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Smart (Support Mathematical Activities and Remediation Tool) on the Students' Motivation and Performance

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Abstract*—The main purpose of the study is to determine the effect of SMART (Support Mathematical Activities and Remediation Tool) on the students' motivation and performance. The study aims to assess the level of SMART's components; features; students' motivation and performance in Mathematics. The study also aims to analyze how well students perform in mathematics in comparison to formative and summative assessments. Additionally, the study determines the effect of SMART on students' motivation and performance. The study employed a descriptive and quasi-experimental research design to assess the effect of SMART on students' motivation and performance. A purposive sampling technique was used to select 80 Grade 7 and Grade 8 students from Los Baños National High School – Batong Malake (San Antonio Extension Campus). Descriptive and inferential statistical tools including weighted mean, standard deviation, percentage, paired t-test, and regression analysis were utilized for data analysis. The respondents gave a high rating on SMART with regards to its components and features. Thus, it was perceived to be Acceptable. Additionally, it was also observed that the students were motivated. Furthermore, the level of students' performance in mathematics were noted to be at non-numerate level to low numerate level. Additionally, it was found out that the summative test scores were higher than formative test scores. The difference between the formative and summative performance was statistically significant. Furthermore, a significant effect of SMART on the students' motivation was found, leading to the rejection of the null hypothesis. However, it was also observed that SMART has no significant effect on students' performance, resulting to the failure of rejecting the null hypothesis. Based on these findings, it is recommended that the material may need refinement to better support student learning and application of knowledge. Furthermore, longitudinal studies should be conducted to assess SMART's long-term effect, and its effectiveness should be investigated in various educational settings.*

I. Introduction

In the 21st century, Mathematics plays a role in connecting various academic fields and facilitating the development of a scientific perspective. It is a subject that encourages interdisciplinary exploration, unlocks opportunities in other domains, and transcends boundaries within its own realm. In science, technology, engineering, and mathematics (STEM) education, Mathematics is indispensable for addressing challenges, fostering innovation, and nurturing a skilled workforce. Integrating mathematics with subjects like arts, design, languages, history, geography, economics, sciences, music, and physical education presents challenges for curricula and teaching methods. Furthermore, Mathematics cultivates critical thinking, logical reasoning, mental discipline, and inventive problem-solving skills, all of which are crucial for achievement in both academic and professional success.

Mathematics proficiency has been a consistent area of concern in the Philippines, with low performance observed in international assessments such as the Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA). To address these challenges, various mathematics intervention materials have been developed and implemented across schools. One such effort is the Numeracy Inventory Tool for Laguna Learners (NIT2L) program, which seeks to provide support to learners struggling with mathematical concepts.

The connection between learners' motivation and academic achievement has been extensively highlighted in educational studies. Motivation, whether driven by internal factors or external influences, is vital in determining how students interact with educational tasks, endure difficulties, and achieve success. In mathematics, promoting motivation is crucial, as stress and negative perceptions of the subject frequently hinder student performance. Initiatives like NIT2L program hold the promise not only of advancing students' math skills but also of boosting their enthusiasm for the subject, thus creating a more enriching learning environment.

Although the implementation of intervention materials in mathematics is on the rise, there remains a significant demand for empirical research that evaluates their efficacy regarding both student enthusiasm and performance. This research aims to bridge this gap by exploring the effects of the intervention material in mathematics on learners' eagerness to engage with mathematics and their success in the subject matter.

In particular, this study aims to determine the effect of Support Mathematical Activities and Remediation Tool (SMART) on the students' motivation and performance in mathematics as an intervention material.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aims to determine the effect of Support Mathematical Activities and Remediation Tool (SMART) on students' motivation and performance in Mathematics.

Specifically, it sought to answer the following questions:

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1. What is the level of Support Mathematical Activities and Remediation Tool (SMART) in terms of components with regards to:
   1.1 Objectives;
   1.2 Key Concepts;
   1.3 Activities;
   1.4 Assessments; and
   1.5 Reflections?
2. What is the level of Support Mathematical Activities and Remediation Tool (SMART) in terms of features with regards to:
   2.1 Design;
   2.2 Adaptability;
   2.3 Usability; and
   2.4 Reliability?
3. What is the level of student's motivation in terms of:
   3.1 Intrinsic factors; and
   3.2 Extrinsic factors?
4. What is the level of student's Performance in terms of:
   4.1 Formative test; and
   4.2 Summative test?
5. Is there a significant difference between students' performance in formative test and summative test?
6. Is there a significant effect of the Support Mathematical Activities and Remediation Tool (SMART) on the students' motivation?
7. Is there a significant effect of the Support Mathematical Activities and Remediation Tool (SMART) on the students' performance in Mathematics?

II. Methodology

The study employed a descriptive and quasi-experimental research design to assess the effect of SMART on students' motivation and performance. A purposive sampling technique was used to select 80 Grade 7 and Grade 8 students from Los Baños National High School – Batong Malake (San Antonio Extension Campus). Descriptive and inferential statistical tools including weighted mean, standard deviation, percentage, paired t-test, and regression analysis were utilized for data analysis.

III. Results and Discussion

This part presents, analyzes, and interprets the data gathered that showed a significant effect of SMART (Support Mathematical Activities and Remediation Tool) on the student's motivation and student's performance in mathematics and a significant difference in the students' performance in mathematics.

Support Mathematical Activities and Remediation Tool (SMART) in terms of Component

The level of support mathematical activities and remediation tool in terms of components with regards to objectives, key concepts, activities, assessments and reflections are presented below. The following tables include statements, means, standard deviations, remarks and verbal interpretations.

Table 1 presents the level of support of mathematical activities and remediation tool (SMART) in terms of components with regards to objectives.

Statements on objectives with mean and standard deviation (M = 4.19; SD = 0.83), (M = 4.08; SD = 0.82), (M = 3.98; SD = 0.87), (M = 3.96; SD = 0.65), and (M = 3.75; SD = 0.82) which all remarks fall under "Agree". The weighted mean score was 3.97, with a standard deviation (SD) of 0.60, resulting in a verbal interpretation of "Accepted", indicating a generally positive level of agreement among respondents regarding the clarity, alignment, achievability, and motivational aspects of the objectives.

TABLE 1. Level of *Support Mathematical Activities and Remediation Tool in terms of Components with regards to Objectives*

STATEMENTS	MEAN	SD	REMARKS
The objectives of the intervention material aligned with my learning needs in mathematics.	4.19	0.83	Agree
The objectives of the intervention material were clearly stated and easy to understand.	4.08	0.82	Agree
The objectives motivated me to engage more with mathematics.	3.98	0.87	Agree
The material met the learning goals they set out to achieve.	3.86	0.65	Agree
The objectives were realistic and achievable within the given time.	3.75	0.82	Agree
Weighted Mean	3.97		
SD	0.60		
Verbal Interpretation	Accepted		

Overall, the results indicate that the objectives of the intervention material are well-structured and effectively support student learning. The level of acceptance across all components shows the importance of clearly defined and relevant objectives in fostering student engagement and improving their mathematical understanding.

The results above are aligned with the idea of Nurdiyanto and Nurhanurawati (2022) that the importance of setting objectives that align with curriculum standards and student characteristics, enhances the relevance and applicability of the learning material. Clear objectives not only help in structuring the intervention but also motivate students by providing them with a clear understanding of what is expected. Babalola (2022) added that instructional materials should be created with specific learning goals in mind, ensuring that they are relevant and effective in promoting student learning.

Table 2 presents the level of support of mathematical activities and remediation tool (SMART) in terms of components with regards to key concepts.

Statements on key concepts with mean and standard deviation (M = 3.94; SD = 0.70), (M = 3.93; SD = 0.76), (M = 3.89; SD = 0.71), (M = 3.86; SD = 0.71), and (M = 3.79; SD = 0.87) which all remarks fall under "Agree". The consistent "Agree" ratings across all statements show that the key concepts component is performing effectively; however, slight improvements in content adaptability and level of difficulty could further optimize. The weighted mean is 3.88, and the standard deviation is 0.49, which also falls under the "Accepted" verbal interpretation. It means that participants were quite satisfied with the relevance, clarity, engagement,

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and comprehensiveness of the key concepts and they felt it was appropriate to their learning needs in mathematics.

TABLE 2. Level of *Support Mathematical Activities and Remediation Tool in terms of Components with regards to Key Concepts*

STATEMENTS	MEAN	SD	REMARKS
The content of the intervention material was relevant to the math topics I struggle with.	3.94	0.70	Agree
The intervention material covered all the essential topics I needed to improve in math.	3.93	0.76	Agree
The materials presented mathematical concepts in a clear and understandable manner.	3.89	0.71	Agree
The content was engaging and maintained my interest in learning mathematics.	3.86	0.71	Agree
The level of difficulty of the content was appropriate for my skill level.	3.79	0.87	Agree
Weighted Mean		3.88	
SD		0.49	
Verbal Interpretation		Accepted	

Overall, the intervention material was perceived as relevant, clear, and comprehensive, with a good level of engagement. However, there was a slightly mixed response regarding the appropriateness of the content's difficulty, with a bit more variation in opinions. Thus, the material appears to have been effective and well-received, as indicated by the high weighted mean and consistent positive feedback from participants.

The result has also been mentioned by Tanrıdiler (2024) that the alignment of instructional materials with key mathematical concepts is critical. He added that the effectiveness of instructional materials is closely tied to how well they represent mathematical concepts.

Table 3 presents the level of support of mathematical activities and remediation tool (SMART) in terms of components with regards to activities.

TABLE 3. Level of *Support Mathematical Activities and Remediation Tool in terms of Components with regards to Activities*

STATEMENTS	MEAN	SD	REMARKS
The activities provided in the material were helpful in reinforcing mathematical concepts.	4.09	0.73	Agree
The hands-on activities improved my understanding of mathematical concepts.	4.09	0.68	Agree
The activities in the material were designed to promote problem-solving skills.	3.95	0.76	Agree
The activities were appropriately challenging for my learning level.	3.93	0.74	Agree
The activities were varied and encouraged active participation in learning.	3.91	0.75	Agree
Weighted Mean		3.99	
SD		0.51	
Verbal Interpretation		Accepted	

Statements on activities with mean and standard deviation (M = 4.09; SD = 0.73), (M = 4.09; SD = 0.68), (M = 3.95; SD = 0.76), (M = 3.93; SD = 0.74), and (M = 3.91; SD = 0.75) which all remarks fall under “Agree”. The highest-rated statements (both at M = 4.09) emphasized that the activities effectively reinforced concepts and enhanced understanding through hands-on engagement. Additionally, a mean of 3.91 for encouraging active participation confirms that students found the activities engaging and interactive, which is vital for deep learning in mathematics. The weighted mean is 3.99, with an SD of 0.51, which falls under the "Accepted" verbal interpretation. This indicates a generally positive reception to the activities in the material, with participants agreeing that the activities reinforced concepts, were engaging, and promoted problem-solving.

Overall, the activities in the intervention material were accepted by the respondents, with strong agreement that they reinforced mathematical concepts, enhanced understanding through hands-on experiences, and promoted problem-solving skills. While there was a bit more variation in how participants viewed the variety of activities and their engagement level, the overall feedback is positive, suggesting that the activities were a key strength of the material.

The results justified the importance of integrating literacy and math activities in informal learning environments can lead to increased engagement and understanding of mathematical concepts (Carter, 2024). In addition, study skills interventions help students manage their anxiety; hence, structured activities can promote a more positive approach to math tasks (Pizzie & Kraemer, 2023).

Table 4 presents the level of support of mathematical activities and remediation tool (SMART) in terms of components with regards to assessments.

TABLE 4. Level of *Support Mathematical Activities and Remediation Tool in terms of Components with regards to Assessments*

STATEMENTS	MEAN	SD	REMARKS
The assessments provided helped me gauge my understanding of the topics covered.	4.11	0.91	Agree
The assessments were fair and accurately measured my progress.	4.06	0.79	Agree
The assessments motivated me to reflect on my learning process in mathematics.	3.96	0.89	Agree
The assessments helped me track my progress over time in learning mathematics.	3.91	0.72	Agree
The assessments were aligned with the learning objectives of the intervention materials.	3.75	0.83	Agree
Weighted Mean		3.96	
SD		0.58	
Verbal Interpretation		Accepted	

Statements on assessments with mean and standard deviation (M = 4.11; SD = 0.91), (M = 4.06; SD = 0.79), (M = 3.96; SD = 0.89), (M = 3.91; SD = 0.72), and (M = 3.75; SD = 0.83) which all remarks fall under “Agree”. The weighted mean is 3.96, with an SD of 0.58, which falls under the "Accepted" verbal interpretation. This indicates a high level of agreement among respondents that the assessments were beneficial in their learning process. This suggests that students generally perceive the assessments as effective tools in tracking progress, understanding topics, and aligning with learning objectives.

Overall, the assessments in the intervention material were highly regarded by the respondents, with strong agreement that it is useful for self-evaluation. In addition, respondents

trust the assessments to effectively reflect their abilities correctly.

The importance of assessment was explained by Emans and Hempel (2016), as it aids individual to understand how various components of an intervention contribute to desired outcomes. In addition, the integration of self-efficacy assessments within math interventions is crucial for fostering a positive learning experience (Szucs and Toffalini, 2023).

Table 5 presents the level of support of mathematical activities and remediation tool (SMART) in terms of components with regards to reflections.

TABLE 5. Level of *Support Mathematical Activities and Remediation Tool in terms of Components with regards to Reflections*

STATEMENTS	MEAN	SD	REMARKS
The intervention material encouraged me to reflect on my learning progress.	4.15	0.64	Agree
I was able to identify my strengths and weaknesses in math through reflection exercises.	4.10	0.74	Agree
I found the reflection questions in the material useful in deepening my understanding of math.	4.06	0.79	Agree
The reflection activities helped me develop a plan to improve my math performance.	4.00	0.68	Agree
I feel more confident in setting personal learning goals after reflecting on my math progress.	3.86	0.94	Agree
Weighted Mean	4.04		
SD	0.49		
Verbal Interpretation	Accepted		

Statements on reflections with mean and standard deviation (M = 4.15; SD = 0.64), (M = 4.10; SD = 0.74), (M = 4.06; SD = 0.79), (M = 4.00; SD = 0.68), and (M = 3.86; SD = 0.94) which all remarks fall under “Agree”. The weighted mean is 4.04, with an SD of 0.49, which falls under the "Accepted" verbal interpretation. This indicates that respondents had a positive experience with the intervention material and its reflection activities.

Overall, the intervention material, with its focus on reflection, was successful in helping students reflect on their math learning, identify their strengths and weaknesses, and develop improvement plans.

The results above were also observed by Iddi et al (2022) - reflective questions are critical for developing learners' comprehension of mathematical concepts. Additionally, Colonnese & Cardetti (2023) stated that engaging in reflective writing allows students to articulate their reasoning and problem-solving processes, which is a vital skill in mathematics.

Support Mathematical Activities and Remediation Tool (SMART) in terms of Features

The level of support mathematical activities and remediation tool in terms of features with regards to design, adaptability, usability and reliability are presented below. The following tables include statements, means, standard deviations, remarks and verbal interpretations.

Table 6 presents the level of support of mathematical activities and remediation tool (SMART) in terms of features with regards to design.

Statements on design with mean and standard deviation (M = 4.13; SD = 0.68), (M = 3.98; SD = 0.71), (M = 3.90; SD = 0.79), (M = 3.89; SD = 0.78), and (M = 3.84; SD = 0.85) which all remarks fall under “Agree”. The weighted mean is 3.95, with an SD of 0.54, which falls under the "Accepted" verbal interpretation. This indicates generally a high appreciation of how the material was presented. The intervention material's design was crucial to its favorable reception.

TABLE 6. Level of *Support Mathematical Activities and Remediation Tool in terms of Features with regards to Design*

STATEMENTS	MEAN	SD	REMARKS
The overall design helped me stay focused and organized during my math learning process.	4.13	0.68	Agree
The design elements (e.g., colors, fonts, graphics) enhanced my learning experience.	3.98	0.71	Agree
The design of the materials was appropriate for my age and learning level.	3.90	0.79	Agree
The layout of the material made it easy to follow and understand the content.	3.89	0.78	Agree
The design of the intervention material was visually appealing and engaging.	3.84	0.85	Agree
Weighted Mean	3.95		
SD	0.54		
Verbal Interpretation	Accepted		

Overall, the respondents held the design of the intervention material in high esteem, with a strong consensus that it aids in focus, organization, and overall learning.

The results aligned with the idea of Uwerhiavwe (2023) that the design of printed intervention materials have an influence on students' mathematics achievement. Saija (2021) added that a well-designed material with a combination of oral explanations, hands-on activities, and physical involvement in class can lead to optimal mathematics achievement.

Table 7 presents the level of support of mathematical activities and remediation tool (SMART) in terms of features with regards to adaptability.

TABLE 7. Level of *Support Mathematical Activities and Remediation Tool in terms of Features with regards to Adaptability*

STATEMENTS	MEAN	SD	REMARKS
The intervention materials were adaptable to my individual learning needs.	4.09	0.75	Agree
The intervention materials allowed me to focus on specific areas of mathematics where I needed improvement.	4.00	0.89	Agree
The materials offered various types of activities to suit my learning preferences.	3.99	0.72	Agree
I was able to adjust the pace of the learning activities to suit my learning speed.	3.98	0.69	Agree
The materials provided various levels of difficulty to match my math proficiency.	3.80	0.74	Agree
Weighted Mean	3.97		
SD	0.51		
Verbal Interpretation	Accepted		

The highest rated statement is “the intervention materials were adaptable to my individual learning needs”. Its mean score of 4.09 suggests that most participants agree that the materials were adaptable to their individual learning needs.

The standard deviation of 0.75 shows a moderate level of consistency in the responses. Most respondents appear to have a positive view of the adaptability of the materials, with only slight variation in their opinions.

Statements on adaptability with mean and standard deviation (M = 4.09; SD = 0.75), (M = 4.00; SD = 0.89), (M = 3.99; SD = 0.72), (M = 3.98; SD = 0.69), and (M = 3.80; SD = 0.74) which all remarks fall under "Agree". The weighted mean of 3.97 falls into the high category with "Accepted" as verbal interpretation, indicating an overall positive evaluation of the intervention materials. The low standard deviation of 0.51 suggests that there was relatively little disagreement among participants. In general, the materials were well-received, with high ratings for adaptability, variety, pacing, and focus on individual needs.

Overall, the intervention materials were positively evaluated, with most participants agreeing that they met their learning needs in various aspects (adaptability, pacing, focus, and variety). However, there are areas that could be refined to further improve the learning experience.

The result above is the same as observed by Zulkarnain (2023), stated that adaptable intervention materials should encourage multiple perspectives and creative solutions to foster problem-solving skills. Additionally, by utilizing digital tools and resources, educators can develop adaptable materials that can be easily modified to suit the specific learning contexts and needs of their students. (Offen, 2020)

Table 8 presents the level of support of mathematical activities and remediation tool (SMART) in terms of features with regards to usability.

TABLE 8. Level of *Support Mathematical Activities and Remediation Tool in terms of Features with regards to Usability*

STATEMENTS	**MEAN**	**SD**	**REMARKS**
The instructions provided in the materials were clear and easy to follow.	4.11	0.76	Agree
The intervention materials were easy to navigate and use without confusion.	3.89	0.91	Agree
The materials were user-friendly and did not require additional help to understand.	3.79	0.71	Agree
I did not face any technical difficulties while using the materials.	3.78	0.98	Agree
I was able to quickly find the information and activities I needed in the materials.	3.71	0.77	Agree
Weighted Mean		3.86	
SD		0.64	
Verbal Interpretation		Accepted	

The mean of 4.11 is the highest among the statements, indicating strong agreement that the instructions were clear and easy to follow. The SD of 0.76 reflects a reasonable level of consistency in participants' experiences, suggesting that most felt the instructions were easy to comprehend. This is the strongest aspect of the usability of the materials, with participants rating the clarity of instructions very positively. However, the higher standard deviation of 0.98 in the statement about technical difficulties indicates that some users faced issues. Additionally, the variability in responses (SD of 0.91) implies that a few users might have encountered challenges.

Statements on usability with mean and standard deviation (M = 4.11; SD = 0.76), (M = 3.89; SD = 0.91), (M = 3.79; SD = 0.71), (M = 3.78; SD = 0.98), and (M = 3.71; SD = 0.77) which all remarks fall under "Agree". The weighted mean of 3.86 indicates that the overall usability of the materials was perceived positively. This mean falls under "Accepted" verbal interpretation. The SD of 0.64 shows that while the overall feedback was favorable, there was some variability in the responses, especially regarding navigation and technical difficulties.

The usability of the intervention materials is generally well-received, with participants agreeing that the materials were mostly easy to navigate, user-friendly, and provided clear instructions. The higher ratings for instruction clarity and the relatively low standard deviation in those areas are particularly positive. However, there are some areas that could benefit from refinement, particularly in terms of quickly finding information and minimizing technical issues for all users.

The results align with the idea presented by Valla et al (2023), involving students in the design process can lead to materials that are more relevant and engaging, improving their usability. Furthermore, Gersten (2016) highlights the importance of conducting usability testing and iterative redesigns to refine intervention strategies based on user feedback.

Table 9 presents the level of support of mathematical activities and remediation tool (SMART) in terms of features with regards to reliability.

TABLE 9. Level of *Support Mathematical Activities and Remediation Tool in terms of Features with regards to Reliability*

STATEMENTS	**MEAN**	**SD**	**REMARKS**
The intervention materials consistently provided accurate and reliable information.	4.16	0.77	Agree
The content and activities in the materials were regularly updated to stay relevant.	4.05	0.78	Agree
The materials were free from technical errors or glitches.	3.93	0.82	Agree
The materials were dependable for consistent practice and skill improvement in mathematics.	3.89	0.73	Agree
I could rely on the materials to provide thorough explanations of mathematical concepts.	3.71	0.78	Agree
Weighted Mean		3.95	
SD		0.54	
Verbal Interpretation		Accepted	

The mean of 4.16 reflects strong agreement that the materials provided accurate and reliable information. The SD of 0.77 shows low variability, indicating that most participants shared a similar positive experience with the reliability of the content. This is the most positively rated statement, suggesting that participants found the materials to be a trustworthy source of information.

Statements on reliability with mean and standard deviation (M = 4.16; SD = 0.77), (M = 4.05; SD = 0.78), (M = 3.93; SD = 0.82), (M = 3.89; SD = 0.73), and (M = 3.71; SD = 0.78) which all remarks fall under "Agree". The weighted mean of

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3.95 is high, indicating that, overall, the materials were considered reliable and consistent by the participants. This mean falls under "Accepted" verbal interpretation. The SD of 0.54 shows some variability in responses, but it is still within a reasonable range, meaning that while most participants were satisfied with the reliability and content quality, there were a few differing experiences.

Overall, the intervention materials were highly rated in terms of accuracy, reliability, and relevance. Most participants agreed that the materials provided dependable content and were generally free of technical errors. However, there is some room for improvement, particularly in providing more thorough explanations of mathematical concepts and reducing any occasional technical glitches.

One important aspect of reliability in instructional materials is the suitability and practicality of the content. Hence, suitability testing is essential to analyze the accuracy and consistency of instructional materials in achieving desired skills (Rosyidi, 2023). Dennis (2015) emphasized the importance of structured and well-designed materials that facilitate repeated practice and cumulative review, both of which are vital for students with serious mathematics deficits.

Student's Motivation

The level of student's motivation in terms of intrinsic factors and extrinsic factors are presented below. The following tables include statements, means, standard deviations, remarks and verbal interpretations.

Table 10 presents the level of motivation in terms of intrinsic factors.

TABLE 10. Level of *Student's Motivation in terms of Intrinsic Factors*

STATEMENTS	**MEAN**	**SD**	**REMARKS**
I feel a sense of accomplishment when I solve math problems correctly.	4.21	0.82	Strongly Agree
I believe learning math is important for achieving my personal and career goals.	4.14	0.67	Agree
I find learning math topics interesting and enjoyable.	4.08	0.99	Agree
I enjoy solving challenging math problems because they make me curious to learn more.	3.93	0.92	Agree
I enjoy the process of learning math, even when the concepts are difficult.	3.75	0.79	Agree
Weighted Mean	4.02		
SD	0.55		
Verbal Interpretation	Motivated		

Statements on intrinsic factors with mean and standard deviation (M = 4.21; SD = 0.82) which remark falls under "Strongly Agree"; (M = 4.14; SD = 0.67), (M = 4.08; SD = 0.99), (M = 3.93; SD = 0.92), and (M = 3.75; SD = 0.79) which remarks fall under "Agree". The weighted mean of 4.02 is high, suggesting that, overall, participants have a positive attitude toward learning math. This mean falls under "Motivated" verbal interpretation. The SD of 0.55 reflects some variability in their responses, meaning that while most participants are motivated and engaged in math, there are a few who might struggle more with it.

The level of motivation in terms of intrinsic factors is highly positive, with participants generally enjoying math, feeling accomplished when solving problems, and recognizing its importance for their future. However, there are some areas where participants may experience less enthusiasm, particularly when it comes to facing challenging concepts.

The result is evidence that intrinsic motivation is a key factor contributing to students' overall motivation and effort in mathematics, thereby enhancing their performance (Amjad, 2022). Furthermore, promoting intrinsic motivation can lead to deeper engagement and higher achievement among students (Froiland & Worrell, 2016).

Table 11 presents the level of motivation in terms of extrinsic factors.

TABLE 11. Level of *Student's Motivation in terms of Extrinsic Factors*

STATEMENTS	**MEAN**	**SD**	**REMARKS**
I am motivated to study math when I receive good grades or rewards.	4.16	0.66	Agree
My math teacher's positive feedback motivates me to do better in math.	4.08	0.57	Agree
I feel more motivated to improve in math when I see my classmates performing well.	4.00	0.86	Agree
I work harder in math when I am in competition with my classmates.	3.93	1.04	Agree
I am motivated to succeed in math because my parents expect me to do well.	3.85	0.94	Agree
Weighted Mean	4.00		
SD	0.5		
Verbal Interpretation	Motivated		

Statements on extrinsic factors with mean and standard deviation (M = 4.16; SD = 0.66), (M = 4.08; SD = 0.57), (M = 4.00; SD = 0.86), (M = 3.93; SD = 1.04), and (M = 3.85; SD = 0.94) which all remarks fall under "Agree". The weighted mean of 4.00 (with SD of 0.50) indicates that, overall, the responses lean toward a high level of motivation in terms of extrinsic factors. The verbal interpretation "Motivated" confirms that the overall motivational level is perceived as strong.

Overall, the data suggests that extrinsic factors such as rewards, grades, and teacher feedback are relatively strong motivators. While peer competition and parental expectations also play a role, they may require more clever approaches.

The result of the study was also observed by Santos (2018) - extrinsic motivation, driven by external rewards such as grades, praise, or parental expectations, has a crucial role in mathematics learning. Murphy et al. (2021) suggested that integrating extrinsic motivation into instructional practices, such as through gamification in printed materials, can make learning more enjoyable and encourage students to strive for external rewards, thereby enhancing engagement and performance.

Student's Performance

The level of student's performance in terms of formative test and summative test are presented as shown. The following tables include scores, frequency, percentage, and verbal interpretation.

Table 12 presents the level of students' performance in terms of formative test.

Of the 80 respondents, the majority (65.00%) fall into the "Non-numerate" range (scores 0–10). A further 35.00% of

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respondents are in the "Low Numerate" range (scores 11–20). Notably, there are no respondents scoring in the higher ranges (21–29 for Numerate, 30–34 for Highly Numerate, or 35–40 for Advance).

TABLE 12. Level of *Student's Performance in terms of Formative Test*

Scores	Frequency	Percentage	Verbal Interpretation
35-40	0	0.00%	Advance
30-34	0	0.00%	Highly Numerate
21-29	0	0.00%	Numerate
11-20	28	35.00%	Low Numerate
0-10	52	65.00%	Non-numerate
Total	80	100%	

Weighted Mean = 8.70
SD=4.83
Verbal Interpretation = Non-numerate

The weighted mean score is 8.70, indicating that on average, respondents have quite low numeracy ability based on the score ranges provided. The weighted mean falls under the "non-numerate" range. The standard deviation (SD) of 4.83 suggests there is some variability among scores; however, given that all scores fall within the lower ranges, the dispersion is mostly confined to the low end.

Overall, the absence of scores in the upper bands combined with the low weighted mean strongly suggest a need for targeted interventions or additional support in numeracy.

Regular formative assessments motivate students to engage with the material and recognize their learning gaps, which encourages them to take ownership of their educational journey (Panchbudhe, 2024).

Table 13 presents the level of students' performance in terms of the summative test.

The table depicts a distribution of scores across 80 respondents, categorized into five proficiency levels. The majority (65.00%) fall into the "Low Numerate" category with scores between 11-20. The second largest group (23.75%) is in the "Non-numerate" category with scores between 0-10. Only 11.25% of respondents achieved "Numerate" status with scores between 21-29. Notably, no respondents reached the "Highly Numerate" (30-34) or "Advance" (35-40) categories.

TABLE 13. Level of *Student's Performance in terms of Summative Test*

Scores	Frequency	Percentage	Verbal Interpretation
35-40	0	0.00%	Advance
30-34	0	0.00%	Highly Numerate
21-29	9	11.25%	Numerate
11-20	52	65.00%	Low Numerate
0-10	19	23.75%	Non-numerate
Total	80	100%	

Weighted Mean = 14.01
SD=5.57
Verbal Interpretation = Low Numerate

The weighted mean score is 14.01, which falls within the "Low Numerate" range. This indicates that on average, the respondents demonstrate limited numeracy skills. The standard deviation of 5.57 suggests moderate variability in scores, though this variation is primarily concentrated in the lower to middle ranges of the scale.

When comparing this distribution to the previous distribution (formative), there's a notable improvement. In formative test, 65% were "Non-numerate" and 35% were "Low Numerate" with no respondents in higher categories. The current distribution shows fewer "Non-numerate" respondents (23.75%), more "Low Numerate" (65%), and the emergence of some "Numerate" respondents (11.25%).

Summative assessments can identify trends in student performance across different cohorts, informing curriculum development and instructional improvements (Lestari, 2023). In addition to that, consistent summative assessment practices highlight areas where students struggle, allowing educators to adjust their teaching methods to better support student learning (Basera, 2019).

Test of Significant Difference on the Students' Performance

The significant difference between formative and summative on the students' performance in mathematics was treated statistically using two-tailed paired t-test.

Table 14 presents the paired samples t-test comparing students' performance. It includes students' performance, mean, mean difference, standard error (SE), computed and critical t-value, p-value and remark.

TABLE 14. *Paired Samples T-Test comparing Students' Performance*

Students' Performance	Mean	SD	Mean Diff	SE	Computed t-value	Critical t-value	p-value	Remark
Formative	8.7	4.83	5.31	0.59	9.076	1.990	0.000	Sig.
Summative	14.01	5.57						

N = 80
df = 79

Results indicated that summative test scores (M = 14.01, SD = 5.57) were significantly higher than formative test scores (M = 8.70, SD = 4.83); the computed t-value (9.076) is greater than the critical t-value (1.990), thus, the null hypothesis is rejected.

This means that the support mathematical activities and remediation tool (SMART) effectively supported student learning, leading to significant gains between the formative and summative assessments. Thus, indicating a meaningful improvement in students' performance.

The result of the study aligns with the findings from a study conducted by Gezer et al. (2021), the study indicates that students' attitudes toward formative assessments can predict their attitudes toward summative assessments, suggesting that formative assessments play a crucial role in preparing students for summative evaluations.

Test of Significant Effect of Support Mathematical Activities and Remediation Tool on the Student's Motivation

A regression analysis was conducted to examine the effect of support mathematical activities and the remediation tool (SMART) on students' motivation, considering both intrinsic and extrinsic factors.

Rodelle Ian Martinez Arroyo, "Smart (Support Mathematical Activities and Remediation Tool) on the Students' Motivation and Performance," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 7, Issue 12, pp. 505-514, 2025.

Table 15 presents the summary of regression analysis for student's motivation in terms of intrinsic and extrinsic from support mathematical activities and remediation tool

For intrinsic motivation, the results indicate that activities (B = 0.439, p = .005) had a significant positive effect, implies that engaging activities played an important role in enhancing students' internal drive for learning mathematics. In contrast, design (B = -0.276, p = .009) showed a negative effect, indicating that certain aspects of the material's structure might have hindered intrinsic motivation. Other variables, including objectives, key concepts, assessments, reflections, adaptability, usability, and reliability, did not significantly predict intrinsic motivation.

For extrinsic motivation, the results showed that key concepts (B = 0.274, p = .031) and activities (B = 0.707, p = .000) had significant positive effects, indicating that well-structured key concepts and engaging activities contributed to external motivational factors, such as rewards, recognition, or external validation. Other predictor variables did not significantly predict intrinsic motivation.

TABLE 15. Summary of Regression Analysis for *Student's Motivation in terms of Intrinsic and Extrinsic from Support Mathematical Activities and Remediation Tool*

Intrinsic Factors						
Variables		**Coefficients**		**t**	***p***	**Remark**
		B	**SE B**			
Components	Objectives	.123	.116	1.062	.292	Not Sig.
	Key Concepts	.007	.115	.062	.950	Not Sig.
	Activities	.439	.153	2.869	.005	Sig.
	Assessments	.054	.091	.591	.556	Not Sig.
	Reflections	.085	.148	.574	.568	Not Sig.
Features	Design	-.276	.103	-2.682	.009	Sig.
	Adaptability	.195	.155	1.258	.213	Not Sig.
	Usability	.138	.116	1.183	.241	Not Sig.
	Reliability	.127	.135	.935	.353	Not Sig.
Note: $R^2 = .706, F(9, 70) = 18.67, p\text{-value} = 0.000$						
Extrinsic Factors						
Variables		**Coefficients**		**t**	***p***	**Remark**
		B	**SE B**			
Components	Objectives	-.140	.126	-1.109	.271	Not Sig.
	Key Concepts	.274	.125	2.200	.031	Sig.
	Activities	.707	.166	4.255	.000	Sig.
	Assessments	.019	.099	.191	.849	Not Sig.
	Reflections	-.243	.161	-1.511	.135	Not Sig.
Features	Design	.204	.112	1.829	.072	Not Sig.
	Adaptability	-.006	.169	-.034	.973	Not Sig.
	Usability	-.138	.126	-1.092	.278	Not Sig.
	Reliability	.057	.147	.388	.699	Not Sig.
Note: $R^2 = .564, F(9, 70) = 10.06, p\text{-value} = 0.000$						

These implies that activities within SMART was the influential factor in both intrinsic and extrinsic motivation, reinforcing the importance of interactive, engaging, and meaningful learning experiences. However, the design of the intervention material negatively affected intrinsic motivation, indicates the need for improvements in how the material is structured to better support students' self-driven learning.

Overall, these results emphasize the effectiveness of mathematical activities and remediation tools (SMART) in fostering student motivation, particularly through well-designed tasks and key concepts that enhance both intrinsic engagement and extrinsic incentives for learning.

The result aligns with the findings of Niemivirta (2023) that nurturing intrinsic motivation sustains and enhance students' mathematical abilities over time. Additionally, Achachagua et al. (2022) found a strong relationship between intrinsic motivation and academic success among undergraduate students in mathematics. On the other hand, extrinsic academic motivation is closely linked to attentional control and perceived learning (İnal et al., 2023) but Bora's research indicates that high levels of extrinsic motivation can lead to increased anxiety among students (Bora & Thokan, 2020).

Test of Significant Effect of Support Mathematical Activities and Remediation Tool on the Student's Performance

A regression analysis was conducted to examine the effect of support mathematical activities and the remediation tool (SMART) on students' performance, considering both intrinsic and extrinsic factors.

Table 16 presents summary of regression analysis for student's performance in terms of formative and summative test from support mathematical activities and remediation tool.

TABLE 16. Summary of Regression Analysis for *Student's Performance in terms of Formative and Summative Test from Support Mathematical Activities and Remediation Tool*

Formative test						
Variables		**Coefficients**		**t**	***p***	**Remark**
		B	**SE B**			
Components	Objectives	2.237	1.756	1.274	.207	Not Sig.
	Key Concepts	-1.190	1.738	-.685	.496	Not Sig.
	Activities	2.198	2.315	.949	.346	Not Sig.
	Assessments	-1.675	1.383	-1.212	.230	Not Sig.
	Reflections	-2.614	2.244	-1.165	.248	Not Sig.
Features	Design	-1.323	1.558	-.849	.399	Not Sig.
	Adaptability	1.471	2.350	.626	.533	Not Sig.
	Usability	-3.265	1.760	-1.856	.068	Not Sig.
	Reliability	3.668	2.050	1.790	.078	Not Sig.
Note: $R^2 = .127, F(9, 70) = 1.128, p\text{-value} = .355$						
Summative test						
Variables		**Coefficients**		**t**	***p***	**Remark**
		B	**SE B**			
Components	Objectives	3.647	2.001	1.823	.073	Not Sig.
	Key Concepts	-.924	1.981	-.467	.642	Not Sig.
	Activities	.014	2.638	.005	.996	Not Sig.
	Assessments	-2.241	1.576	-1.422	.159	Not Sig.
	Reflections	-.747	2.557	-.292	.771	Not Sig.
Features	Design	-1.625	1.775	-.916	.363	Not Sig.
	Adaptability	5.065	2.678	1.891	.063	Not Sig.
	Usability	-3.071	2.005	-1.532	.130	Not Sig.
	Reliability	.757	2.336	.324	.747	Not Sig.
Note: $R^2 = .146, F(9, 70) = 1.329, p\text{-value} = .238$						

For formative test performance, none of the variables in the model were statistically significant predictors of formative performance (all p-values > 0.05). Furthermore, the variable

usability came close to significance (B = -3.265, p = .068), but its negative coefficient suggests that perceived ease of use may have had a counterintuitive association with lower test performance, possibly due to over-reliance on the tool rather than active engagement. Additionally, reliability also approached significance (B = 3.668, p = .078), with a positive coefficient, implying that greater reliability of the material might support better performance, though this effect did not reach statistical significance. The overall model was not statistically significant, with F(9, 70) = 1.128, p = .355. Despite these trends, the overall weak explanatory power suggests that the components and features of the intervention tool had limited direct effect on formative assessment outcomes.

Similarly, in the summative test performance, none of the variables in the model were statistically significant predictors of formative performance (all p-values > 0.05). Though, adaptability showed a nearly significant, positive effect (B = 5.065, p = .063), suggesting that materials that adapt to students' needs might be beneficial for long-term performance and objectives also approached significance (B = 3.647, p = .073), implying that clear and targeted learning objectives may contribute to summative outcomes, though not conclusively. The absence of statistically significant variables indicates that other unmeasured factors may be more influential in driving summative test performance than the components and features of SMART.

The results showed that the model explained 12.7% (R^2 = .127, p = .355) of the variance in formative test scores and 14.6% (R^2 = .146, p = .238) of the variance in summative test scores, suggesting that additional factors beyond the analyzed predictors contributed to student performance.

The result of the study justifies the result of the study conducted by Wang et al. (2022) found a positive correlation between the mathematical attitudes, behavioral engagement, and performance of the students. thus, these variables were not included in the current paper's model.

IV. Conclusion and Recommendations

Based on the findings above, the following conclusions were hereby drawn:

The use of support mathematical activities and remediation tool (SMART) effectively supported student learning, leading to significant gains between the formative and summative scores. This leads to the rejection of null hypothesis. The findings support the effectiveness of SMART as an educational intervention, demonstrating its potential to bridge learning gaps and reinforce mathematical understanding over time. This improvement highlights the importance of integrating targeted support tools within instructional strategies to promote academic growth.

SMART has a significant effect on students' motivation. This leads to the rejection of null hypothesis. Specifically, the activities emerged as a significant driver of both intrinsic and extrinsic motivation, underscoring the importance of engaging and interactive learning experiences.

SMART has no significant effect on students' performance in Mathematics. This leads to the failure of rejecting the null hypothesis. While the support mathematical activities and remediation tool (SMART) played a role in supporting student learning, there are other unmeasured factors that may be more influential in driving performance than the components and features of SMART.

The conclusions drawn from the results suggested that:

Educators may enhance SMART integration in the curriculum through consistent implementation, activity alignment with objectives, regular feedback, and performance monitoring. Continuous evaluation and refinement of SMART usage will help optimize student learning outcomes effectively.

Educators may enhance curriculum engagement through interactive, gamified, and collaborative experiences, fostering motivation. Allowing student choice boosts ownership and involvement. Implementing regular feedback and recognizing progress can strengthen motivation. By refining SMART's strategies, educators can sustain students' interest and enthusiasm for learning mathematics effectively.

Conduct a thorough review of the tool's design. Gather feedback from students on usability, aesthetics, and navigation. Consider if the design is confusing, cluttered, or visually unappealing. Prioritize a clean, intuitive, and engaging user interface.

Longitudinal studies could be conducted to assess SMART's long-term effect, and its effectiveness should be investigated in various educational settings.

Increase sample size may provide more statistical power to detect significant relationships or effect between variables.

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