Assessment of the Impact of Activity-Based Learning on Mathematics Academic Performance among Primary School Learners in Lagos State

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Abstract

The traditional teaching methods employed in primary school Mathematics often overlook the importance of fostering creative thinking, resulting in poor academic performance. This study investigated the impact of Activity-Based Learning (ABL) on Mathematics performance among primary school learners in Eti-Osa Local Government Area of Lagos State, Nigeria. A descriptive survey research design was employed, involving 50 students divided into three groups: traditional method (control), ABL (experimental), and combined method (integrating ABL and traditional methods). Data collection was done using an achievement test administered to students and a questionnaire administered to 50 primary school teachers. Data collected were analyzed using means with percentages, t-tests, and analysis of variance (ANOVA). The results revealed a significant difference in Mathematics performance between the ABL group and the traditional method group, with the ABL group demonstrating improved performance (t-test). However, ANOVA results showed no significant difference between the control group, ABL group, and the combined method group. The study concludes that integrating ABL with traditional methods can positively influence primary school learners' mathematics performance. Recommendations include incorporating ABL into Mathematics instruction, providing resources and training for teachers, and conducting further research to explore long-term effects and scalability.

Keywords: Learning, Teaching, Activity-based, Traditional Method, Assessment, Mathematics, Primary, Learners.

1. Introduction

Mathematics is crucial at the primary school level as it lays the groundwork for students' future education and their ability to engage meaningfully in society. Celik (2018) highlights that the significance of mathematics has led to its mandatory inclusion in school curricula, ensuring that every child develops essential mathematical skills to handle life challenges. Thus, mathematics should be a core subject for primary and secondary school students to build a strong foundation for scientific and reflective thinking and to prepare them for advanced studies. Unfortunately, this ideal is often undermined by the continued use of outdated traditional teaching methods. These conventional methods, which place full control in the hands of teachers, often result in passive students who lack creativity. Azuka (2015) corroborates this by observing that many teachers in Nigerian schools still use the traditional lecture method, where teachers lead the class and students primarily listen and take notes. This issue is especially pronounced at the primary level, where teachers, often untrained in specialised subjects, teach a broad range of topics. This situation tends to make mathematics appear abstract and contributes to lower student performance.

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Nwoke (2021) indicates that mathematics is deeply linked to problem-solving, with students' success in the subject largely dependent on their problem-solving abilities. Thus, teaching mathematics should emphasise the development of students' creative skills. Every math lesson should strive to promote a mindset geared towards creative problem-solving through practical or activity-based learning. The National Council of Teachers of Mathematics (NCTM, 2015) underscores the importance of offering students challenging problems that spark diverse and robust mathematical thinking and creativity. Similarly, the National Curriculum Framework (NCF, 2015) notes that creativity in arts, literature, and other areas is interconnected and education should provide opportunities to enhance children's creative expression. Creativity involves generating imaginative ideas that lead to innovations and solutions for problem-solving. Nwoke (2021) highlights that creativity includes the ability to generate entirely new ideas or solutions through rearranging existing knowledge. Shah (2015) expands on this, stating that creativity in mathematics involves not only producing original work but also discovering previously unknown concepts or solutions. He describes creativity in mathematics as encompassing fluency, flexibility, and originality - qualities essential for higher-order reasoning and innovative problem-solving. Mathematical creativity involves coming up with new ideas and finding different ways to solve math problems. According to Noreen (2019), being mathematically creative means analyzing problems from various angles, spotting patterns, and generating multiple ideas to decide on the best approach for unfamiliar math situations. To nurture this creativity in students, they should engage in learning experiences that present them with new and challenging math problems. At a professional level, Shah (2015) defines mathematical creativity as producing original work that adds to existing knowledge or opens up new questions for others to explore. In schools, it involves finding novel and insightful solutions to problems and looking at old problems in new ways. Developing mathematical creativity depends largely on how teachers conduct their classes. Teachers who encourage students to think creatively and flexibly about math concepts help create environments where students can share their insights and ideas. Rather than giving away solutions, these teachers provide hints that guide students toward solving problems independently and reflecting on their approaches.

Nwoke (2021) suggests that learning environments that promote various problem-solving strategies and allow students to formulate their problems lead to deeper mathematical exploration and increased motivation. Such environments encourage students to investigate, generalise, find patterns, communicate ideas, and consider different problem-solving methods. Activity-based learning is one effective approach to fostering creativity, especially in primary school. This method emphasises hands-on experiences and experiments where students actively participate in their learning process (Celik, 2018). In active learning, teachers facilitate discussions and practical activities, while students engage deeply with the subject matter and take responsibility for their learning. Malhotra et al. (2015) highlight that activity-based learning supports self-exploration among students, regardless of their socioeconomic background, by providing equal opportunities for participation. This approach moves away from memorization and encourages students to think critically about observed events, question outcomes, and understand cause-and-effect relationships. Cooperative learning environments also play a crucial role in nurturing mathematical creativity. Ayhan (2015) suggests that problem-posing and solving activities, combined with constructive feedback within cooperative settings, help students develop their creative thinking skills in mathematics.

Activity-based education refers to a learning approach where students actively explore subjects both physically and mentally. This involves simulating work environments, using tools and materials relevant to real-world tasks, and performing actual work activities. Such methods aim to enhance students' knowledge, attitudes, and skills (Ravı & Xaviera, 2017). Students learn through personal actions and experiences, developing their ideas about the world and evaluating things based on their thoughts and experiences. Activity-based teaching aids in constructing their knowledge (Shah & Rahat, 2015). Interactivity among students is crucial for successful learning; interactive resources and environments are beneficial as they can be accessed and revisited multiple

times, forming the foundation of activity-based learning (Ravı & Xaviera, 2017). Activity-based learning is an essential method that encourages students to think creatively about their problems, facilitates finding practical solutions, and promotes self-esteem during their developmental years (Öcal, 2015). This approach aligns with primary and secondary school mathematics curricula by simulating real-life problem situations (Camci, 2015). The interdisciplinary nature of activity-based learning was first applied by Diane Bricker and colleagues at Oregon University. Since 2005, it has been integrated into classroom and extracurricular activities within educational curricula (Öcal, 2015).

Additionally, activity-based learning encompasses various pedagogical approaches emphasizing hands-on, minds-on, or hearts-on experiments and activities. Its foundation is based on the idea that children learn through active engagement instead of merely receiving content. Proponents of this method include constructivist psychologists such as Dewey, Piaget, and Vygotsky, who emphasize the significance of active learning. By creating optimal learning environments that encourage exploration, activity-based learning can make learning joyful and enduring, challenging the traditional teacher-centred approach by placing students at the core of the learning process (Golji & Dangpe, 2016). Designing activity-based learning effectively hinges on a comprehensive understanding of the concept of activity, as it enhances the efficiency of this educational method (Günay, 2015). Activities in learning serve as diverse tools that individuals in learning environments use to materialize abstract concepts and facilitate effective teaching. Various types of activities such as research-based activities, practical investigations, problem-solving activities, and project work contribute significantly to teaching and learning processes, particularly in building students' understanding of mathematical concepts and procedures.

Activity-based learning allows students to explore themselves. It gives them a range of experiences, ensuring everyone can participate equally in discussions, regardless of their socio-economic background. Instead of just memorizing answers, it makes students think deeply about what they observe and encourages them to question events and data. This approach fosters critical thinking and reduces reliance on authority figures (Malhotra et al., 2015). Using activities in education puts students at the center, offering richer learning opportunities and making subjects like mathematics more enjoyable. It also encourages note-taking and discussions about math, which boosts student engagement. When students find the content and teaching methods enjoyable, they participate actively and learn better. Therefore, integrating teaching activities in classrooms is crucial for effective learning. These activities can help make learning stick, improve attitudes toward subjects, and stimulate interest (Camci, 2015).

Research shows that activity-based learning enhances academic achievement and changes attitudes toward subjects like mathematics. For example, Ayhan (2015) found that 8th-grade students improved their ability to understand relationships between models or data through activities. Other studies have shown that this approach increases success compared to traditional teaching methods and improves students' interpretation skills while reducing negative attitudes toward math (Camci, 2015). Ayhan (2015) demonstrated in their study on probability that activity-based learning positively impacts students' understanding of concepts. This method not only makes learning enjoyable but also meaningful. Similarly, Günay (2015) discovered that integrating text and images in activities led to better learning outcomes in secondary school mathematics compared to activities that used text or images alone. The way mathematics is taught in primary schools today often overlooks the importance of fostering creative thinking among students. This neglect affects their ability to solve problems effectively, leading to poorer academic performance in the subject. Math education must encourage students to develop creative skills alongside understanding the subject. This method supports students in actively constructing, adapting, and solving math challenges within the classroom. Instead of relying exclusively on memorisation, which can lead to passive learning, teachers should implement techniques that foster engaging learning environments. Vansdadiya et al. (2023) suggested that such environments, where students tackle challenges using various

methods, create their questions, and explore concepts, significantly boost motivation. This approach prompts students to investigate, make choices, recognise patterns, generalise, communicate, discuss ideas, and explore alternatives. This study examines how an activity-based learning method can boost mathematical creativity in elementary students, thereby improving their overall academic performance in mathematics.

2. Literature review

Scholars advocate for Activity-Based Learning (ABL) techniques due to their lasting positive impact on student engagement and learning outcomes. Studies, such as those by Shaheen and Kayani (2017), demonstrate significant differences between activity-based learning and traditional lecture methods, suggesting superior learning experiences with active engagement (Singh, 2015). In activity-based teaching, learners are actively involved in discovering, processing, and applying information, moving away from the passive reception of lectures (Bonwell & Eison, 2015). This method encourages meaningful conversations and requires students to listen, write, read, and reflect on academic topics. Teachers are facilitative, guiding students through learning (Singh, 2015).

Activity-based teaching is recognized as a cornerstone in modern education, emphasizing experiential learning through active participation. This approach enables students to engage their senses, fostering personal growth and deeper understanding through direct experience and reflection (Bonwell & Eison, 2015). Research by Rillero underscores the effectiveness of hands-on learning, such as teaching children to swim by immersing them in water, highlighting the method's practical application (Bonwell & Eison, 2015).

2.1 Background of Activity-Based Teaching

Horsburgh's innovative approach marked a significant development in educational practices, emphasizing hands-on learning and practical skills. Dewey's influence and later theorists like Kolb continued to shape the evolution of activity-based teaching, particularly in primary education settings (Rama, 2018).

Activity-based teaching traces its roots back to the late 19th century when John Dewey introduced the concept of learning by doing during a parents' parent-teacher meeting at his laboratory school in Chicago in 1897 (Rama, 2018). Despite Dewey's early advocacy, this approach did not gain widespread popularity until much later. It was not until the mid-20th century that David Horsburgh became a pioneer in implementing activity-based teaching. In 1944, Horsburgh established Neel Bagh School in Kolar, India, which featured a diverse curriculum, including music, sewing, gardening, carpentry, pottery, and more, all meticulously planned through sketches and drawings (Rama, 2018).

2.2. Comparing Activity-Based Teaching and traditional methods of teaching Mathematics at the primary level

2.2.1. Activity-Based Method

Education aims at holistic child development, necessitating the organisation of diverse activities to nurture various facets of learners' personalities. Activity-based instruction acts as a dynamic problem-solving tool, fostering innovative thinking and providing a real-world context for learning. Offering diverse experiences encourages the acquisition of information, skills, and qualities while building students' self-confidence and fostering a deeper understanding through practical application.

Central to activity-based learning is its focus on the learner. Rather than passively receiving information from teachers, students are actively engaged, allowing them to learn according to their abilities and interests. Johnson, Johnson & Smith (2018) argue that this approach contrasts with traditional methods that often leave learners inactive, emphasizing instead the dynamic connection between learners and resources.

Research supports the efficacy of activity-based learning across various subjects. For instance, Hussain et al. (2015) highlight its effectiveness in teaching science, particularly physics, where students engage in hands-on experiences that bridge abstract theories with concrete observations. Similarly, Çelik (2018) and Shah and Rahat (2015) underscore how activity-based learning methods improve academic achievements and attitudes toward learning, especially in elementary science education.

Activity-Based Teaching/Learning emphasizes learning through active engagement rather than passive reception of information. It has been demonstrated that when learners actively participate in hands-on activities, their senses are more engaged, leading to enhanced learning and retention. This approach not only fosters activeness and intelligence among learners but also contributes to their overall personal development.

In mathematics, activity-based instruction involves learners in reading, discussions, practical activities, problem-solving, and higher-order thinking tasks like analysis, synthesis, and evaluation (Festus, 2015). Such innovative approaches not only enhance mathematical learning experiences but also promote deep understanding and application of mathematical concepts in real-life situations (Riley et al., 2017).

Prince (2015) defines activity-based learning as an educational approach where learners are deeply involved in the learning process. This method emphasises practical activities that enable students to transform information into personal knowledge applicable in various contexts (Edward, 2015). Kenley (2017) emphasises that activity-based learning differs significantly from traditional teaching methods by encouraging learners to actively participate in activities that foster critical thinking and data exchange.

Churchill (2015) underscores that activity-based learning facilitates the creation of intellectual models, promoting higher-order cognitive skills such as applied critical thinking. Hake (2018) highlights the effectiveness of intuitive activities in inspiring learners and facilitating the understanding of complex concepts through hands-on engagement.
Moreover, Hug et al. (2015) assert that face-to-face interaction in activity-based learning enhances learners' motivation and engagement. They suggest that practical, hands-on activities in a laboratory setting provide an ideal environment for learning through active experimentation and application of knowledge. Activity-based learning methods emphasise learner engagement, active participation, and practical application of knowledge, fostering deeper understanding and skill development across various educational contexts.

2.2.2. The Traditional Method

In traditional classrooms, students are often engaged in repetitive learning tasks, and forced to repeat information delivered by the teacher. This method sometimes leads to issues such as corporal punishment, animosity towards teachers, and a perception of the teacher as a frightening authority figure, particularly in authoritarian environments (Haghighi, 2015). During prolonged traditional teaching sessions, students' interests and engagement may not be adequately addressed.

Reformers argue that traditional teaching methods often rely on repetitive learning and recitation, where students passively absorb information without fully engaging with it or understanding its relevance (Haghighi et al, 2015). Students are typically engaged in note-taking or responding to teacher inquiries, limiting opportunities for active participation or discussion. This approach tends to make the learning process monotonous and dry, offering little room for creativity or exploration by both teachers and learners.

One significant drawback of the traditional method is its inflexibility in accommodating different learning styles or addressing the needs of students with learning difficulties. The rigid structure and reliance on lecture-based teaching may not effectively cater to diverse educational needs, hindering the ability of some students to grasp and retain information effectively (Haghighi et al, 2015).

The traditional method of teaching places the instructor at the centre of the classroom, assuming responsibility for all activities and ensuring that all information flows through them using a deductive approach. This approach is primarily content-focused, where the teacher is more dominant, subjective, and less emotionally engaging (Singh, 2015). Traditional techniques emphasize rote memorization of factual information and often neglect higher levels of cognitive outcomes (Rao, 2015). Critics argue that traditional teaching methods contradict the natural functioning of the human mind (Weber, 2016).

The traditional approach is teacher-centred, focusing heavily on textbook-based instruction akin to the grammar-translation method, emphasizing recitation and memorization of facts, rules, and formulas (Weber, 2016). This method does not encourage critical thinking or active participation from students; instead, it primarily involves the teacher delivering lectures or explanations using a blackboard. While the traditional teaching method has its merits, particularly in conveying foundational knowledge, its limitations in promoting active learning, critical thinking, and student engagement have led educators and researchers to advocate for more student-centred and innovative teaching approaches in modern education.

3. Methodology

The study employed an experimental research design. Participants were randomly assigned to one of three groups: the experimental group, the control group, and a combination of the control and experimental group. Measurements were taken in all three groups both before and after the treatment. To assess the impact of activity-based learning on students' academic performance and attitudes toward mathematics, achievement tests were administered to the experimental and control groups as pretests before the instruction and posttests after the instruction.

3.1. Methods

The sampling frame for this study was a primary school in Lagos State that has implemented activity-based learning (ABL) specifically in mathematics.

Purposeful sampling techniques were employed. The researcher selected a specific school known to have implemented activity-based learning (ABL) in mathematics. This technique allows for in-depth exploration of the impact of ABL within a single school context. 50 teachers were sampled using random sampling.

The research instrument used for the study was a questionnaire and an achievement test. The respondents were allowed to express their opinions on the study by ticking the alternative, which represent their opinion. The teacher questionnaire contains two sections, section A and section B. Section A deals with the personal data of the respondents, wheras Section B contained a

sampling question titled, Challenges of Implementing Activity-based Learning in Primary School Mathematics Classroom. Achievement tests in the form of pre-tests and post-tests were administered to the learners for data collection. Five questions were used for the test. The questionnaire for the learners contains two sections, section A and section B. Section A deals with the learners' data. Section B contained a sampling question titled, Impact of Activity-Based Learning on Students' Attitudes to Mathematics. The sampling question was divided into two parts. Attitudes Towards Mathematics and the Impact of Activity-Based Learning.

Alternatives available in the questionnaire are as follows;

SA - Strongly Agree

A – Agree

D – Disagree

SD – Strongly Disagree

The terms SA (Strongly Agree), A (Agree), D (Disagree), and SD (Strongly Disagree) will be used to indicate the degree of agreement or disagreement with specific statements or propositions to gather quantitative data on opinions, attitudes, or preferences of participants.

The Responses on SA, A, D, and SD will be converted into numerical values for statistical analysis, facilitating comparisons and correlations.

SA will equal 5, A will equal 4, D will equal 2, and SD will equal 1

3.2. Background information

How mathematics is taught in primary schools today often overlooks the importance of fostering creative thinking among students. This neglect affects their ability to solve problems effectively, leading to poorer academic performance in the subject. Math education must encourage students to develop creative skills alongside understanding the subject. This method supports students in actively constructing, adapting, and solving math challenges within the classroom. Instead of relying exclusively on memorisation, which can lead to passive learning, teachers should implement techniques that foster engaging learning environments. Vansdadiya et al. (2023) suggested that such environments, where students tackle challenges using various methods, create questions, and explore concepts, significantly boost motivation. This approach prompts students to investigate, make choices, recognise patterns, generalise, communicate, discuss ideas, and explore alternatives. This study examines how an activity-based learning method can boost mathematical creativity in elementary students, thereby improving their overall academic performance in mathematics.

The study aimed to explore the impact of activity-based learning on primary school students' creativity and academic performance in mathematics. The specific objectives were to:

1. Investigate the effect of activity-based learning on the academic performance of primary school students in mathematics.
2. Compare the academic achievement of students taught mathematics using activity-based learning with those taught using traditional methods.
3. Determine the impact of activity-based learning on students' attitudes to mathematics.
4. Identify the challenges of implementing activity-based learning in primary school mathematics classrooms.

Several methods of teaching mathematics in primary schools have emerged recently. The ideal method is not teacher-centred but rather student-centred. This study aims to foster an interest in mathematics among young learners and teachers. It may be

instrumental in evaluating the teaching and learning of mathematics, thereby aiding in developing strategies aimed at improving learning, especially in areas that require a hands-on approach.

Additionally, it is hoped that curriculum developers will emphasize the importance of activity-based teaching methods in mathematics so that teachers can be empowered and inspired. This study contributes to the development of innovative mathematics education strategies in Lagos State, ultimately enhancing students' creative thinking, problem-solving, and academic performance. The findings will inform policymakers, educators, and stakeholders on effective approaches to improve mathematics education in Nigeria.

3.3. Participants

The study involved 50 female students from two 6th-grade classes at a primary school in the Eti-Osa Local Government Area of Lagos State for the 2023/2024 academic year. The students had an average age of 11 years. The area's economic status is upper middle class. Both classes shared the same mathematics teachers, had an equal number of students, and achieved similar mathematics grades last year. The classes were randomly assigned to treatment group 1 (traditional method), treatment group 2 (activity-based method), and treatment group 3 (activity-based + traditional method).

3.4. Procedure

The study utilised an achievement test as its primary data collection tool. The test, developed by the researcher, aimed to assess students' performance in the mathematics topic of "Factors and Multiples." It served as a pre-test to gauge students' readiness levels before the experimental interventions and as a post-test to evaluate their academic progress afterwards. The test was drafted with five questions based on the relevant subject outcomes. It included theory questions sourced from the 6th-grade mathematics textbook and the National Common Entrance Past Questions Textbooks. To ensure content validity, the draft test was reviewed by an expert supervisor. Based on the expert feedback, necessary corrections were made, and the revised test was administered to a group of 50 Primary six students who had previously studied the subject differently from those in the experimental and control groups.

3.5. Results and analysis

Responses from respondents were analyzed using descriptive statistics of frequency counts and percentages for demographic characteristics, while the hypothesis was tested using a T-test and Analysis of Variance (ANOVA) at the 0.5 level of significance.

Factors that determine the impact of Activity-Based Learning on students' attitudes to Mathematics

Examining the factors that can be used to determine the impact of Activity-Based Learning on students' attitudes to mathematics, two categories were formed. The first category was attitudes towards mathematics, and the second category was the impact of Activity-Based Learning.

For the first category, as seen in Table 1, the respondents indicated their level of agreement with the five statements given. The statements include mathematics is interesting, I feel more confident in solving math problems with activities, I enjoy learning mathematics through hands-on activities, activity-based learning helps me understand math concepts better, and I prefer activity-based learning over traditional methods in mathematics. Of the respondents who agreed that mathematics is interesting 60%, 18% strongly agreed, 14% disagreed and 8% strongly disagreed. 30% strongly agreed that they feel more confident solving math problems with activity, 26% agreed, 34% disagreed and 10% strongly disagreed. The respondents who strongly agreed that they enjoy learning mathematics through hands-on activities were 42%, 36% agreed, 14% disagreed, and 8% strongly disagreed.

48% agreed that Activity-Based Learning helps them understand math concepts better. 30% strongly agreed, 16% disagree and 6% strongly disagreed. For preference of Activity-Based Learning over the traditional method, 40% strongly agreed, 28% agreed, 18% disagreed and 14% strongly disagreed.

Table 1.1: Attitudes towards Mathematics

SN	ITEMS	A		D		SA		SD	
		Freq	%	Freq	%	Freq	%	Freq	%
1.	Mathematics is interesting.	30	60	7	14	9	18	4	8
2.	I feel more confident in solving math problems with activities.	13	26	17	34	15	30	5	10
3.	I enjoy learning mathematics through hands-on activities.	18	36	7	14	21	42	4	8
4.	Activity-based learning helps me understand math concepts better.	24	48	8	16	15	30	3	6
5.	I prefer activity-based learning over traditional methods in mathematics.	14	28	9	18	20	40	7	14

For the second category, as seen in Table 2, the respondents indicated their level of agreement with the four statements given. The statements include Activity-Based Learning influences students' attitude toward mathematics, Activity-Based Learning makes mathematics lessons more enjoyable, Activity-Based Learning makes you find mathematics concepts easier to understand now, and Activity-Based Learning made my interest in mathematics increase. 48% of the respondents agreed that including Activity-Based Learning influences students' attitude toward mathematics, 30% of them strongly agreed, 18% disagreed and 4% strongly disagreed.

The respondents who strongly agreed that Activity-Based Learning makes mathematics lessons more enjoyable were 46%, 30% agreed, 18% disagreed and 6% strongly disagreed. 40% of the respondents strongly agreed that Activity-Based Learning makes them find mathematics concepts easier to understand now, 32% agreed, 10% disagreed while 8% strongly disagreed. For Activity-Based Learning making their interest in mathematics increased, 48% agreed, 20% strongly agreed, 18% disagreed and 14% strongly disagreed.

Table 2: Impact of Activity-Based Learning

SN	ITEMS	A		D		SA		SD	
		Freq	%	Freq	%	Freq	%	Freq	%
1.	Activity-Based Learning influences students' attitude toward mathematics.	24	48	9	18	15	30	2	4
2.	Activity-Based Learning makes mathematics lessons more enjoyable.	15	30	9	18	23	46	3	6
3.	Activity-Based Learning makes you find mathematics concepts easier to understand now.	16	32	10	20	20	40	4	8
4.	Activity-Based Learning made my interest in mathematics increased.	24	48	9	18	10	20	7	14

Challenges of Implementing Activity-Based Learning in Primary School Mathematics Classroom

Examining the challenges faced in implementing activity-based learning in primary school mathematics classrooms, the respondents were asked to indicate the extent to which they agree with the 8 challenges of implementing activity-based learning in primary school mathematics as shown in Table 3.

The challenges listed are lack of suitable resources and materials for activities, difficulty in managing time for activities within the curriculum, resistance from students who prefer traditional teaching, limited support or training for teachers on Activity-Based Learning methods, assessment difficulties with Activity-Based Learning, lack of professional development is a hindrance to the adoption of Activity-Based Learning in classrooms, inadequate coaching or mentoring of teachers by senior colleagues prevents teachers from using Activity-Based Learning in primary school, and lack of collaboration with colleagues is a major hindrance to the implementation of Activity-Based Learning in the classroom.

For lack of suitable resources and materials for activities, 46% of the respondents agreed, 18% disagreed, 32% strongly agreed and 4% strongly disagreed. 50% of the respondents agreed, 16% disagreed, 34% strongly agreed, and no one strongly disagreed with the difficulty in managing time for activities within the curriculum. Resistance from students who prefer traditional teaching had 24% of the respondents agreeing, 28% disagreed, 10% strongly agreed, and 10% strongly disagreed. 60% agreed, 6% disagreed, 32% strongly agreed, and 2% strongly disagreed that limited support or training for teachers on Activity-Based Learning methods is one of the challenges they faced. For assessment difficulties with Activity-Based Learning, 40% of the respondents agreed, 44% disagreed, 14% strongly agreed and 2% strongly disagreed. 52% of the respondents agreed, 20% disagreed, 28% strongly agreed, and 0% strongly disagreed that lack of professional development is a hindrance to the adoption of activities-based learning in classrooms. Inadequate coaching or mentoring of teachers by senior colleagues prevents teachers from using activities-based learning in primary school, had 48% of the respondents agreeing, 28% disagreeing, 24% strongly agreeing and 0% strongly disagreeing.

Lastly, 52% of the respondents agreed, 36% disagreed, 12% strongly agreed, and 0% strongly disagreed that lack of collaboration with colleagues is a major hindrance to the implementation of activity-based learning in the classroom.

Table 3: Challenges faced

SN	ITEMS	A		D		SA		SD	
		Freq	%	Freq	%	Freq	%	Freq	%
6.	Lack of suitable resources and materials for activities.	23	46	9	18	16	32	2	4
7.	Difficulty in managing time for activities within the curriculum.	25	50	8	16	17	34	0	0
8.	Resistance from students who prefer traditional teaching.	12	24	28	46	5	10	5	10
9.	Limited support or training for teachers on activity-based learning methods.	30	60	3	6	16	32	1	2
10.	Assessment difficulties with activity-based learning.	20	40	22	44	7	14	1	2
11.	Lack of professional development is a hindrance to the adoption of activities-based learning in classrooms.	26	52	10	20	14	28	0	0
12.	Inadequate coaching or mentoring of teachers by senior colleagues prevents teachers from using activities-based learning in primary school	24	48	14	28	12	24	0	0
13.	Lack of collaboration with colleagues is a major hindrance to the implementation of activity-based learning in the classroom	26	52	18	36	6	12	0	0

Hypothesis Testing

Effect of Activity-Based Learning on the mathematics academic performance of primary school learners.

Examining the effect of Activity-Based Learning on the mathematics academic performance of primary school learners, the mean score for activity-based learning was higher than that of the traditional method (Table 4). The standard deviation of 2.66651 suggests that Activity-Based Learning is more effective in teaching mathematics to primary school students than the Traditional method.

The effects of Activity-Based Learning, traditional method and activity and traditional methods on the mathematics academic performance of primary school learners were analyzed using a One-way Analysis of variance. The result showed that there was a significant difference in the use of Activity-Based Learning compared to the Traditional method. However, there is no significant difference in the use of Activity-Based Learning compared with traditional and activity-based methods combined (Table 6). The hypothesis can, therefore, be accepted. The analysis further reveals that the Activity-Based Learning combined with the Traditional Method is capable of producing the same effect as the activity-based method alone (Table 7).

Table 4: Independent Samples Test on the Effect of Activity-based Learning on the Mathematics Academic Performance of Primary School Learners

	sn	N	Mean	Std. Deviation	Std. Error Mean
scores	1	16	3.8750	1.20416	.30104
	2	17	5.8824	2.66651	.64672

Table 5: T-test Analysis on the Effect of ABL on Student Mathematics Performance

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
scores	Equal variances assumed	8.7	.01	-2.76	31	.010	-2.00735	.72826	-3.49264	-.52206
	Equal variances not assumed			-2.81	22.555	.010	-2.00735	.71336	-3.48466	-.53005

Table 6: ANOVA Analysis of the Effect of Activity-based Learning on the Mathematics Academic Performance of Primary School Learners for Treatment 1 and 2

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	36.683	2	18.341	3.725	.031
Within Groups	231.397	47	4.923		
Total	268.080	49			

Table 7: ANOVA Analysis of the Effect of Activity-based Learning on the Mathematics Academic Performance of Primary School Learners for Treatment 1, 2 and 3

Scores Tukey Ba,b

GROUP	N	SUBSET FOR ALPHA = 0.05	
		1	2
TRADITIONAL METHOD	16	3.8750	
ACTIVITY-BASED METHOD	17	4.3529	4.3529
TRADITIONAL PLUS ACTIVITY-BASED	17		5.8824

Means for groups in homogeneous subsets are displayed.
A. Uses harmonic mean sample size = 16.653.
B. The group sizes are unequal. The harmonic mean of the group sizes is used. Type i error levels are not guaranteed.

3.6. Discussion

Demographic characteristics of the respondents

The learners were in their final class of primary school. They were between the ages of 10 and 12. They have always taken mathematics compulsorily from pre-school and then to their current class. The teachers were gotten across Lagos State and Ogun State, Nigeria. They are all in their active years within the public and private sectors. Their years of experience span between 1 year to 23 years. A larger percentage of these young and vibrant teachers were full-time staff members in private schools.

Impact of Activity-Based Learning

This study identified the effects of Activity-Based Learning, including improved understanding of mathematical concepts, easier teaching of concepts, enhanced attitude towards learning, increased collaboration and interaction among students, and greater interest in the subject. These factors strongly indicate the potential impact of Activity-Based Learning on students. These findings are consistent with Singh's (2015) research, which highlighted that activity-based learning methods facilitate easier teaching, enhance learning, and promote concrete understanding. Singh also noted that various scholars believe Activity-Based Learning (ABL) techniques have a lasting positive effect on students, with those who prefer active learning methods favouring activity-based approaches over traditional ones. Rama (2018) suggested that teachers should embrace active learning methods, treating students not as empty vessels but as engaged learners. Activity-based teaching strategies create an environment conducive to learning, allowing students to collaborate, learn through activities and play, and engage in cooperative learning (Rama, 2018).

Impact of Activity-Based Learning on students' attitudes towards Mathematics

This study found that a key factor influencing students' performance in mathematics is their attitude toward the subject, which includes their preferences, aversions, and overall disposition. Activity-based learning can help cultivate a positive attitude toward mathematics, often resulting in better academic performance. This is consistent with Wang (2022), who discovered that students' attitudes are shaped by their perceptions of the subject. Similarly, instructional methods and the classroom environment significantly impact these attitudes.

Attitude is a crucial indicator of current learning, and learning outcomes serve as a benchmark for assessing student attitudes (Iqbal et al., 2023). Previous studies have primarily focused on factors influencing student attitudes, such as motivation, self-efficacy, interest, and personality. However, there is a need to explore how student attitudes impact academic performance in subjects like mathematics. The effect of attitude on learning outcomes can vary depending on the subject, its difficulty, and the

type of assessment. In mathematics, students' attitudes play a crucial role in the learning process. Attitudes developed during learning can guide student behaviour (Kaya & Bicen, 2016; Haynes et al., 2023; Wang & Bai, 2023). Consequently, students with a positive attitude tend to behave differently and achieve better learning outcomes compared to those with a negative attitude. Conversely, students lacking a positive attitude may experience a decline in their learning outcomes (Veloo et al, 2015; Wang et al, 2022). Thus, students with a positive attitude can enhance not only their learning outcomes but also potentially influence the outcomes of their peers. According to Utami et al, (2023), attitudes reflect an individual's reactions to other people or specific objects. For students who dislike mathematics, their attitudes are often evident in their learning results. A lack of a positive attitude toward mathematics can significantly impact the learning process and hinder students' potential. Students with a negative attitude may lack self-confidence and be less motivated to seek information or solve problems in mathematics.

Challenges of implementing Activity-Based Learning in primary school Mathematics classroom

This study found that Implementing activity-based learning (ABL) in primary school mathematics classrooms presents several challenges. One significant issue is the limited professional competence of teachers, which can hinder effective ABL implementation and reduce its potential benefits, such as increased student engagement and improved learning outcomes. Additionally, the cognitive load associated with complex activities can detract from students' ability to focus on essential mathematical concepts, leading to muted learning impacts despite increased activity levels. Infrastructure inadequacies and time management issues further complicate the successful application of ABL strategies. Moreover, the shift towards performance-based management in schools adds pressure on educators, often resulting in work overload and insufficient support, which can negatively affect the implementation of innovative teaching methods like ABL. Collectively, these factors highlight the multifaceted challenges educators face in effectively integrating activity-based learning into primary mathematics education.

Engaging learners through interactive activities is a crucial instructional strategy, but the learning-by-doing approach carries certain risks. Analyzing different types of learning activities reveals and addresses potential issues related to activity-based learning. These activities can range from simple motor tasks to more complex ones involving additional task-related knowledge. Excessive movement or poor integration of motor activities can create challenges for learning. For instance, elaborate tasks like generating drawings can become secondary tasks, potentially diverting focus. Demanding activities may also increase cognitive load, reducing the working memory available for the primary content.

To maximize the effectiveness of activity-based interventions, it is important to minimize redundant aspects and offer clear guidance to learners. Additionally, as tasks transition from physical to digital formats, it's crucial to assess how cognitive load may change. This review integrates educational and cognitive perspectives on activity-based learning, offering models and recommendations that are highly relevant to the digital transformation of education and learning. This study agrees with Robert (2015) that Implementing project-based learning (PBL) which is a form of activity-based learning in general education settings presents various challenges. Teachers encounter difficulties due to factors like lack of time, absence of specific guidance and assessment criteria, mixed student abilities and interests, limited materials, and large class sizes.

Additionally, students face obstacles in collaborative activities, time management, problem-solving, teamwork, and investigation techniques, often stemming from a lack of self-regulation. Furthermore, remote learners struggle with speaking sub-skills, inadequate practice environments, and communication barriers, highlighting the challenges in teaching speaking skills online through PBL. These challenges underscore the need for tailored support, clear guidelines, and enhanced resources to effectively

implement PBL in general education settings, emphasizing the importance of addressing both teacher and student needs for the successful project-based learning experience.

4. Conclusion and Recommendations

The study examined how activity-based learning influences the academic performance of primary school students in mathematics. By comparing students' scores on pre-tests and post-tests, the research demonstrated that activity-based learning has a significantly greater impact than traditional teaching methods. It highlights the importance for mathematics teachers to integrate as many activities as possible into their lessons. Additionally, the study revealed that combining activity-based learning with traditional methods can enhance mathematics instruction effectively.

Based on the findings of the study, it is recommended that:

1. School administrators and management should provide resources that can facilitate activity-based teaching and learning.
2. Teachers should be encouraged to incorporate activities in their teaching processes.
3. Teachers should plan mathematics lesson activities deliberately to foster hands-on learning and interactions among learners.
4. Teachers should use differentiated activities to accommodate students' unique learning styles and needs.
5. Teachers should improvise with resources around to make activity-based learning a constant part of their teaching process.
6. Government and school leaders should constantly address the impact of activities-based teachings on the overall performance of primary school mathematics learners.

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