MATHEMATICS FOR SUSTAINABLE DEVELOPMENT: IMPROVING STUDENTS' LEARNING THROUGH RICH MATHEMATICAL TASKS STRATEGY

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Abstract: *Mathematics is needed to achieve sustainable development goal 4, which targets inclusive, equitable education cum lifelong learning. Nonetheless, the students' achievement in senior secondary mathematics is below average. Thus, this study examined the effects of the Rich Task strategy and numerical ability on senior secondary mathematics achievement. The sample comprised 203 pupils from two public senior secondary schools in Ijebu-Ode Local Government Area, Ogun State, selected on purpose. Three data collection instruments are the Mathematics Achievement Test (r = 0.84), the Numerical Ability Test (r = 0.79), and the Treatment Instructional Package. The data collected were analysed with descriptive and inferential statistics at 0.05 significance. The study discovered that the treatment significantly influenced students' academic achievement, with the Rich Task instructional strategy found to be more effective than the conventional method. The findings also showed that numerical ability significantly impacted academic achievement, with high-ability students outperforming low and medium-ability students. However, there was no significant interaction effect between instructional strategies and numerical ability on students' academic achievement. The study recommended that teachers employ Rich Task Strategy to meet their students' different learning requirements and skills, and the implications for achieving sustainable development Goal 4 were identified.*

Keywords: *rich task; students' achievement; mathematics; secondary school; numerical ability.*

Introduction

Mathematics is crucial to reaching global sustainable development goals. Sustainable development balances economic development, environmental conservation, and social progress. It provides the tools and procedures for effective decision-making and problem-solving in various domains. Specifically, Sustainable Development Goal (SDG) 4 sets to guarantee inclusive and equitable quality education and allows for lifelong learning.

Mathematics is a core subject in secondary education, and a solid foundation in mathematics is necessary to achieve SDG 4. It equips students with the required skills and information for success in higher education and the workforce. Science, technology, engineering, and mathematics (STEM), which are crucial for economic growth and innovation, also require mathematics. In addition, mathematics in schools contributes to developing fundamental life skills, such as rational, abstract, logical, critical thinking, problem-solving, and analysis. These abilities are essential for attaining SDG 4, as they enable individuals to adapt to changes in the workforce, contribute to innovation and creativity, and actively participate in civic life. Mathematical applications can also aid politicians, engineers, and scientists optimize resource allocation, minimize waste and environmental damage, and ensure development projects' efficiency, effectiveness, and equity.

Being a signatory to the United Nations' Sustainable Development Goals, Nigeria is dedicated to attaining sustainable development (UNSDGs). The nation has proved its dedication by developing laws and activities that employ mathematics to address critical development concerns. For example, the Nigerian government recognises the significance of mathematics education and has made it mandatory for primary and secondary school students. It has also made substantial investments to enhance the quality of mathematics instruction at all educational levels. In addition, there is a partnership with a body like the United Nations Educational, Scientific, and Cultural Organization (UNESCO) to produce mathematical education initiatives relevant to the yearnings of Nigerian students and instructors (UNESCO, 2020).

Mathematics is a compulsory subject in the country's senior secondary schools to prepare students to gain mathematical skills. The skills will enable them to learn and apply the subject's fundamentals to sustainable development. Yet, the mathematics achievement of senior secondary school students in Nigeria has been a concern for many years. According to studies, the mathematics performance of secondary school students in Nigeria is often poor (Adigwe & Chukwudi, 2021; Nwosu & Atuanya, 2018). At the 2019 West African Senior School Certificate Examinations (WASSCE), only 34.59 percent of students who sat for mathematics earned a credit pass (i.e., grades A1-C6), while 25.99 percent earned a pass (i.e., grades D7-E8) and 39.42 percent failed (West African Examinations Council, 2019).

Okoro (2017) discovered in Nigeria that in 2016, just 18.3% of students in senior secondary schools passed the WASSCE mathematics examination. Also, Adeoye and Adeoye (2016) found that only 26.6% of senior secondary school students in Oyo State had a solid grasp of mathematical concepts and principles. This observation was based on the students' performance in mathematics in the examination conducted by the West African Examinations Council (WAEC). In addition, it appears all regions of Nigeria have difficulty learning mathematics, as Adu and Owusu-Ansah (2016) discovered that Northern Nigerian pupils did less well in mathematics than their Southern counterparts.

The challenges with mathematics learning in Nigeria can have severe implications for sustainable development. For instance, without adequate mathematics skills, Nigeria's workforce may not have the technical skills to develop and maintain the infrastructure and industries necessary for sustainable development. Similarly, people may struggle to understand scientific concepts and research findings, which can impede progress in fields such as medicine, energy, and agriculture. A lack of mathematics skills can further limit Nigerian entrepreneurs from developing and implementing sustainable solutions to societal challenges.

To address the problems bedeviling the subject, the Nigerian government introduced several policies to improve mathematics instruction quality, including the Universal Basic Education (UBE) programme. Other efforts include revising the mathematics curriculum and providing training and professional development opportunities for mathematics teachers (Ajogwu, 2020). Despite these supports and interventions, students' mathematics learning difficulty remains unabated. To this end, innovative and student-centred teaching methods have been suggested to teach mathematics due to their effectiveness (Adeyemo & Adeyemi, 2019). Hence, this paper explored the effect of the Rich Mathematical Task strategy, shortened as Rich Task Strategy (RTS) in this study, on students' mathematics achievement in senior secondary schools.

A rich task instructional strategy provides students with complex and challenging mathematical problems that require them to engage in critical thinking, problem-solving, and communication skills (Freiman, Lai, & Huang., 2016). It is an active learning approach that encourages students to construct their understanding of mathematical concepts and apply them to real-world situations. Rich task strategy typically involves open-ended problems with multiple solutions and requires students to use various mathematical skills and strategies (Kaur, 2015). Students are encouraged to work collaboratively, share their thinking, and make connections between different mathematical concepts. The strategy aims to develop students' mathematical thinking, problem-solving abilities, and confidence in their mathematical abilities (Boaler, 2016). It also allows the students to make sense of problems and work productively collaboratively to persevere in solving them (Melucci, 2021).

This study on using Rich Task Strategy to teach mathematics hinges on constructivism learning theory. Constructivism suggests that learners actively construct their own understanding of concepts and ideas through their experiences and interactions with the environment. In mathematics teaching, rich tasks provide students with opportunities to engage in problem-solving, reasoning, and communication. Students can construct their comprehension of mathematical ideas and develop problem-solving skills through these tasks. In this technique, the teacher's job is to help the learning process by guiding students through their discoveries and providing feedback and support. Thus, the theory emphasizes the importance of learners actively constructing their understanding of mathematical concepts through meaningful experiences and interactions.

Fitriati, Elizar, and Marlaini (2022) constructed problem-based rich mathematical tasks. They also investigated the treatment's impact on enhancing students' higher-order thinking abilities. The finding disclosed that students exposed to the method significantly improved their learning. Similarly, Warren (2019) examined the connection between mathematical tasks and student achievement. The correlational investigation revealed a significant association between rich mathematical activities and student achievement. This result suggests that the rich task strategy considerably enhanced students' learning. Tashtoush, Wardat, Aloufi and Taani (2022) also studied the effects of a concept-rich instructional strategy on students' algebra course performance and attitudes toward mathematics. The results showed that students taught with the rich task strategy performed better than those who learned mathematics with the conventional teaching technique. The study proposed a concept-rich instructional technique for teaching and learning algebra and improving attitudes.

Wujek (2020) investigated whether sixth-grade children in Baltimore County Public Schools who participated in daily instruction that included mathematically-rich tasks performed better on a standard-based examination (BCPS). The study adopted, for data comparison, pre-and post-test research design. The finding exposed that student demonstrated considerable improvement in unit assessments after exposure to rich mathematical tasks but not in the Measure of Academic Progress (MAP) examination. Wujek advised that additional research be conducted to establish if learners' engagement in daily mathematically-rich work improves their mathematics achievement. The findings regarding the favorable impact of rich task strategy are consistent with those of Lei and Hu (2021), who discovered that rich-numeracy tasks helped students' numeracy development and promoted students' social and linguistic growth.

Bobboyi and Yara (2019) also investigated the rich mathematical task approach's impact on the achievement of students in mathematics in senior secondary school in Bauchi State, Nigeria. The study, which utilized a quasi-experimental approach with 84 students from two schools, revealed that using rich mathematical strategy significantly enhanced students' mathematics achievement. Similarly, Dambazau, Aliye and Abubakar (2021) determined the effectiveness of a rich task strategy on the achievement of students in senior secondary schools' mathematics in Kano State, Nigeria. The research design employed was a quasi-experimental pretest-posttest with 160 students from four secondary schools. The results indicated a significant difference between the mean achievement scores of students in the experimental and control groups, demonstrating that employing a rich-task method enhanced students' mathematical achievement.

This study examined the effects of the Rich Task Strategy (RTS) on mathematics learning in the Ijebu Ode Local Government Area, Ogun State, Nigeria, where literature showed it had not been used, despite its reported effectiveness. Hence, more research is required to examine the long-term viability of the RTS's benefits. This effort is required for sustainable development since it is crucial to comprehend the long-term effects of this instructional technique on students' learning outcomes. Thus, it is important to continue investigating the effectiveness of rich task strategy to identify how best to modify this method to match the demands of various students and learning contexts in the face of persistent mathematics learning difficulty.

When investigating the effectiveness of rich task strategy on the achievement of students in mathematics in senior secondary schools, it may be essential to consider the role of numerical ability as a potential moderating variable. Numerical ability, which refers to an individual's proficiency in understanding and using numbers, may moderate the effect of rich task strategy on students' mathematics achievement. Studies have shown that high numerical ability students may be better equipped to engage with and benefit from rich tasks as they have a stronger foundation in numerical concepts and may be more comfortable with complex problem-solving (Kesici & Uysal, 2019). On the other hand, students with low numerical ability may struggle with rich tasks and may require additional support or scaffolding to understand and apply the concepts presented (Mamolo et al., 2019). Hence, this study used numerical ability as a moderating variable to provide valuable insights into the effectiveness of rich task strategy for different subgroups of students and help to identify ways to optimize its use in mathematics instruction.

Objectives

The study's primary purpose was to investigate the effect of treatment (Rich Task Strategy and conventional approach) on students' mathematics achievement in senior secondary schools. Particularly, the following were investigated:

i. The effect of the Rich Task Strategy and the conventional teaching method on senior secondary students' mathematics achievement;

ii. The effect of students' numerical ability on mathematics achievement in senior secondary schools; and

iii. What numerical ability moderates' students' mathematics achievement at the two levels of the treatment (Rich Task Strategy and the conventional method).

Research question

For this study, one research question was posed:

i. What is the numerical ability distribution of the participants?

Hypotheses

Three null hypotheses were generated and tested to achieve these objectives at a significance level of 0.05. They are:

$H_0$1: The treatment (Rich Task Strategy and the traditional technique) has no significant main effect on the mathematics achievement of senior secondary school students.

$H_0$2: Numerical ability has no significant main effect on students' mathematics achievement in senior secondary schools.

$H_0$3: Treatment and numerical ability have no significant interaction effect on students' achievement in senior secondary school mathematics.

Methods

Research Design

This study adopted a quasi-experimental design with a pretest-posttest control group and a 2x3 factorial. Two groups were purposefully selected and randomly allocated as experimental and control. The groups were crossed with numerical ability to examine their moderating effect on senior secondary mathematics achievement. There were three levels of numerical ability: low, medium, and high.

The design layout is as depicted below:

O_1	X_1	O_2	Experimental Group
O_1	X_c	O_2	Control Group

O_1 is the pretest score; O_2 is the post-test score; X_1 is the Rich Task Strategy, and X_c is the conventional method.

Target Population

The public schools' senior secondary two (SS 2) students in Ijebu-Ode Local Government Area were the target group for this study. The SS 2 class was targeted since they were familiar with senior-level math's concepts despite having no external examination pressure.

Sample and Sampling Techniques

The participants were 203 SS 2 students in the two purposively selected schools. The schools were purposively selected because they had qualified teachers with B.Sc. (Ed.) in Mathematics; the schools were located in the same city and had similar characteristics, such as the number of students, teachers, and resources available for teaching mathematics. However, the schools were distant from each other to prevent experimental contamination. The study employed complete (intact) classes of students from the selected schools. An arm of a class in the school with multiple arms of a class was selected using simple random selection. Thus, there were 97 students in the experimental group and 106 students in the control group.

Instrumentation

Data was collected using the Mathematics Achievement Test, Numerical Ability Test, and Teacher Instructional Guides. The Mathematics Achievement Test (MAT) was a 30-item multiple designed by the researcher to test students' knowledge of mensuration. Menstruation is one of the problematic mathematics concepts reported by the WAEC Chief Examiners Report (2019). The instrument's validity was tested through the critiques of two university experts in Mathematics Education and two secondary school mathematics teachers. The critiques of these experts were used for adjusting the instrument. Later, copies were administered to twenty-five students from a non-participating school with similar characteristics to participating schools twice within a week. The test-retest statistics yielded a reliability coefficient of 0.84.

The Numerical Ability Test (NAT) comprised 20 multiple-choice questions with four options (A, B, C, D). The face and content validities were ascertained by subjecting to the critiques of 2 experts in test construction and an expert in mathematics education. The experts' suggestions were used to modify the instrument. After that, it was administered to 30 students from a non-participating school. The reliability index of 0.79 was obtained using K-R 21 formula.

The Treatment Instructional Package (TIP) was the model lesson plan for the experimental group. It was validated by subjecting it to the comments of 2 experts in mathematics education and one secondary school mathematics teacher. Their comments were used to modify the lesson plan before trial testing it to teach SS2 students in a public senior secondary school in another Local Government Area. Observations from the trial testing were further corrected before the real experimentation with the lesson plan. The mathematics teacher in the control group was allowed to use the usual lesson plan procedure (Conventional method).

Procedure for Data Collection

During the data collection phase, ethical considerations were taken into account to ensure the well-being and rights of the participants. The following procedures were followed:
The researcher visited the selected schools' authorities and sought permission to undertake the study. After due permission, the mathematics teachers were briefed about the study's purpose and obtained informed consent from the participants. The purpose and nature of the study were explained to them, and they were allowed to ask any questions or express any concerns they may have had. In addition, the participants were informed that their participation was optional and that they could withdraw from the study at any moment without consequence. They were assured that their involvement, or lack thereof, would not affect their grades or status in the class. The teacher, who served as the assistant, was also trained on how to implement the rich task instructional strategy. After that, the experimental and control groups were given MAT and NAT as a pretest to determine their maths skills and knowledge of mensuration concepts. The instruments were created to be age-appropriate and free of cultural and gender bias. The experimental group was then exposed to the following rich task strategy:

The researcher designed engaging and rich tasks to teach the students concepts in mensuration. The tasks were designed to cultivate critical thinking and problem-solving skills. The instructor then introduced the assignment to the students and clarified its objective. In addition, they were provided with essential information and resources on the whiteboard. The students were then instructed to work on the assignment in a group of four, sharing ideas and knowledge. The instructor promoted collaboration by offering direction and feedback. The teacher and assistant watched the students' progress throughout the activities and provided feedback and assistance as needed. In addition, they evaluated the students' comprehension of the mathematical ideas and skills necessary to complete the activity. After completing the exercise, students were encouraged to reflect on their learning experiences to promote reflection. They were requested to discuss their plans, solutions, and problems. The teachers also facilitated a class discussion to promote further reflection. Ultimately, the teacher used the rich task to generalize mathematical concepts and skills. The teacher helped the students to connect the mathematical concepts they used to solve the task to the broader curriculum. The teacher then assigned pupils specific assignments to assess their comprehension of the mensuration principles, and corrective measures were administered to those who required them. The instructor also assigned follow-up work in the form of homework. The control group got typical mathematics education that was age-appropriate and devoid of cultural and gender prejudice.

During the intervention, data were collected to track the participants' development and measure changes in their mathematics achievement. Participants were given explicit instructions on completing the tasks and were permitted to ask questions or seek clarification. The researcher and mathematics instructors from the chosen school, trained as research assistants, collected the data, but the researcher did grading to prevent bias.

After six weeks of intervention, reshuffled versions of the MAT and NAT were administered to experimental and control group students as post-tests to examine changes in their performance on the taught mensuration topics. The examination was also created to be age-appropriate and free of cultural and gender bias. Throughout the data collection phase, participants' privacy and confidentiality were likewise respected, and their personal information was kept private.

The collected data were analyzed using descriptive mean and standard deviation statistics and inferential statistics of Analysis of Covariance

(ANCOVA) with version 23 of Statistical Package for the Social Sciences (SPSS).

Results

The results are based on the research question and the formulated hypotheses. The anonymity of the participants was maintained during the presentations.

Research question: What is the distribution of the participants by numerical ability?

Table 1. Descriptive statistics of participants' distribution by numerical ability

Numerical Ability	Number of Participants	Mean	Standard Deviation
Low	64	19.925	0.544
Medium	79	21.677	0.481
High	60	21.835	0.553

Table 1 displayed that the majority of participating students (79) have a medium numerical ability, followed by those with a low numerical ability (64) and those with a high numerical ability (60). It also indicates that students with high numerical ability have the highest mean achievement (21.835) and standard deviation value (0.553), followed by those with a medium numerical ability (21.677) and low numerical ability (19.925) and standard deviation values (0.481) and 0.544).

Test of Hypotheses

$H_0$1: The treatment (Rich Task Strategy and the traditional technique) has no significant main effect on the mathematics achievement of senior high school students.

Table 2. Summary of Analysis of covariance of students' achievement in Mathematics according to treatment **and numerical ability**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3093.489a	6	515.582	28.256	0.000	0.464
Intercept	4976.787	1	4976.787	272.751	0.000	0.582

Pretest	13.886	1	13.886	0.761	0.384	0.004
Treatment	2687.978	1	2687.978	147.314	0.000	0.429
Numerical ability	142.098	2	71.049	3.894	0.022	0.038
treatment * numerical ability	11.872	2	5.936	0.325	0.723	0.003
Error	3576.333	196	18.247			
Total	96445.000	203				
Corrected Total	6669.823	202				

a. R Squared = 0.464 (Adjusted R Squared = 0.447)

Table 2 reveals a significant main effect of strategy treatment (Rich Task Strategy and Conventional method) on senior secondary students' mathematical achievement ($F_{(1,196)} = 147.314$, $p < 0.05$). This result depicted that the post-test means achievement scores of students taught with the rich task strategy and the conventional method are significantly different. Hence, the hypothesis that treatment (Rich Task Strategy and the conventional approach) has no significant main effect on the students' mathematics achievement in senior secondary schools is rejected.

In the meantime, Table 3 divulged the results of the Multiple Classification Analysis (MCA) conducted to determine the magnitude and the direction of the effect of the strategy (RTS and conventional method) on mathematics academic achievement.

Table 3. Multiple classification analysis of students' achievement in mathematics by strategy and numerical ability

Grand Mean = 21.03								
			Predicted Mean		**Deviation**			**Beta**
		N	**Unadjusted**	**Adjusted for factors**	**Unadjusted**	**Adjusted for factors**	**Eta**	**Adjusted for factors**
Treatment	RTS	97	25.00	24.92	3.970	3.887	0.663	0.649

	Conventional	106	17.40	17.47	-3.633	-3.557		
Numerical ability	Low	64	19.27	19.80	-1.764	-1.231	0.209	0.146
	Medium	79	21.82	21.52	0.793	0.487		
	High	60	21.87	21.70	0.837	0.672		

Table 3 demonstrates that students taught with the Rich Task Method had an average post-test achievement score of 24.92, compared to 17.47 for those subjected to the conventional teaching style. According to the results, this mean difference of 7.45 is statistically significant. Table 3 further reveals that the strategy accounted for 64.9% of the variations in mathematics achievement among senior high school pupils.

$H_0$2: Numerical ability has no significant main effect on students' mathematics achievement in senior secondary school.

Table 2 demonstrates a statistically significant relationship between numerical ability and students' academic achievement in senior secondary mathematics ($F_{(2,196)} = 3.894$, $p<0.05$). This result indicates that students with low, medium and high numerical ability mean academic achievement scores differ significantly. Consequently, the hypothesis that Numerical ability has no significant main effect on students' mathematics achievement in senior secondary school is refuted.

Table 3 displays the results of the MCA to establish the magnitude and direction of the impact of numerical ability on student achievement. Students with high numerical ability had the highest mean achievement score (21.70), followed by students with a medium numerical ability (21.52) and students with a low numerical ability (19.80). The table also demonstrates that numerical ability accounted for 14.6% of the variances in students' academic achievement in mathematics in senior secondary school.

Table 4 depicts the paired comparison of numerical ability results.

Table 4. Pairwise comparisons of mean differences in mathematics achievement by numerical ability

(I) numerical ability	(J) numerical ability	Mean Difference (I-J)	Std. Error	Sig.
Low	Medium	-1.752*	0.726	0.017
	High	-1.910*	0.776	0.015
Medium	Low	1.752*	0.726	0.017
	High	-.158	0.733	0.830
High	Low	1.910*	0.776	0.015
	Medium	.158	0.733	0.830

Table 4 reveals that the mean achievement score of students with low numerical ability (19.80), as displayed in Table 3, is significantly lower than that of students with medium numerical ability (21.52). Likewise, it is significantly lower than the mean achievement score of students with high numerical ability (21.70). However, the mean achievement score of students with medium numerical ability (21.52) is not statistically distinguishable from that of students with high numerical ability (21.70). This result indicates that the mean mathematics accomplishment scores of students with medium and high numerical ability are nearly identical.

$H_0$3: Treatment and numerical ability have no significant interaction effect on students' achievement in senior secondary school mathematics.

Table 2 demonstrates that there is no significant interaction effect of treatment and numerical ability on the academic achievement of students in senior secondary mathematics ($F_{(2,196)} = 0.325$, $p > 0.05$). This result indicates no significant difference between the mean mathematical achievement scores of students with low, medium, and high numerical ability across the two levels of the instructional strategy, i.e., Rich Task and Conventional technique. So, the hypothesis that treatment and numerical ability have no significant interaction effect on students' achievement in senior secondary school mathematics is retained.

Discussion

Mathematics is vital for attaining the sustainable development agenda in Nigeria and worldwide. But students' annual achievement in the subject is below expectation, suggesting a solution is required. Hence, this study investigated the Rich Task Strategy's effect on students' mathematics achievement. It also considered the moderating effect of numerical ability.

In terms of the numerical ability of the participant, the study found that most participating students have a medium numerical ability, followed by students with a low numerical ability and then those with a high numerical ability. This finding aligns with a study by Fan, Xu, Cai, He, J., and Fan (2016) that found the majority of students in China have a moderate level of numerical ability, followed by those with a low level of ability and then those with a high level of ability. It also concurs with that of Vermeer and Veldhuis (2014), which found that the distribution of mathematical ability was skewed towards the middle, with most students falling into the average or moderately able category. One possible explanation is that most students in the population may have had a medium level of numerical ability, with fewer students having either high or low numerical ability. This could have influenced the distribution of numerical ability observed in the study sample.

The study guessed that the treatment (Rich Task Strategy and conventional method) had no significant effect on the mathematics achievement of senior secondary school students. The finding indicated, however, that the treatment significantly impacted senior mathematics achievement. Multiple classification analyses revealed that the experimental group exposed to the RTS had higher mean achievement scores than the control group, which got the conventional technique. These findings are congruent with Bobboyi and Yara (2019) and Dambazau et al. (2021), who also discovered that the RTS enhanced students' mathematical achievement relative to the conventional method.

The Rich Task Strategy is grounded in the constructivist learning theory, which posits that knowledge is constructed through the active involvement of learners in the learning process. The RTS approach provides students with real-world problems requiring critical thinking and problem-solving skills. Students are encouraged to work collaboratively and actively learn, constructing their knowledge through exploration, experimentation, and reflection. The significant effect of the RTS on students' achievement in mathematics can be attributed to the fact that it aligns with the constructivism learning theory. The approach enables students to construct their knowledge of mathematics through active involvement, reflection, and engagement with real-world problems.

In addition, the RTS approach promotes students' acquisition of key problem-solving and critical thinking abilities for mathematics achievement. Since RTS is successful for mathematics instruction and learning, it can aid in reaching the mathematics-based sustainable development aim. The strategy supports the development of important skills for sustainable growth, including collaboration, critical thinking, and problem-solving.

The study also surmised that numerical ability has no significant effect on students' achievement in mathematics at the senior secondary level. Yet, the data demonstrated a significant effect of numerical ability on students' mathematics achievement. Students with low, medium and high numerical ability had significantly varied mean achievement scores. The multiple classification analysis revealed that students with high numerical ability had the highest mean achievement score, followed by those with medium and low numerical ability. A pairwise comparison of the mean scores revealed a significant difference between the mean scores of low and medium; low and high numerical ability students. Still, no significant difference existed between the mean achievement scores of medium and high-numerical-ability students. This finding is consistent with Kesici and Uysal's (2019) assertion that students with high numerical ability may be better ready to interact with and profit from rich assignments due to their stronger foundation in numerical ideas and comfort with sophisticated problem-solving. Furthermore, it is consistent with Mamolo et al. (2019) that students with low numerical ability may struggle with complex activities and require additional guidance or scaffolding to comprehend and apply the offered concepts.

Furthermore, these findings are consistent with the constructivism learning theory, which emphasizes that students construct knowledge actively through exploration, experimentation, and reflection. Students with high numerical ability may be better equipped to engage with and benefit from rich tasks, as they have a stronger foundation in numerical concepts and may be more comfortable with complex problem-solving. In contrast, students with low numerical ability may struggle with rich tasks and require additional support or scaffolding to understand and apply the presented concepts. These findings align with the sustainable development goal of promoting quality education, as they suggest that a more inclusive approach to teaching mathematics is necessary.

The findings support the hypothesis that treatment (Rich Task Strategy and conventional method) and numerical ability have no significant interaction effect on students' achievement in senior secondary mathematics. This outcome suggests that the mean achievement scores of students with low, medium, and high numerical ability do not differ significantly between the two levels of the strategy. This result indicates that the instructional technique implemented (Rich Task and Conventional Method) had no significant effect on the academic achievement of students with varying degrees of numerical competence. This finding is inconsistent with Kim and Kim's (2017) report that rich task training had a significant effect on students' mathematical achievement, but only for students with high ability. The outcome may be because the rich task technique and the conventional method were implemented equally successfully, resulting in comparable academic outcomes for all students regardless of numerical capacity. However, the fact that the Rich Task strategy had no significant impact on the academic achievement of students with varying degrees of arithmetic competence implies that constructivist approaches may have limitations in certain settings.

On the basis of the study's findings, it can be inferred that the rich task approach had a greater effect on the mathematics achievement of senior secondary students than the conventional teaching method. In addition, it was determined that numerical ability is influential in mathematics learning in senior secondary schools. This study shows, however, that there is no significant interaction effect between strategy and numerical ability, showing that the choice of method has little bearing on students' academic achievement based on numerical ability. Further, this study established that using the rich task strategy that aligns with constructivist learning theory can provide a valuable approach to promoting deep understanding and higher-order thinking skills in mathematics education, particularly for students with high numerical ability. In terms of sustainable development, the findings suggest that well-implemented instructional strategies that cater to students' diverse learning needs and abilities can contribute to developing a more equitable and sustainable society. By promoting more profound understanding and critical thinking skills, students can develop the knowledge and skills to address complex challenges facing their communities and the world.

Consequently, this study recommends using the rich task strategy in senior secondary school mathematics education because it caters to the students' diverse learning needs and abilities and helps promote more profound understanding and critical thinking skills. Teachers need to deeply understand constructivist learning theory and how it can be applied in mathematics education to implement rich task strategies and conventional methods effectively. Therefore, it is recommended that policymakers and education stakeholders provide ongoing professional development opportunities for teachers to enhance their knowledge and skills in this area.

This study recommends further research to explore the conditions under which different instructional strategies are most effective in promoting academic performance and sustainable development. Therefore, it is recommended that policymakers and education stakeholders prioritize research and reflection on instructional practices in mathematics education to ensure that practical approaches are being used to promote the achievement of SDG 4.

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