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Model: Mathematical Outcomes Development and Engagement Learning Activity in Geometry to the Student's Traits and Performance in Mathematics

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Abstract*—This study aimed to determine the significant effect of the components and characteristics of the Mathematical Outcomes Development and Engagement Learning (MODEL) activity in Geometry on the traits and performance in Mathematics of Grade 9 students at Dayap National High School. Specifically, it examined the extent of MODEL activity implementation in terms of components and characteristics; students' mathematical traits and performance; the difference between formative and summative assessment results; and the relationship and effect of the MODEL activity on students' traits and performance in Mathematics. The methodology employed in this research was a descriptive research design involving seventy Grade 9 students from two sections who are purposively selected by the researcher. The study utilized self-made learning materials tailored for Geometry named MODEL, applying the GRR model's stages. Questionnaire-checklist and Formative and summative assessments were administered to evaluate student's traits and performance in Mathematics. The findings revealed that the MODEL Activity in Geometry were verbally interpreted as Evident by the Grade 9 respondents in its components and characteristics. The level of Student's Traits was verbally interpreted as Well-Developed. Students Performance in Formative Assessment has an interpretation of Average while in summative Assessment has an interpretation of Meets Expectations. The study tested the significance of the components and characteristics of the MODEL activity in Geometry on students' traits and performance in Mathematics. A significant difference was found between students' performance in formative and summative assessments, indicating improvement over time. Findings revealed no significant relationship between the MODEL activity and students' mathematical traits, and no significant effect on their performance in Mathematics. The MODEL Activity in Geometry shows significant difference between student's performance in formative and summative assessment, therefore the null hypotheses is rejected. Conversely, the MODEL Activity shows no significant relationship with students' traits and has no notable effect on their performance, therefore the null hypotheses are accepted. The results indicate that the MODEL Activity in Geometry leads to a significant improvement in student performance. This implies that the activity supports learning progression and mastery over time. However, teachers can use the MODEL Activity with all students to help improve their traits and math performance. Based on the outcomes of this research, it is recommended that educators adopt the MODEL activity or similar structured learning materials. Future studies may expand this approach across different grade levels or mathematical strands to further validate its effectiveness. Teachers are encouraged to continue innovating instructional strategies and designing materials that address individual differences, encourage self-directed learning, and nurture positive mathematical mindsets to improve academic performance and learner traits in mathematics.*

***Keywords*—** *MODEL, Mathematics, Traits, Performance, Students*.

I. Introduction

Teaching Mathematics in today's educational environment presents a complex set of challenges for both educators and learners. Mathematics is a subject that not only demands mastery of theoretical knowledge but also the ability to apply concepts in practical, real-world situations. Students often perceive mathematics as difficult and abstract, which can lead to disinterest, anxiety, and low academic engagement. Teachers, therefore, play an essential role in addressing these challenges by adopting innovative strategies, providing continuous support, and fostering an environment that nurtures mathematical confidence and curiosity.

One of the most pressing concerns in mathematics education is the variation in students' performance and their ability to meet expected academic outcomes. Differences in learning styles, levels of preparedness, and individual coping mechanisms all contribute to the performance gap seen in many mathematics classrooms. When students are not fully engaged or when learning resources fail to accommodate their needs, this often results in lower problem-solving ability, limited mathematical confidence, and diminished perseverance, ultimately affecting their academic performance in mathematics.

Performance in Mathematics is a critical indicator of a student's ability to understand, retain, and apply mathematical concepts both inside and outside the classroom. It reflects how well students navigate mathematical challenges, approach problem-solving tasks, and demonstrate mastery through assessments and real-world applications. For students to achieve success, they require learning experiences that build both competence and self-belief, alongside structured opportunities for independent and collaborative practice.

In response to these challenges, instructional materials that are thoughtfully designed and aligned with the Department of Education's Most Essential Learning Competencies (MELC) can play a significant role in enhancing both student performance and motivation.

One such intervention is the Mathematical Outcomes Development and Engagement Learning (MODEL) Activity, which incorporates the Gradual Release of Responsibility (GRR) approach. Through the stages of Focus Lesson, Guided Instruction, Collaborative Learning, and Independent Practice,

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MODEL aims to create an engaging and supportive learning experience, helping students develop key mathematical traits and improve academic performance.

This study, therefore, seeks to use a strategic intervention material as such MODEL Activity in Geometry and determine its effect to the Student's Traits and Performance in Mathematics of Grade 9 Learners of Dayap National High School.

1.1 Statement of the Problem

Problem/s which were addressed by the research

The purpose of this study is to determine the significant effect of the Components and Characteristics of MODEL Activity in Geometry using GRR Approach in the Student's Attitude and Academic Performance of Grade 9 Mathematics learners of Dayap National High School.

Specifically, it sought to answer to the following questions:

1. What is the level of using MODEL Activity in Geometry in terms of Component as to:
   1.1 Focus Lesson;
   1.2 Guided Instruction;
   1.3 Collaborative Learning; and
   1.4 Independent Practice?
2. What is the level of using MODEL Activity in Geometry in terms of Characteristics as to:
   2.1 Usefulness;
   2.2 Creativity; and
   2.3 Adaptability?
3. What is the level of the Student's Traits in Mathematics in terms of:
   3.1 Problem Solving Ability;
   3.2 Mathematical Confidence ; and
   3.3 Perseverance and Resilience?
4. What is the level of the Student's Performance in Mathematics in terms of:
   4.1 Formative Assessment;
   4.2 Summative Assessment ?
5. Is there a significant difference between Student's Performance in Formative and Summative Assessment?
6. Does the Component and Characteristics of MODEL Activity in Geometry have significant relationship to the Student's Traits in Mathematics?
7. Does the component and characteristics of MODEL Activity in Geometry have significant effect to the Student's Performance in Mathematics?

II. Methodology

The methodology employed in this research was a descriptive research design involving seventy Grade 9 students from two sections who are purposively selected by the researcher. The study utilized self-made learning materials tailored for Geometry named MODEL, applying the GRR model's stages. Questionnaire-checklist and Formative and summative assessments were administered to evaluate student's traits and performance in Mathematics.

III. Results and Discussion

This part presents, analyzes, and interprets the data gathered, which showed a significant relationship between the components and characteristics of the model activity and the student's traits, a significant effect of the components and characteristics of model activity in geometry on the student's performance, and a significant difference between the student's performance in formative and summative assessment.

MODEL Activity in Geometry (Component)

In this study, the level of using MODEL Activity in Geometry in terms of component as to focus lesson, guided instruction, collaborative learning, and independent practice was treated statistically using mean and standard deviation.

Table 1 presents the level of using the MODEL Activity in Geometry in terms of its Focus Lesson component.

The table shows the statements, mean, standard deviation, remarks and verbal interpretation.

The computed weighted mean (3.69), with a standard deviation of (1.02), indicates a good level of agreement among respondents regarding the effectiveness of the focus lesson in helping them recall key concepts, understand the content, identify main ideas, apply knowledge, and stay motivated during the mathematics class.

Overall, this implies that the MODEL activity in Geometry is a well-structured instructional tool that supports student learning by reinforcing key concepts, enhancing understanding, and fostering motivation. The consistently positive responses emphasize its value in promoting active student engagement and better comprehension of mathematical concepts.

TABLE 1. Level of using MODEL Activity in Geometry in Terms of Component as to Focus Lesson

Statements The Focus Lesson helps me to…	MEAN	SD	REMARKS
…recall key concepts for me to remember essential information from the lesson.	3.67	1.02	Agree
…explain the content clearly, enabling me to understand the material better.	3.66	1.02	Agree
…identify the lesson's main ideas, aiding in my understanding of the topic.	3.70	0.95	Agree
…apply the knowledge from the lesson to feel prepared for the next activities.	3.69	1.02	Agree
…create a sense of motivation and eagerness to participate actively after the lesson.	3.73	1.03	Agree
Weighted Mean	3.69		
SD	1.02		
Verbal Interpretation	Evident		

As stated by NCTM (2015), focus lessons must include effective teaching of mathematics that establishes clear goals for the students to learn, situates goals within learning progressions, and uses the goals to guide instructional decisions. In addition, the objectives should be clearly stated before discussion as they establish what the students need to know.

Mathematical Outcomes Development and Engagement Learning (MODEL) activity is aligned with the Department of

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Education's Most Essential Learning Competency (MELC). It enables students to have resources besides textbooks focusing on the lesson they need to learn during the third grading period. Students are more engaged with the lesson as guided during the process. Resources and references that are focused on lessons help a lot in the teaching and learning process.

Table 2 presents the level of using the MODEL activity in Geometry in terms of its guided instruction component.

TABLE 2. Level of using MODEL Activity in Geometry in Terms of Component as to Guided Instruction

Statements The Guided Instruction helps me to…	MEAN	SD	REMARKS
…remember important concepts and the key elements of the lesson.	3.73	0.99	Agree
…clarify the examples provided, making it easier for me to understand.	3.70	0.98	Agree
…solve problems or complete tasks effectively.	3.73	1.03	Agree
…calculate the examples provided, deepening my understanding of the material.	3.66	1.09	Agree
…assess my performance using the feedback to improve my understanding and results.	3.70	0.97	Agree
Weighted Mean	3.70		
SD	1.01		
Verbal Interpretation	Evident		

The computed weighted mean (3.70), with a standard deviation of (1.01), indicates a good level of agreement among respondents regarding the effectiveness of the guided instruction in helping them remember important concepts, clarify examples provided, solve problems, and calculate and assess their performance.

According to Murgatroyd (2020), instruction is broadly identified. Challenges with e-learning are accessibility, affordability, flexibility, learning pedagogy, life-long learning, and educational policy. Overall, this indicates that the MODEL activity in Geometry is an established intervention material that enables students to learn Mathematics through clearly stated instructions and examples that deepen their understanding of the lesson. The consistently positive responses emphasize the value of promoting proactive student relationships in the classroom that enable the lesson to be understood.

Table 3 shows the degree of use of the MODEL activity in Geometry and its collaborative learning component.

Students rated collaborative learning at 3.67 (SD = 1.04), indicating a good level of agreement on its effectiveness in enhancing understanding through group discussions. According to research, cooperative learning enhances students' critical thinking and participation (Johnson & Johnson, 2019). The MODEL activity incorporates peer learning strategies, which help students exchange diverse problem-solving approaches and strengthen their mathematical reasoning skills.

Table 4 shows the MODEL activity in Geometry's degree of use in relation to its independent practice component.

The highest rating among the components, 3.73 (SD = 1.02), was for independent practice, which indicates that students found it useful for applying concepts and assessing their understanding.

TABLE 3. Level of using MODEL Activity in Geometry in Terms of Component as to Collaborative Learning

Statements Collaborating with my classmates helps me to…	MEAN	SD	REMARKS
…explain key concepts from the lesson through group discussions and interactions.	3.70	0.98	Agree
…discuss the lesson through meaningful group discussions.	3.60	1.01	Agree
…analyze the ideas shared in group work to solve problems or complete tasks.	3.67	1.02	Agree
…categorize different perspectives offered by my classmates to deepen my understanding.	3.60	1.12	Agree
…assess my understanding and improve based on feedback and ideas from my peers.	3.61	1.05	Agree
Weighted Mean	3.67		
SD	1.04		
Verbal Interpretation	Evident		

TABLE 4. Level of using MODEL Activity in Geometry in Terms of Component as to Independent Practice

Statements The independent practice tasks enable me to…	MEAN	SD	REMARKS
…describe key concepts I learned by working on my own.	3.80	0.99	Agree
…practice my understanding by working on myself alone	3.79	0.98	Agree
…apply the knowledge I gained in class to solve problems or complete tasks during independent practice.	3.70	1.07	Agree
…identify areas where I could improve.	3.61	1.08	Agree
…evaluate my learning based on feedback from my independent work, making adjustments for improvement.	3.77	1.00	Agree
Weighted Mean	3.73		
SD	1.02		
Verbal Interpretation	Evident		

MODEL Activity in Geometry (Characteristics)

The level of MODEL activity in geometry in terms of characteristics such as usefulness, creativity, and adaptability were treated statistically using mean and standard deviation.

Table 5 shows the degree of use of the MODEL activity in Geometry according to its usefulness characteristics.

TABLE 5. Level of using MODEL Activity in Geometry in Terms of Characteristics as to usefulness

Statements The MODEL Activity in Geometry guides me to…	MEAN	SD	REMARKS
…retrieve important concepts from the activity sheet that I needed to know.	3.74	0.99	Agree
…comprehend the topic more clearly by completing the activities on the sheet.	3.76	0.95	Agree
…utilize the knowledge gained from the sheet to solve problems in other subjects.	3.69	1.02	Agree
… Exam the activity sheet's content to assess its relevance to my learning.	3.64	1.05	Agree
…assess my understanding of the topic through the activity sheet and identify areas for improvement.	3.54	1.05	Agree
Weighted Mean	3.67		
SD	1.01		
Verbal Interpretation	Evident		

The table shows the statements, mean, standard deviation, remarks and verbal interpretation.

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Students found the MODEL activity useful, with a mean of 3.67 (SD = 1.01). The highest-rated statement, "comprehending the topic clearly" (mean = 3.76), suggests that the activity effectively enhances conceptual clarity.

Research highlights that well-designed instructional materials improve student learning outcomes by making abstract concepts more accessible (Mayer, 2015). The MODEL activity aligns with this by presenting structured and relevant tasks that support mathematical comprehension.

The degree of usage of the MODEL activity in Geometry and its creativity characteristics is shown in Table 6. The table includes key statements, mean scores, standard deviations, and remarks.

TABLE 6. Level of using MODEL Activity in Geometry in Terms of Characteristics as to Creativity

Statements MODEL activity in Geometry aids to…	MEAN	SD	REMARKS
…recall key concepts from the activities on the sheet engagingly.	3.67	1.02	Agree
…clarify the topic by presenting it in fun and interesting ways.	3.49	1.07	Agree
…apply the new ideas I came up with from the sheet to other tasks or subjects.	3.61	1.04	Agree
… Analyze the different types of tasks on the sheet to think critically about the concepts I was learning.	3.69	1.06	Agree
…create my work based on what I learned from the activity sheet, making the process more enjoyable.	3.80	1.03	Agree
Weighted Mean	3.65		
SD	1.04		
Verbal Interpretation	Evident		

The creativity characteristic had a mean of 3.65 (SD = 1.04), with the highest-rated item being "creating my own work based on what I learned" (mean = 3.80). The MODEL activity fosters creative engagement by encouraging students to innovatively explore and apply math concepts. This reinforces the need to innovate instructional material as educational reform arises. Educators should provide instructional material so that learners will easily understand the lesson.

The degree of use of the MODEL activity in Geometry and its adaptability characteristics are shown in Table 7. The table includes key statements, mean scores, standard deviations, and remarks.

TABLE 7. Level of using MODEL Activity in Geometry in Terms of Characteristics as to Adaptability

Statements MODEL activity in Geometry contributes to…	MEAN	SD	REMARKS
…remember the concept on the activity sheet that I can apply	3.71	1.01	Agree
…understand how to adapt the activities to suit my learning needs	3.54	1.02	Agree
…apply the tasks in a way that allowed me to make my own choices during the activity.	3.79	1.01	Agree
…analyze how to effectively use the activities for group and individual work.	3.67	1.07	Agree
…measure my understanding through answering tasks in the activity sheets.	3.67	0.99	Agree
Weighted Mean	3.68		
SD	1.02		
Verbal Interpretation	Evident		

Students rated adaptability at 3.68 (SD = 1.02), showing that while most students could adjust to different learning tasks, some found adaptation challenging. The MODEL Activity provides flexibility, but further modifications may be needed to accommodate varied learning styles.

Student's Traits in Mathematics

The level of students' mathematical traits in terms of problem-solving ability, mathematical confidence, perseverance, and resilience was treated statistically using mean and standard deviation.

The level of student's traits in Mathematics in terms of problem solving ability is shown in Table 8.

TABLE 8. Level of Student's Traits in Mathematics in Terms of Problem-Solving Ability

Statements MODEL Activity improves my Problem-Solving Ability by…	MEAN	SD	REMARKS
…recalling of the steps needed to solve math problems.	3.70	1.03	Agree
…understanding the concepts and strategies used to approach different math problems.	3.63	1.00	Agree
…applying math formulas and methods to solve problems on my own.	3.99	0.89	Agree
…solving complex math problems into smaller, more manageable steps.	3.51	1.06	Agree
…developing my strategies to solve new and unfamiliar math problems.	3.86	1.01	Agree
Weighted Mean	3.74		
SD	1.00		
Verbal Interpretation	Well-Developed		

The mean score of 3.74 (SD = 1.00) suggests that MODEL activities improved problem-solving skills, especially in applying formulas and developing new strategies.

Booth, J. L., & Newton, K. J. (2018) explore how students' problem-solving abilities are influenced by their prior knowledge and cognitive load. Their research highlights the need to develop students' foundational skills and reduce cognitive overload to improve their problem-solving performance. The MODEL activity's problem-based approach strengthens students' analytical abilities and independent thinking skills, which are a foundation of knowledge and understanding regarding Mathematics that learners find to be difficult.

Level of Student's Traits in Mathematics in Terms of Mathematical Confidence

The level of student's traits in Mathematics in terms of Mathematical Confidence is shown in Table 9.

A mean of 3.69 (SD = 1.02) shows students felt more confident solving math problems after engaging in the MODEL activity that is verbally interpreted as Well Developed. Goetz, T., Bieg, M., Ludtke, O., & Hall, N. C. (2016). Mathematical confidence is a student's belief in their ability to successfully perform mathematical tasks, directly impacting their engagement and persistence in math-related activities. Their research highlights how self-perception of ability is crucial in shaping students' approaches to learning mathematics. The MODEL activity's structured exercises enhance self-efficacy, making students feel more capable and motivated to tackle mathematical challenges. These also

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encourage learners to explore independently by building their confidence to cope with the problems in the lesson and during the discussions in Mathematics class.

TABLE 9. Level of Student's Traits in Mathematics in Terms of Mathematical Confidence

Statements MODEL Activity improves my Mathematical Confidence by…	MEAN	SD	REMARKS
I…recall feeling confident when solving math problems in the past.	3.67	1.03	Agree
…identifying the specific aspects of math that boost my confidence.	3.71	0.95	Agree
…applying strategies to increase my confidence when solving math problems.	3.64	1.05	Agree
…analyzing my feelings of confidence in math to determine how they influence my problem-solving ability.	3.59	1.07	Agree
…developing new techniques or strategies to enhance my confidence while solving math problems.	3.86	0.98	Agree
Weighted Mean	3.69		
SD	1.02		
Verbal Interpretation	Well-Developed		

Level of Student's Traits in Mathematics in Terms of Perseverance and Resilience

Table 10 presents students' traits in mathematics regarding perseverance and resilience.

A mean of 3.71 (SD = 1.02) indicates that students recognize persistence as the key to solving difficult math problems which has a verbal interpretation of Well Developed.

TABLE 10. Level of Student's Traits in Mathematics in Terms of Perseverance and Resilience

Statements MODEL Activity improves my Mathematical Confidence by…	MEAN	SD	REMARKS
I remember times when I persisted through difficult math problems.	3.74	1.02	Agree
…understanding that persistence is important for solving challenging math problems.	3.67	1.03	Agree
…persisting through tough math problems by trying different methods until I find a solution.	3.64	1.01	Agree
…analyzing my progress and making adjustments when encountering setbacks in math problems.	3.73	1.06	Agree
…creating new strategies and approaches to solve math problems when my initial methods do not work.	3.76	1.00	Agree
Weighted Mean	3.71		
SD	1.02		
Verbal Interpretation	Well-Developed		

The MODEL Activity encourages perseverance by incorporating progressive problem-solving tasks that build student resilience. Muis, K. R., & Duffy, M. C. (2018) examine the role of self-regulation in mathematical resilience. Their study suggests that students who can effectively regulate their emotions and behaviors, particularly in the face of challenges, are more likely to persevere in mathematics. Muis and Duffy emphasize that teaching students' self-regulation strategies, such as goal setting and self-monitoring, can significantly improve their ability to overcome mathematical challenges and remain resilient.

Student's Performance

The level of student performance in terms of formative and summative assessment was treated statistically using frequency and percentage. Mean and standard deviation were also employed to determine the level of student's performance in Mathematics.

Table 11 presents the level of students' performance on the formative assessment.

The table displays the distribution of student scores, frequency, percentage, and corresponding remarks on the student's score on the assessment.

The majority of students (70.00%) scored between 14-26, falling under the "Average (AVR)" category. Additionally, 22.86% of students obtained scores within the 8-13 range, categorized as "Low Average (L)." A smaller percentage (7.14%) scored within the 3-7 range, classified as "Very Low Average (VL)." Notably, no students achieved scores in the "Moving Towards Mastery (MTM)," "Meets Expectations," or "Exceeds Expectations" categories.

TABLE 11. Level of Student's Performance in Terms of Formative Assessment

Scores	Frequency	Percentage	Remarks
39-40	0	0.00%	Exceeds Expectations
35-38	0	0.00%	Meets Expectations
27-34	0	0.00%	Moving Towards Mastery (MTM)
14-26	49	70.00%	Average (AVR)
8-13	16	22.86%	Low Average (L)
3-7	5	7.14%	Very Low Average (VL)
1-2	0	0.00%	Absolutely No Mastery (ANM)
Total	70	100%	

Weighted Mean = 14.70
SD=4.03

The computed weighted mean of 14.70, with a standard deviation of 4.03, indicates that students performed, on average, within the "Average (AVR)" category. This implies that while most students have a basic grasp of the material, there is still room for improvement.

Overall, the results indicate the need for intervention strategies such as remedial instruction, formative assessments, differentiated teaching approaches, and scaffolded learning activities to enhance students' understanding and mastery of the subject matter.

Wiliam (2017): In his discussions, he frames formative assessment as a process that helps educators and learners identify where they are in their learning, where they need to go, and how to get there, focusing on the interplay of learning intentions, success criteria, and feedback.

Table 12 presents the level of students' performance on the Summative Assessment.

A dramatic improvement was observed: 27.14 % of students exceeded expectations, and 71.43% met expectations (mean = 37.63, SD = 1.31).

This confirms that the MODEL activity significantly enhanced student learning outcomes. According to Black and Wiliam (2018), summative assessments provide timely feedback that helps students identify gaps in understanding

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and adjust their learning strategies. The observed high performance in the formative test suggests continuous feedback and structured learning interventions, such as the MODEL activity, support knowledge retention and application in real-world problems, enabling students to explore and apply knowledge in scenarios that might happen in the near future.

TABLE 12. Level of Student's Performance in Terms of Summative Assessment

Scores	Frequency	Percentage	Remarks
39-40	19	27.14%	Exceeds Expectations
35-38	50	71.43%	Meets Expectations
27-34	1	1.43%	Moving Towards Mastery (MTM)
14-26	0	0.00%	Average (AVR)
8-13	0	0.00%	Low Average (L)
3-7	0	0.00%	Very Low Average (VL)
1-2	0	0.00%	Absolutely No Mastery (ANM)
Total	70	100%	

Weighted Mean = 37.63
SD=1.31

Test of Significant Difference in the Students' Performance

The significant difference in the student's performance in mathematics was treated statistically using Real Statistics Data Analysis Tools, using the t-test for paired samples.

Table 13 presents the Paired Samples T-Test Comparing Students' Performance in Formative and Summative Assessment

TABLE 13. Paired Samples T-Test Comparing Students' Performance

Measure	Mean	SD	T	df	P	Cohen's d
Formative	14.67	4.10	-45.51	68	<.001	5.48
Summative	37.59	1.29				

Note:*p < .05, **p < .01, ***p < .001; Cohen's d: 0.20 (Small); 0.50 (Medium); 0.80 (Large)

A paired samples t-test was conducted to compare students' performance in the formative and summative assessments. Results indicated that summative test scores (M = 37.59, SD = 1.29) were significantly higher than formative test scores (M = 14.67, SD = 4.10), t(68) = -45.51, p < .001. The effect size (Cohen's d = 5.48) is extremely large, indicating a substantial improvement in students' performance.

Reddy, P., & Andrade, H. (2018). This study explores student perceptions of summative assessment, focusing on how these assessments influence their learning experiences. The authors highlight the importance of clarity and alignment between assessments and learning goals. However, to be effective, summative assessments must align with the learning objectives and provide valuable insights for students and educators.

This implies that the MODEL activity in Geometry was highly effective in enhancing student learning. The significant increase in scores implies that the intervention played an important role in reinforcing mathematical concepts, addressing learning gaps, and improving overall academic performance. The exceptionally large effect size shows the strong impact of the structured remediation strategies, demonstrating their effectiveness in boosting students' understanding and achievement in mathematics.

Significant Relationship between the Component and Characteristics of MODEL Activity and the Student's Traits in Mathematics

Table 14 presents the results of the Pearson correlation analysis examining the relationship between the components and characteristics of the MODEL activity and students' traits in mathematics.

TABLE 14. Significant Relationship between the Component and Characteristics of MODEL Activity and the Student's Traits in Mathematics

MODEL Activity (IV)	Student's Traits (DV)		
	Problem-Solving Ability	Mathematical Confidence	Perseverance and Resilience
Focus Lesson:			
Pearson Correlation	-0.08	0.25*	0.23
Significance(2-Tailed)	0.483	0.035	0.055
N	70	70	70
Guided Instruction:			
Pearson Correlation	0.02	-0.01	-0.11
Significance(2-Tailed)	0.483	0.941	0.365
N	70	70	70
Collaborative Learning:			
Pearson Correlation	-0.07	0.04	0.06
Significance(2-Tailed)	0.582	0.719	0.645
N	70	70	70
Independent Practice:			
Pearson Correlation	0.12	-0.15	-0.12
Significance(2-Tailed)	0.318	0.225	0.338
N	70	70	70
Usefulness:			
Pearson Correlation	0.24*	0.03	-0.00
Significance(2-Tailed)	0.047	0.789	0.994
N	70	70	70
Creativity:			
Pearson Correlation	0.12	-0.04	-0.09
Significance(2-Tailed)	0.3119	0.725	0.437
N	70	70	70
Adaptability:			
Pearson Correlation	-0.26*	0.09	0.05
Significance(2-Tailed)	0.031	0.474	0.659
N	70	70	70

Note: *p<.05, ** p<.01, ***p<.001

The table analysis reveals varying degrees of correlation between different components and characteristics of the MODEL activity in Geometry and student's traits such as problem-solving ability, mathematical confidence, and perseverance and resilience.

A very weak positive correlation was found between focus lessons and Mathematical confidence (r = 0.25, p = 0.035), indicating that while structured focus lessons contribute to students' confidence in mathematics, the correlation is minimal. Similarly, usefulness showed a very weak positive correlation with problem-solving ability (r = 0.24, p = 0.047); this implies that students who perceive the MODEL activity as useful may perform slightly better in solving mathematical problems. On the other hand, adaptability demonstrated a weak negative correlation with problem-solving ability (r = -0.26, p = 0.031), implying that students who struggle to adapt to the activity may also encounter difficulties in problem-solving.

The remaining components, including guided instruction, collaborative learning, independent practice, and creativity,

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did not show statistically significant relationships with students' traits. This implies that these aspects may not have a direct correlation with students' problem-solving skills, mathematical confidence, perseverance, and resilience. This implies that confidence-building and perceived usefulness in the MODEL activity can have a small but notable relationship with students' mathematical abilities. However, the negative correlation between adaptability and problem-solving ability shows the need for instructional strategies that support students adjusting to different learning activities. While some components did not exhibit strong correlations, student engagement and performance in mathematics may also be correlated by other factors, such as teaching methods, learning environments, and individual learning styles. This is a remarkable indication that students' traits are being developed during Mathematics lessons.

In a study on cooperative learning, Gillies (2016) explored how collaborative group work helps develop social skills in primary and secondary education. The study showed that students who engage in cooperative learning activities, such as group projects and peer teaching, improve academically and enhance their communication and teamwork skills. This has a lasting positive impact on their social and behavioral aspects.

Test of Significant Effect of Component and Characteristics of MODEL Activity on the Student's Performance

To test the significant effect of the component and characteristics of the model activity on the student's performance in mathematics in terms of formative and summative tests, a statistical treatment was performed using Jamovi 2.3.28 and regression analysis.

Table 15 shows the test of significant effect of component and characteristics of MODEL activity on the student's performance. A regression analysis was conducted to examine the influence of the components and characteristics of the MODEL activity on students' performance in both formative and summative assessments. The analysis assessed how different predictor variables, such as focus lesson, guided instruction, collaborative learning, independent practice, usefulness, creativity, and adaptability, contribute to student performance in Mathematics of Grade 9 learners of Dayap National High School.

For the formative assessment model, the results indicate that the predictor variables collectively explained 9.4% (R^2 = .094, F(7, 62) = 0.92, p = .495) of the variance in student performance. Among the variables, creativity was the only significant predictor (B = 0.66, p = 0.031), indicating that students who engage in creative activities tend to perform better in formative assessments. Other predictor variables, including focus lesson, guided instruction, collaborative learning, independent practice, usefulness, and adaptability, did not show significant effects, implying that these components may not directly impact formative test scores.

For the summative assessment model, the predictor variables accounted for 5.3% (R^2 = .053, F(7, 62) = 0.49, p = .837) of the variance in student performance. Unlike the formative assessment model, none of the predictor variables significantly influenced summative performance. While independent practice (B = 0.33, p = 0.198) and Creativity (B = 0.21, p = 0.352) had positive coefficients, their effects were not statistically significant, indicating limited effect on summative assessments.

TABLE 15. Summary of Regression Analysis for Student's Performance in Terms of Formative and Summative from Component and Characteristics of MODEL Activity

MODEL: Mathematical Outcomes Development and Engagement Learning Activity in Geometry		Student's Performance in Mathematics	
		Formative Assessment	Summative Assessment
Focus Lesson:	t-value	-0.43	-0.74
	p-value	0.67	0.47
	N	70	70
Guided Instruction:	t-value	-0.85	-0.63
	p-value	0.40	0.53
	N	70	70
Collaborative Learning:	t-value	-0.88	-0.07
	p-value	0.38	0.95
	N	70	70
Independent Practice	t-value	-0.35	1.30
	p-value	0.72	0.198
	N	70	70
Usefulness	t-value	0.31	-0.18
	p-value	0.76	0.86
	N	70	70
Creativity	t-value	2.21	0.94
	p-value	0.03	0.35
	N	70	70
Adaptability	t-value	1.17	0.24
	p-value	0.25	0.81
	N	70	70

The low R^2 values in both models indicate that the MODEL activity alone does not fully explain students' performance in formative and summative assessments. This indicates the need for additional instructional strategies, such as personalized learning, differentiated instruction, and reinforcement techniques, to enhance student achievement.

These findings reinforce the need for more engaging and structured instructional approaches that integrate creative and adaptive learning strategies to enhance student performance, particularly in formative assessments.

Research by Holzapfel et al. (2016) shows that guided instruction, particularly through tasks designed to be cognitively challenging, supports students in diverse classroom settings. They argue that effective task design and instructional strategies that adjust based on student needs enhance mathematical engagement and learning outcomes. The emphasis is on differentiated instruction, where tasks are open-ended to allow students at varying levels of ability to participate meaningfully.

IV. Conclusion and Recommendations

Based on the findings of the study, the following conclusion was drawn:

There is a significant difference between students' performance in Formative and Summative Assessment, therefore the null hypothesis is rejected. This implies that MODEL Activity in Geometry was highly effective in enhancing student's learning.

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There is no significant relationship between the MODEL (Mathematical Outcomes Development and Engagement Learning) and the student's traits. Thus, the null hypothesis is accepted. This implies that the utilization of MODEL (Mathematical Outcomes Development and Engagement Learning) has helped students develop a deeper appreciation and understanding of their lesson in Geometry but does not fully account for the variations of student's traits in Mathematics.

There is no significant effect between the MODEL (Mathematical Outcomes Development and Engagement Learning) and on the mathematical proficiency. Therefore, the null hypothesis is accepted. It implies additional instructional strategies, such as differentiated instruction and reinforcement activities, are necessary to enhance students' conceptual understanding and reasoning skills.

Overall, MODEL serves as an additional supplemental material that need more engaging instructional approaches that integrate creative and adaptive learning.

Based on the results and conclusions posted in the study, the following recommendations were formulated into the following:

The MODEL may be further developed to incorporate structured scaffolding techniques during focus lesson and guided instruction to support students.

The implementation of MODEL may be expanded to other discipline or remediation programs and targeted interventions on other grade levels within the school to assess its broader applicability and effectiveness in diverse classroom settings.

Future studies may expand the application of MODEL Activity across different grade levels and mathematical topics.

Teachers may be provided with a more comprehensive program understanding through various discussions that contributes student's success in Mathematics.

Future research may examine the maximize potential of MODELon student learning outcomes on both academic performance and sustained mathematical proficiency.

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