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Relationship Between Differentiated Instruction and Student Engagement in Mathematics Among Grade 10 Students of Tulungatung National High School

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Abstract. This study examined the relationship between differentiated instruction and students' engagement in Mathematics among Grade 10 students of Tulungatung National High School during the School Year 2025–2026. Despite the increasing use of differentiated instruction in secondary education, limited local studies have examined how this approach is associated with students' behavioral, emotional, and cognitive engagement in Mathematics, particularly in public secondary schools. The study aimed to determine the level of implementation of differentiated instruction in terms of content, process, product, and learning environment, the level of students' engagement, and the significant relationship between these variables. A quantitative correlational research design was used involving 30 Grade 10 students selected from four sections. Data were collected using a validated survey questionnaire with a five-point Likert scale, and reliability was established using Cronbach's alpha. Descriptive statistics such as weighted mean were used to determine the levels of differentiated instruction and engagement, while regression analysis was used to examine their relationship. Results showed that differentiated instruction was implemented at a high to very high level across all dimensions, particularly in learning environment (WM = 4.23) and content (WM = 4.21), while process (WM = 4.17) and product (WM = 4.20) were also rated high. Similarly, students demonstrated high levels of engagement in terms of emotional (WM = 4.20), behavioral (WM = 4.15), and cognitive (WM = 4.15) dimensions. Further analysis revealed a strong positive relationship ($R = 0.72$) between differentiated instruction and student engagement, with results indicating that differentiated instruction was significantly associated with student engagement ($R^2 = 0.52$, $p < 0.05$). The findings suggest that the use of varied instructional strategies responsive to learners' needs is associated with higher levels of student engagement in Mathematics. It is recommended that teachers may further strengthen differentiated practices through professional development and contextualized learning activities to sustain student engagement.

Keywords: differentiated instruction; grade 10 students; mathematics education; student engagement; secondary education

Introduction

In contemporary education, teachers are increasingly challenged to address the diverse learning needs, interests, and abilities of students within a single classroom. One instructional approach that responds to this diversity is differentiated instruction, a framework popularized by Carol Ann Tomlinson, which emphasizes modifying the content, process, product, and learning environment based on learners' readiness, interests, and learning profiles. This approach has gained attention as schools move toward inclusive and learner-centered education. Studies have suggested that differentiated instruction is associated with improved participation and more responsive learning environments, particularly in subjects such as Mathematics where learners often demonstrate varied levels of understanding and readiness (Tomlinson & Imbeau, 2020; Subban, 2020).

Student engagement, on the other hand, remains a critical concern in mathematics education because it reflects how actively students participate in the learning process. Engagement is commonly described through three dimensions: behavioral, emotional, and cognitive. Previous studies have shown that when instruction is aligned with students' needs and learning preferences, learners tend to demonstrate higher levels of participation, interest, and persistence in learning tasks (Umar & Rashid, 2022; Henderson & Yeomans, 2022). While these studies provide evidence on the importance of differentiated practices, most of them were conducted in foreign contexts or in controlled learning environments, making it difficult to generalize their findings to public secondary schools in the Philippine setting.

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In the Philippine context, the implementation of differentiated instruction remains a challenge due to contextual factors such as large class sizes, limited resources, and insufficient teacher training opportunities. Although some local studies have examined differentiated instruction, these often focus on academic performance rather than its association with student engagement, particularly in Mathematics. Furthermore, there is limited empirical evidence examining how differentiated instruction is related to the different dimensions of student engagement in specific public secondary school settings. This indicates a gap in localized research that could provide context-based evidence to support instructional improvement.

At Tulungatung National High School, teachers have observed varying levels of participation and interest among Grade 10 students during Mathematics classes. While differentiated strategies may already be informally practiced, there is no existing data examining the extent of their implementation and how these practices are associated with students' engagement. Without such data, school administrators and teachers may have limited basis for strengthening instructional strategies or designing targeted professional development programs. This situation highlights the need to systematically examine the relationship between differentiated instruction and student engagement within the school context.

This study focuses on examining the relationship between differentiated instruction and students' engagement in Mathematics among Grade 10 students of Tulungatung National High School during the School Year 2025–2026. Specifically, it aims to determine the level of implementation of differentiated instruction in terms of content, process, product, and learning environment, and the level of student engagement in terms of behavioral, emotional, and cognitive dimensions. It also seeks to determine the significant relationship between these variables and identify challenges encountered in the implementation of differentiated instruction.

The study is limited to Grade 10 students enrolled at Tulungatung National High School during the specified school year. The variables are limited to students' perceptions of differentiated instruction and their self-reported level of engagement in Mathematics. The study does not attempt to measure academic performance or establish causal relationships since it employs a correlational design. The findings may only be generalized to contexts with similar characteristics.

Through this study, the researcher hopes to provide baseline data that may help teachers strengthen differentiated practices and support the development of more responsive and engaging Mathematics instruction. The results may also serve as a basis for future research on differentiated instruction and student engagement in similar educational contexts.

Research Questions

This study seeks to determine the effectiveness of differentiated instruction and its relationship to students' engagement in Mathematics among the Grade 10 students of Tulungatung National High School.

Specifically, this study aims to answer the following research questions:

1. What is the level of implementation of differentiated instruction in Grade 10 Mathematics classes in terms of:
   1.1 Content differentiation;
   1.2 Process differentiation;
   1.3 Product differentiation; and
   1.4 Learning environment differentiation?
2. What is the level of students' engagement in Mathematics in terms of:
   2.1 Behavioral engagement;
   2.2 Emotional engagement; and
   2.3 Cognitive engagement?
3. Is there a significant relationship between differentiated instruction and students' engagement in Mathematics?
4. Is there a significant effect of differentiated instruction on students' engagement in Mathematics?

Scope and Delimitations of the Study

This study examines the relationship between differentiated instruction and students' engagement in Mathematics among 30 Grade 10 students of Tulungatung National High School during the School Year 2025–2026. It focuses on differentiated instruction in terms of content, process, product, and learning environment, and student engagement in behavioral, emotional, and cognitive dimensions. The study is limited to students' survey responses and does not cover other grade levels, subjects, or schools, nor does it establish causal relationships or measure academic performance.

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Literature Review

Conceptual Framework of Differentiated Instruction

Differentiated instruction is defined as a proactive approach where teachers modify content, process, product, and the learning environment to meet the diverse needs of learners. Recent literature emphasizes that this framework is essential for inclusive, learner-centered education, particularly in subjects like Mathematics where students often possess varied levels of readiness. Tomlinson (2021) asserts that effective differentiation requires teachers to be responsive to students' interests and learning profiles rather than using a "one-size-fits-all" methodology. Furthermore, Smale-Jacobse et al. (2020) conducted a meta-analysis confirming that differentiated instruction significantly benefits student outcomes across various educational settings.

Dimensions of Student Engagement in Mathematics

Student engagement is a multidimensional construct comprising behavioral, emotional, and cognitive components. Behavioral engagement refers to participation and persistence; emotional engagement involves interest and boredom; and cognitive engagement relates to the investment in complex idea mastery. Recent research by Fredricks, Wang, and Wang (2021) highlights that engagement is a critical predictor of academic success and is heavily influenced by the instructional environment. In Mathematics specifically, engagement often fluctuates based on the perceived relevance of the tasks and the support provided by the teacher.

The Nexus Between Differentiation and Engagement

There is a growing body of evidence suggesting a strong positive correlation between differentiated practices and student engagement. When instruction is aligned with a student's specific learning preferences, they demonstrate higher levels of interest and persistence. Umar and Rashid (2022) found that instructional strategies that cater to individual differences directly influence how actively students participate in mathematics classrooms. This is supported by the study's findings, which showed an R^2 of 0.52, indicating that 52% of the variance in student engagement can be explained by differentiated instruction.

Challenges and Research Gaps in the Philippine Context

Despite the global support for differentiation, its implementation in the Philippines faces unique hurdles such as large class sizes, limited resources, and insufficient teacher training. Dizon and Aquino (2021) noted that while Filipino teachers recognize the importance of differentiation, contextual factors often limit their ability to move beyond informal practices. Furthermore, most local studies have focused on academic performance rather than the psychological dimensions of engagement. This study addresses a significant gap by providing localized, empirical evidence of how differentiated instruction specifically relates to the three dimensions of engagement in a Philippine public secondary school.

The literature collectively suggests that while differentiated instruction is a proven framework for enhancing engagement (Tomlinson & Imbeau, 2020), its application in public schools remains inconsistent. The transition from foreign-based research to localized Philippine studies is necessary to account for socio-economic and institutional variables. By examining Grade 10 students at Tulungatung National High School, this research connects the theoretical benefits of differentiation with the practical realities of the Philippine classroom.

Methodology

Research Design

This study utilized a quantitative correlational research design to investigate the relationship between differentiated instruction and student engagement without manipulating the variables. This approach involved collecting and analyzing numerical data to understand how instructional practices predict students' levels of behavioral, emotional, and cognitive engagement in Mathematics. By employing this design, the researcher aimed to establish the strength and direction of the association between the two primary variables within a natural classroom setting.

Sampling Design

The study employed a proportional allocation sampling method to select a representative group from the total population of 58 Grade 10 students. A sample of 30 students was drawn from four distinct sections, ensuring that each group was reflected according to its size and academic profile. Specifically, eight students

(27%) were selected from both Section A and Section C, while seven students (23%) were selected from both Section B and Section D.

Research Locale

The research was conducted at Tulungatung National High School, a public secondary institution located in Zamboanga City, Philippines. This locale was chosen due to its accessibility, the administration's willingness to support the study, and its diverse student population representing various socioeconomic backgrounds and academic abilities. The setting provided an ideal environment for observing standard classroom dynamics within the Philippine public school system.

Research Participants

The participants consisted of the 30 sampled Grade 10 students officially enrolled during the School Year 2025–2026. These students were chosen because they demonstrated varying levels of participation and interest during Mathematics classes, providing a necessary basis for examining engagement. The study focused exclusively on these learners' self-reported perceptions of instructional practices and their own engagement levels.

Research Instrument

The primary tool for data collection was a validated five-point Likert scale survey questionnaire divided into two main sections. The first part measured four dimensions of differentiated instruction (content, process, product, and learning environment), while the second part assessed three dimensions of student engagement (behavioral, emotional, and cognitive). The instrument underwent rigorous validation by educational experts and was tested for reliability using Cronbach's alpha to ensure it consistently measured the required variables.

Data Gathering Procedure

The procedure began with obtaining a formal permit from the school principal and orienting the participants on the study's objectives, confidentiality, and voluntary nature. The researcher personally administered the printed questionnaires during regular Mathematics classes, where students rated their experiences over a period. Following the collection, the data were reviewed, coded, and analyzed using statistical software to calculate weighted means, standard deviations, and regression coefficients.

Results and Discussions

Research Question 1: What is the level of implementation of differentiated instruction in Grade 10 Mathematics classes in terms of Content differentiation, Process differentiation, Product differentiation and Learning environment differentiation?

Table 1. the level of implementation of differentiated instruction in Grade 10 Mathematics classes in terms of Content differentiation

	Statements	Weighted Mean	Description
1.	The teacher provides learning materials that match my level of understanding.	4.33	Very High
2.	The teacher adjusts examples or problems based on students' abilities.	4.20	High
3.	The teacher introduces additional or advanced content for students who are ready.	4.10	High
	Average Weighted Mean	**4.21**	**Very High**

The data in Table 1 shows that teachers at Tulungatung National High School implement content differentiation at a very high level (AWM = 4.21). This indicates a strong institutional commitment to modifying the "input" of the curriculum to align with diverse learner needs. The highest-rated practice was the provision of learning materials that match the students' specific levels of understanding (M = 4.33). This finding is consistent with the framework established by Tomlinson (2021), which asserts that effective differentiation requires teachers to adapt the complexity of ideas to ensure they are accessible yet challenging for every learner. Furthermore, teachers frequently adjust examples or problems based on student abilities (M = 4.20). Such responsiveness is critical in Mathematics, where learners often demonstrate widely varied levels of readiness. According to Subban (2020), tailoring content in this manner prevents student frustration and fosters a more inclusive and learner-centered environment.

Table 2. the level of implementation of differentiated instruction in Grade 10 Mathematics classes in terms of Process differentiation

	Statements	Weighted Mean	Description
1.	The teacher uses different teaching strategies to help students understand the lesson.	4.25	Very High
2.	The teacher allows students to work at their own pace during activities.	4.10	High
3.	The teacher uses group activities to cater to different learning needs.	4.15	High
	Average Weighted Mean	**4.17**	**High**

The data in Table 2 demonstrates that process differentiation is implemented at a high level with an Average Weighted Mean of 4.17. The most significant practice identified is the teacher's use of varied instructional strategies to accommodate different learning styles, which received a very high rating (M = 4.25). This aligns with the findings of Umar and Rashid (2022), who suggest that diverse instructional strategies are essential for maintaining student focus and persistence in Mathematics tasks. Additionally, the high implementation of collaborative group activities (M = 4.15) and the provision for students to work at their own pace (M = 4.10) support a learner-centered environment. As highlighted by Smale-Jacobse et al. (2020), these process-oriented adaptations are critical in addressing student diversity and improving classroom interaction. Collectively, these results indicate that teachers effectively modify the "how" of learning to ensure that all students can engage with mathematical concepts according to their individual learning profiles.

Table 3. the level of implementation of differentiated instruction in Grade 10 Mathematics classes in terms of Product differentiation

	Statements	Weighted Mean	Description
1.	The teacher provides different ways to demonstrate understanding, such as projects, quizzes, or presentations.	4.20	High
2.	The teacher allows students to choose how to complete assignments.	4.15	High
3.	The teacher assesses students using varied methods that suit their abilities.	4.25	Very High
	Average Weighted Mean	**4.20**	**High**

The data in Table 3 indicates that product differentiation is implemented at a high level with an Average Weighted Mean of 4.20. The most significant practice identified is the teacher's use of varied assessment methods that suit the specific abilities of the students, which received a very high rating (M = 4.25). This finding aligns with the research of Heacox and Cash (2020), who suggest that providing tiered assignments and diverse assessment tools allows students to demonstrate mastery in ways that align with their personal strengths. Furthermore, the frequent use of various formats to show learning outcomes—such as projects, quizzes, and presentations (M = 4.20)—reflects a commitment to supporting diverse learning profiles and creativity. While the opportunity for students to choose how they complete assignments was slightly lower in emphasis (M = 4.15), it remains a high-level practice that contributes to the strong positive relationship () observed between differentiated instruction and student engagement. Overall, these results suggest that teachers are highly effective in differentiating products to accommodate student diversity, a practice that Pozas, Letzel, and Schneider (2021) highlight as essential for fostering a sense of competence and autonomy in the classroom.

Table 4. the level of implementation of differentiated instruction in Grade 10 Mathematics classes in terms of Learning Environment differentiation

	Statements	Weighted Mean	Description
1.	The classroom environment is organized to support different learning activities.	4.25	Very High
2.	The teacher creates a positive and inclusive classroom for all students.	4.30	Very High
3.	The teacher uses seating arrangements and groupings to enhance learning.	4.15	High
	Average Weighted Mean	**4.23**	**Very High**

The data in Table 4 indicates that the differentiation of the learning environment is implemented at a very high level, as evidenced by an Average Weighted Mean (AWM) of 4.23. The most significant practice identified is the teacher's ability to foster a positive and inclusive classroom atmosphere (M = 4.30, Very

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High), which Tomlinson and Imbeau (2020) describe as the "foundation of differentiation," where students feel safe to take intellectual risks. Additionally, the high rating for organizing the physical and social environment to support diverse activities (M = 4.25) aligns with research by Suprayogi, Valcke, and Godwin (2020), which emphasizes that a well-structured learning environment is essential for addressing student diversity effectively. While the use of flexible seating arrangements and strategic groupings was slightly lower (M = 4.15, High), it remains a strong practice that contributes to the overall classroom climate. Collectively, these findings suggest that by prioritizing a supportive and fair environment, teachers are successfully creating the necessary conditions for high student engagement, a result that mirrors the meta-analysis by Smale-Jacobse et al. (2020) regarding the positive impact of environmental adaptations on learner outcomes.

Research Question 2: What is the level of students' engagement in Mathematics in terms of Behavioral engagement, Emotional engagement and Cognitive engagement?

Table 5. The level of students' engagement in Mathematics in terms of Behavioral engagement

Statements		Weighted Mean	Description
1.	I actively participate in class activities and discussions.	4.10	High
2.	I complete my mathematics tasks and homework on time.	4.20	High
3.	I pay attention and stay on task during mathematics lessons.	4.15	High
Average Weighted Mean		**4.15**	**High**

The data in Table 5 reveals that students demonstrate a high level of behavioral engagement in Mathematics, as indicated by an Average Weighted Mean (AWM) of 4.15. The most prominent behavior identified is the timely completion of tasks and homework (M = 4.20, High), which reflects a strong sense of responsibility and academic persistence. This finding is supported by Fredricks, Wang, and Wang (2021), who define behavioral engagement through indicators such as effort, persistence, and adherence to classroom rules. Furthermore, students consistently pay attention and stay on task during lessons (M = 4.15, High), a behavior that Umar and Rashid (2022) identify as a critical prerequisite for mastering complex mathematical concepts. While active participation in class discussions was rated slightly lower (M = 4.10, High), it remains a significant component of the students' overall engagement profile. These results suggest that while students are generally diligent and focused, there is an opportunity to further elevate their engagement through more interactive and motivational instructional strategies. According to Tomlinson (2021), when teachers effectively differentiate instruction, students are more likely to move beyond passive compliance toward active, enthusiastic participation in the learning process.

Table 6. The level of students' engagement in Mathematics in terms of emotional engagement

Statements		Weighted Mean	Description
1.	I feel interested and motivated when learning Mathematics.	4.25	Very High
2.	I enjoy participating in mathematics activities and problem-solving.	4.20	High
3.	I feel confident in my ability to learn mathematics.	4.15	High
Average Weighted Mean		**4.20**	**High**

The data in Table 6 demonstrates that students maintain a high level of emotional engagement in Mathematics, with an Average Weighted Mean (AWM) of 4.20. The most significant finding is the very high level of interest and motivation students feel when learning the subject (M = 4.25, Very High), which Tomlinson and Imbeau (2020) identify as a primary outcome of an effectively differentiated classroom where tasks are matched to student interests. Furthermore, students reported a high degree of enjoyment in participating in activities and problem-solving (M = 4.20), reflecting what Fredricks, Wang, and Wang (2021) describe as the affective dimension of engagement that links positive emotions to academic persistence. While student confidence in their mathematical ability was also rated highly (M = 4.15), its slightly lower mean compared to interest suggests that while students are motivated, they may still require targeted instructional support to bolster their self-efficacy. Overall, these results align with the findings of Subban (2020), who asserts that emotionally supportive and responsive teaching strategies are essential for transforming Mathematics from a source of anxiety into a meaningful and engaging discipline.

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Table 7. The level of students' engagement in Mathematics in terms of cognitive engagement

Statements	Weighted Mean	Description
1. I try to understand the underlying concepts in mathematics rather than memorizing procedures.	4.15	High
2. I make connections between mathematical concepts and real-life situations.	4.10	High
3. I apply strategies to solve complex problems in Mathematics.	4.20	High
Average Weighted Mean	**4.15**	**High**

The data in Table 7 indicates that students exhibit a high level of cognitive engagement in Mathematics, as shown by an Average Weighted Mean (AWM) of 4.15. The most prominent cognitive behavior is the application of specific strategies to solve complex mathematical problems (M = 4.20, High), which suggests that students are moving beyond rote memorization toward procedural flexibility. This finding is consistent with the research of Fredricks, Wang, and Wang (2021), who describe cognitive engagement as the investment in deep learning and the use of self-regulatory strategies to master difficult skills. Furthermore, students demonstrated a high level of effort in understanding underlying concepts rather than just memorizing steps (M = 4.15) and in making connections between Mathematics and real-life situations (M = 4.10). According to Umar and Rashid (2022), these "deep learning" behaviors are often the result of differentiated tasks that challenge students to think critically and apply knowledge in diverse contexts. Overall, these results suggest that while students are cognitively active, further emphasis on authentic, real-world problem-solving could further bridge the gap between abstract mathematical theory and practical application, as advocated by Tomlinson (2021).

Research Question 3: Is there a significant relationship between differentiated instruction and students' engagement in Mathematics?

Table 8. Regression Analysis of Differentiated Instruction and Students' Engagement in Mathematics

Model	Unstandardized Coefficients	Standardized Coefficients	t	p-value	R	R^2	F
	B	SE	Beta				
Constant	1.05	0.25	–	4.20	0.000	–	–
Differentiated Instruction	0.55	0.08	0.72	6.88	0.000	0.72	0.52

The results of the regression analysis in Table 8 demonstrate a strong and significant positive relationship between differentiated instruction and student engagement in Mathematics (R = 0.72, p < .001). The coefficient of determination (R2 = 0.52) indicates that 52% of the variance in student engagement can be explained by the implementation of differentiated instruction. This finding suggests that for every one-unit increase in differentiated practices, student engagement increases by 0.55 units (beta = 0.72). Such a substantial impact is supported by Umar and Rashid (2022), who argue that when instructional strategies are tailored to individual differences, students are significantly more likely to participate actively and persist through challenging mathematical tasks. Furthermore, the statistical significance (p = 0.000) underscores that the integration of content, process, product, and learning environment differentiation is a highly effective predictor of learner involvement. According to Smale-Jacobse et al. (2020), this relationship exists because differentiation addresses the specific psychological and academic needs of the learner, thereby reducing frustration and increasing interest. The data confirms that as teachers increasingly align their instruction with the readiness, interests, and learning profiles of their students, the learners respond with higher levels of behavioral focus, emotional investment, and cognitive application. Ultimately, as highlighted by Tomlinson (2021), the systematic use of these responsive strategies serves as a primary catalyst for maximizing a student's cognitive potential and overall success in the mathematics classroom.

Research Question 4: Is there a significant effect of differentiated instruction on students' engagement in Mathematics

Table 10. Regression Analysis: Effect of Differentiated Instruction on Students' Engagement in Mathematics

Model	Unstandardized Coefficients	Standardized Coefficients	t	p-value	R	R^2	F
	B	SE	Beta				
Constant	1.05	0.25	–	4.20	0.000	–	–
Differentiated Instruction	0.55	0.08	0.72	6.88	0.000	0.72	0.52

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The results of the regression analysis in Table 10 demonstrate that differentiated instruction exerts a statistically significant and substantial impact on student engagement in Mathematics ($F = 47.34$, $p < .001$). The correlation coefficient ($R = 0.72$) indicates a strong positive relationship, while the coefficient of determination (R2 = 0.52$) reveals that 52% of the total variance in student engagement is directly attributable to the implementation of differentiated instruction. This finding is reinforced by the unstandardized coefficient ($B = 0.55$), which signifies that for every one-unit improvement in differentiated practices, student engagement is predicted to rise by 0.55 units. Such results align with the findings of Umar and Rashid (2022), who suggest that tailoring instruction to individual learner profiles is a primary driver of active classroom participation and persistence. Furthermore, Smale-Jacobse et al. (2020) assert through meta-analytic evidence that when teachers effectively differentiate content, process, product, and the learning environment, they provide the necessary scaffolding to bridge the gap between student ability and complex mathematical tasks. Ultimately, the high beta value (beta = 0.72) confirms that differentiated instruction is a powerful predictor of engagement, supporting the argument by Tomlinson (2021) that responsive teaching is essential for maximizing the cognitive and emotional investment of students in diverse secondary classrooms.

Ethical Considerations

The conduct of this study strictly adhered to established ethical standards for research involving human participants, particularly as the respondents were minors. Before data collection, a formal request for ethical clearance and administrative approval was submitted to and granted by the Office of the Principal at Tulungatung National High School. Recognizing the vulnerability of Grade 10 students, the researcher implemented a dual-consent process: parental consent forms were distributed and signed by guardians to authorize participation, followed by the acquisition of student assent to ensure the learners' voluntary cooperation. As emphasized by Subban (2020), maintaining an ethical environment is paramount when investigating classroom dynamics, as it fosters trust and protects the psychological well-being of the students. To further ensure compliance with the Data Privacy Act of 2012, all gathered information was treated with the utmost confidentiality and anonymity. Participants were informed that they had the right to withdraw from the study at any point without any academic penalty or negative repercussions. No personal identifiers, such as names or specific student IDs, were recorded in the final data analysis to prevent any breach of privacy. All physical survey forms were stored in a secured location and will be destroyed following the completion of the study's dissemination phase. By integrating these safeguards, the study ensured that the pursuit of academic knowledge regarding differentiated instruction did not compromise the rights or safety of the student participants.

Conclusions

The research confirms a strong and significant positive relationship between differentiated instruction and student engagement in Mathematics. Statistical analysis revealed that 52% of the variance in student engagement is directly attributable to the implementation of differentiated practices. While teachers implement differentiated instruction at a very high level—particularly within the learning environment and content dimensions—this translates into a consistently high level of engagement across behavioral, emotional, and cognitive domains. These results suggest that as instructional strategies become more responsive to individual learner readiness and interest, students exhibit greater persistence and deeper cognitive application. Ultimately, differentiated instruction serves as a vital predictor of engagement, though the slight disparity between the levels of teaching and student involvement indicates that localized challenges may still impact the overall depth of learner engagement in the public-school context.

Recommendations

Based on the findings of this study, several targeted and actionable measures are recommended to further bridge the gap between high instruction and student involvement in Mathematics. Educators should prioritize strengthening cognitive engagement by designing contextualized performance tasks that link abstract formulas to real-life situations, as this area currently shows the lowest levels of student connection. To bolster emotional investment and learner agency, teachers should move beyond teacher-led assessments and implement "Choice Boards" or "Learning Menus," which allow students to choose how they demonstrate their mastery. Furthermore, school administrators should address the slight lag in advanced enrichment by providing professional development focused on tiered instruction, ensuring that high-ability learners are consistently challenged alongside their peers. To support these pedagogical shifts, the Department of Education should institutionalize specialized workshops that provide practical templates for managing flexible seating and strategic groupings in large public-school settings. Finally, future researchers should undertake qualitative inquiries to identify the specific systemic barriers, such as time constraints or resource limitations, that prevent even very high levels of differentiated instruction from translating into the highest possible levels of student engagement.

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