and interests? Is there a significant difference in the level of students' motivation and involvement before and after using differentiated instruction?

RESEARCH METHODOLOGY

This study employed a quasi-experimental research design to investigate the effects of differentiated learning activities on student motivation and involvement in learning mathematics. Quasi-experimental designs were particularly suitable for educational research where random assignment of participants to groups was often impractical or unethical (Campbell & Stanley, 1963). This design was applicable to the study as it allowed the researcher to conduct a practical and ethical investigation of differentiated instruction within a classroom setting, providing valuable insights into its potential effects on student learning. The study was conducted at Coleto Elementary School, situated in the Bislig 2B District within the Bislig City Division, which provided a relevant and suitable locale for this study. Coleto Elementary School possessed salient features that made it an appropriate site for this research. It served a diverse student population, including learners from various socioeconomic backgrounds and with varying academic abilities. This diversity provided an ideal environment to explore how differentiated instruction could cater to the unique needs of individual learners. Choosing Coleto Elementary School as the research locale was strategic for several reasons. First, it allowed for an examination of the effectiveness of differentiated instruction in a context that was representative of schools in the division. Second, the school's diverse student population ensured that the findings would be relevant to a wide range of learners. Finally, the school's supportive environment contributed to the successful implementation of the study and the generation of meaningful results that could inform educational practices in Bislig City.

The respondents of this study were Grade 4 students enrolled at Coleto Elementary School in Bislig City, Philippines. The study involved 36 respondents, who were grouped into two distinct groups using systematic sampling. Odd-numbered respondents (R1, R3, R5, etc.) were assigned to the experimental group, while even-numbered respondents (R2, R4, R6, etc.) were placed in the control group.

Systematic sampling ensured that each respondent had an equal chance of being assigned to either the experimental or control group, thereby promoting unbiased representation. In systematic sampling, participants are selected at regular intervals from a list or population. In this study, respondents were assigned to groups based on odd and even numbering, which facilitated a straightforward and organized approach to group assignment. By using systematic sampling, the researchers effectively eliminated selection bias, as every respondent had a predetermined opportunity for inclusion in either group. This method enhances the generalizability of the findings to a broader population, as it allows for a representative sample drawn from the larger student body. Furthermore, this approach enabled a fair comparison between the groups, focusing on the impact of differentiated instruction on academic performance within the context of a quasi-experimental research design. By ensuring that the assignment to groups was systematic and equitable, the study aimed to provide valid insights into how differentiated learning activities influence student motivation and involvement in mathematics education.

The primary instrument for this study was a pretest/posttest designed to measure changes in students' mathematical understanding, problem-solving skills, and motivation. This questionnaire was adopted from the instrument used in the unified quarterly examination. The pretest was administered before the implementation of differentiated instruction to establish a baseline measure of students' abilities and attitudes. The posttest, identical in content to the pretest, was administered after the intervention to assess any changes that may have occurred.

To ensure the ethical and reliable collection of information. Prior to commencing data collection, informed consent was obtained from the parents or guardians of the participating students. This process included explaining the purpose of the study, the procedures involved and assuring them of the confidentiality and anonymity of the data collected. The pretest was then administered to both groups of respondents before the implementation of differentiated instruction. This was followed by a period of instruction during which respondents received differentiated learning activities. Upon completion of the intervention period, the posttest was administered to both groups to assess changes in academic performance and motivation. All data were handled with utmost confidentiality, ensuring the privacy of the participants and the integrity of the research.

RESULTS AND DISCUSSIONS

Table 1 presents the pretest and post-test mean scores of students taught using experimental and conventional teaching methods.

Table 2. Pretest and Posttest Mean Scores

	Experimental		**Conventional**	
	Pre-Test	**Post Test**	**Pre-Test**	**Post Test**
Mean Score	13.61	20.94	15.83	19.28

The statistics indicate that both experimental and conventional teaching methods improved mean scores from pre-test to post-test; either approach was effective in improving student learning. However, there was more improvement using the experimental method, as the mean score achieved was an increase of 7.33 points when compared with a mean score increase of 3.45 points for the conventional method.

Several educational implications of this study deserve mention. Firstly, they indicate that the improvement of student outcomes could benefit from professional development for teachers involved with innovative teaching methods. The second thing is an indication of the need for data to guide instructional decisions. Once the progress of students is tracked and the impact of different teaching approaches evaluated, teachers can make evidence-based decisions on the most effective approach to helping students learn. Other things considered; the implication is that the experimental approach provides more meaningful improvements in learning than the traditional. Evidence from Vogt et al. (2020) shows that innovative teaching methods led to statistically meaningful improvements in academic performance. In contrast, Capone (2022) systematically elaborated on elements such as active learning, technology use, or personalized instruction, as these motivated students' engagement and understanding.

Table 2 provides an analysis comparing the means of students' scores on a pretest and posttest in two instructional methods: Conventional and Experimental. Each method provides the F-statistic and p-value.

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Table 2. Significant Difference in the Mean Scores of Pretest and Posttest

Method	**F**	**p-value**	**Decision**	**Conclusion**
Conventional (Pre-test vs. Post-test)	2.97	0.094	Failed to Reject the Null Hypothesis	Not Significant
Experimental (Pre-test vs. Post-test)	18.34	0	Reject the Null Hypothesis	Significant

Conventional and Experimental. Each method provides the F-statistic and p-value. An analysis shows that for the Conventional method, there were no statistically significant differences in pretest and posttest mean scores ($F = 2.97$, $p = 0.094$), whereas in the case of the Experimental method, there was a significant difference ($F = 18.34$, $p = 0.000$). Consequently, Experimental teaching methods, which involve some form of innovative methods such as active learning or technology integration, have contributed significantly to the improvement of student performance compared to the Conventional methods. The findings here indicate that the Experimental teaching method powerfully impacted student learning, while the Conventional method had no significant impact on the improvement in students' performances from pretest to posttest. This means that the Experimental may have had active learning, technology integration, and personalization in other cases; therefore, it must have been more engaging to facilitate learning. The findings are quite significant for educators and policymakers. They imply that investing in professional development for teachers to experiment with innovative teaching techniques has the potential to improve student outcomes. This study also underscores the importance of using data for instructional decision-making. By following students' progress and evaluating how well certain teaching strategies achieve that goal, educators can make decisions about the provision of each student's support that is accountable to students, parents, and each other, as well as themselves. This conforms with Villena-Taranilla et al. (2022), who said teaching innovation concordantly relates to significant gains in student achievement.

Table 3 posits data on students' motivation and involvement in mathematics under the following three key areas: Readiness, Engagement, and Interests.

Table 3. Level of Student Motivation and Involvement

Indicators	Weighted Mean	Verbal Description
Readiness		
I am confident in my ability to understand new mathematical concepts.	3.77	Agree
I have the necessary skills to succeed in mathematics.	3.38	Agree
I am prepared to face challenges in learning mathematics.	4.05	Agree
Average Weighted Mean	3.74	Agree
Engagement		
I enjoy participating in mathematical problem-solving activities.	3.83	Agree
I stay focused and attentive during mathematics lessons.	3.77	Agree
I actively seek out additional resources to improve my understanding of mathematics.	4.27	Agree
Average Weighted Mean	3.96	Agree
Interests		
Learning mathematics is an exciting challenge.	3.33	Agree
I am curious to learn more about real-world applications of mathematics.	4.05	Agree
I enjoy discussing mathematical ideas with my classmates or teachers.	3.5	Agree
Average Weighted Mean	3.62	Agree

Students tended to show positive responses across all areas, with the weighted mean within the 'Agree' range. In terms of readiness, students had confidence in being able to learn new concepts and believed that they had sufficient skills to be successful. For engagement, students enjoyed problem-solving activities, were focused during a lesson, and sought additional resources on their own. While students considered mathematics interesting in general, scores within the category of Interests were low when compared to Readiness and Engagement.

Data suggest that students hold a generally positive disposition towards mathematics. They are highly ready and engaged, which indicates positive self-efficacy and active participation in learning. However, there could be other aspects that stimulate and cultivate students' intrinsic motivation towards the learning of mathematics by making it more relevant and engaging the students somehow. Such methods could include but are not limited to, drawing a connection between mathematical concepts with real-world applications, incorporating a wider variety of interactive learning activities, and encouraging group discussions and collaborative learning opportunities for the students to talk about and investigate mathematical ideas together.

The results highlight the importance of a nurturing and encouraging learning environment that would strengthen the students' self-belief and offer opportunities for active learning and problem-solving. Educators might motivate students by utilizing innovative teaching styles that will increase student engagement and relevance in mathematics. Alrajeh and Shindel (2020) have been adamant that motivation and engagement among students lead to successful mathematics learning. Studies on motivation have concluded that intrinsically motivated students are more likely to persist in a challenging task, reach a richer understanding, and achieve more academically.

Table 4. Significant Difference in the Level of Students Motivation and Involvement

Source of Variances	**p-value**	**Conclusion**	**Decision**
a significant difference in the level of students' motivation and involvement before and after using differentiated instruction	0.003	Sig.	Reject H_0

Table 5 shows the findings from a statistical analysis examining the significance of differences in students' motivation and involvement before and after the implementation of differentiated instructions. The p-value 0.003 is below the traditionally accepted alpha level of 0.05, suggesting that the difference observed is statistically significant. Hence, this statistically significant difference indicates that differentiated instruction positively impacted students' motivation and involvement. The low p-value presents compelling evidence that the changes seen in students' motivation and involvement were unlikely to be caused solely by chance.

The implications of these findings for educational practice are immense. These results strongly support how differentiated instruction promotes student engagement and motivation, which is in line with Sapan and Mede (2022), where differentiated instructions have almost consistently met various learning needs, improved student learning, and increased motivation. These findings point to the necessity of customizing instruction to address students' individual needs to create a more inclusive and engaging learning culture.

CONCLUSION

Based on the findings of the study, the following conclusions are given: The findings suggest that both traditional and experimental teaching methods can improve student learning to some degree. However, the experimental method, likely incorporating innovative approaches, demonstrated a more significant positive impact on student performance. The significant improvement in student performance observed in the experimental group, which utilized innovative teaching methods, suggests that educators may consider incorporating these methods into their instructional practices to enhance student learning outcomes. While students exhibited positive attitudes towards mathematics, there is room for improvement in fostering intrinsic motivation, particularly in terms of students' interest in mathematics. Educators can explore strategies to make mathematics more engaging and relevant to students. Differentiated instruction has a positive and significant impact on student motivation and involvement. Educators should actively seek ways to implement differentiated instruction strategies in their classrooms to create a more engaging and inclusive learning environment for all students.

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