PEDAGOGICAL STRATEGIES BY TEACHERS FOR IMPROVING PUPILS' PERFORMANCE IN MATHEMATICS IN EDUCATION DISTRICT 5A, GRAND BASSA COUNTY, LIBERIA

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Abstract

This study investigated pedagogical strategies employed by teachers to enhance pupils' performance in mathematics in Education District 5A, Grand Bassa County, Liberia. Guided by three research questions, the study adopted a descriptive survey design. The population comprised 555 teachers across 89 primary schools, from which a stratified random sample of 75 mathematics teachers (45 males and 30 females) was selected to ensure proportional representation. Data were collected using a self-structured, 18-item instrument titled *Pedagogical Strategies for Improving Pupils' Performance in Mathematics Questionnaire (PSIPPMQ)*. The instrument was validated by experts, and reliability testing using Cronbach's Alpha yielded a coefficient of 0.82, confirming strong internal consistency. Descriptive statistics, including mean and standard deviation, were employed to analyze the data. Findings revealed that teachers strongly endorsed hands-on instructional, problem-solving, and collaborative learning strategies as effective approaches to improving mathematics achievement. Problem-solving approaches fostered critical thinking, resilience, and contextual application of mathematics to everyday life. Collaborative learning strategies, including group projects, peer tutoring, and teamwork-based games, promoted motivation, communication, and shared responsibility, thereby strengthening both cognitive and social skills. It recommends deliberate integration of these strategies into classroom practice, supported by teacher training and curriculum development, to ensure sustainability. Collectively, these approaches provide practical, evidence-based solutions to address resource limitations and low performance in Liberia's educational context, preparing pupils for future academic and professional success.

Keywords: *Hands-on Instruction, Problem-Solving Strategies, Collaborative Learning, Mathematics Achievement, Pedagogical Approaches*

Introduction

Mathematics is an indispensable subject of study. It organizes life, prevents chaos, and nurtures qualities such as reasoning power, creativity, abstract and spatial thinking, critical thinking, problem-solving ability, and effective communication skills. According to Oni (2019), mathematics is utilized daily in one form or another, as it is the cradle of all creations; without it, the world cannot move an inch. Whether a cook, farmer, carpenter, mechanic, shopkeeper, or scientist, everyone needs mathematics in their day-to-day activities.

Mathematics is also one of the core subjects in which pupils are expected to earn credit to further their studies in institutions of higher learning (Adejumo, Oluwole, and Muraina, 2015). Despite its recognized importance, many pupils struggle with mathematics, leading to lower performance and achievement. Since its inception, mathematics has played a pivotal role in shaping the culture and intellectual landscape of societies worldwide (Emeniru, 2019). Eya (2017) contends that mathematics is integral to human culture, and the education system is instrumental in its transmission. Teaching mathematics fosters critical thinking skills in young learners, and through systematic reasoning, it provides solutions to human challenges across various domains of life (Onifade, 2017).

This challenge is particularly evident in Education District 5A, Grand Bassa County, Liberia, where pedagogical strategies for improving pupils' performance in mathematics remain a critical concern. Mathematics proficiency is essential for academic success and future opportunities, yet Liberia's educational landscape faces challenges such as limited resources, teacher shortages, and infrastructure constraints. Understanding the specific needs of pupils in District 5A is crucial for developing targeted interventions that address gaps in mathematical understanding and promote positive learning outcomes.

Hands-on activities provide students with tangible objects for direct investigation, making classroom learning more engaging. When students apply classroom concepts in real-world scenarios, they develop comprehension, motivation, and personal growth. Activity-based learning enhances retention and academic performance (Ryan and Deci, 2017). Teachers can use visual aids, real-life examples, and hands-on activities to make mathematics more accessible and enjoyable. By catering to diverse learning styles, instructors create stimulating environments that promote understanding and retention of mathematical concepts. Conducting a comprehensive study on pedagogical strategies in District 5A allows educators and policymakers to identify

evidence-based practices that can drive positive change. Such a study must consider socio-economic conditions, cultural influences, and educational policies that affect implementation. Understanding this background highlights the significance of addressing low performance in mathematics and its impact on pupils' future academic and professional endeavors.

Pedagogical techniques are pivotal in shaping academic outcomes and developing 21st-century skills. Traditional teacher-centered approaches, where instructors act as sole knowledge disseminators, are increasingly being replaced by student-centered strategies emphasizing active engagement, collaboration, communication, and creativity (Leather and Stockham, 2016; Bature, 2020; Loreman, 2017; Hoidn, 2016; Chan, 2023; Dimaano, 2021). Rooted in constructivist theories, these approaches encourage inquiry-based learning, technology integration, and authentic assessment, preparing students to thrive in a complex, interconnected world.

Among these strategies, hands-on instruction, problem-solving, and collaborative learning stand out as effective methods for enhancing mathematical achievement. Hands-on instruction allows students to engage with concepts through practical activities, while problem-solving develops analytical skills and resilience. Collaborative learning fosters teamwork and peer support, motivating pupils and deepening understanding. Problem-solving, defined as "deciding what to do when what to do is not known" (Altun, 2015), encourages learners to analyze, strategize, and discover solutions. It gives students responsibility for their learning, helping them structure information and share knowledge with peers (Ali, 2019; Pohan et al., 2020). Teachers play a guiding role, designing activities based on problematic situations and supporting learners during the process. This method promotes group discussion, teamwork, and communication (Fidan and Tuncel, 2019). Collaborative learning strategy (CLS) involves pupils working together to explore questions or create projects. Unlike cooperative learning, CLS is more student-centered, empowering learners to control their own outcomes (Oluwole and Muraina, 2016). Despite research efforts, few studies have examined the combined effects of collaborative learning and self-monitoring skills on mathematics achievement, particularly in African contexts. Addressing this gap is vital for enhancing mathematics learning outcomes.

Gender differences in mathematical performance also warrant attention. Attitudes toward gender roles can influence how pupils perceive and approach mathematics. While international studies such as TIMSS (2019) report gender gaps in performance, findings remain inconclusive, with some research suggesting differences depend on test type and problem-solving strategies

(Ramírez-Uclés and Ramírez-Uclés, 2020). In District 5A, understanding these dynamics is essential for designing inclusive strategies that support all learners. Even so, pedagogical strategies such as hands-on instruction, problem-solving, and collaborative learning have proven effective in enhancing mathematics achievement. Employing these approaches enables educators in District 5A to create supportive, engaging environments that foster mathematical proficiency and prepare pupils for future success.

Statement of the Problem

The persistent underperformance of pupils in mathematics within Education District 5A, Grand Bassa County, Liberia, reflects a critical educational challenge with far-reaching implications for academic progression and future opportunities. Despite mathematics being a core subject essential for higher education and professional advancement, many learners struggle to grasp abstract concepts due to limited pedagogical innovation, resource constraints, and traditional teacher-centered approaches. This situation is compounded by systemic issues such as inadequate instructional materials, overcrowded classrooms, and insufficient teacher training, which hinder effective delivery of mathematics education.

Although research highlights the effectiveness of hands-on instruction, problem-solving approaches, and collaborative learning in improving mathematics achievement, their systematic application in District 5A remains limited and underexplored. Teachers often lack the training and support necessary to implement these strategies in ways that align with the socio-economic realities of the region. Furthermore, contextual factors such as gender disparities, cultural influences, and resource scarcity exacerbate the challenge, leaving many pupils without equitable access to quality mathematics instruction. Without targeted interventions, the district risks perpetuating cycles of poor performance, reduced academic mobility, and limited preparedness for 21st-century skills.

Purpose of the Study

The main purpose of the study was to examine the pedagogical strategies employed by teachers to improve pupils' performance in mathematics in Education District 5A, Grand Bassa County, Liberia. Specifically, the study aimed to:

1. Examine hands-on instructional strategies used by teachers to improve pupils' performance in mathematics.
2. Investigate problem-solving strategies employed by teachers to enhance pupils' mathematical achievement.
3. Explore collaborative learning strategies adopted by teachers to foster pupils' performance in mathematics.

Research Questions

The following research questions guided the study:

1. What are the hands-on instructional strategies used by teachers to improve pupils' performance in mathematics in Education District 5A, Grand Bassa County, Liberia?
2. What are the problem-solving strategies employed by teachers to enhance pupils' performance in mathematics in Education District 5A, Grand Bassa County, Liberia?
3. What are the collaborative learning strategies adopted by teachers to improve pupils' performance in mathematics in Education District 5A, Grand Bassa County, Liberia?

Methods

A descriptive survey research design was adopted. The population consisted of 89 primary schools in District 5A with 555 teachers (289 male and 266 female). A stratified random sampling technique was used to select 75 teachers (45 males and 30 females), ensuring proportional representation of both genders.

The instrument for data collection was the *Pedagogical Strategies by Teachers for Improving Pupils' Performance in Mathematics Questionnaire (PSUBTIPPMQ)*, developed on a 4-point rating scale: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). The instrument was validated by experts in the Department of Educational Foundations, Faculty of Education, Nnamdi Azikiwe University, Awka. Reliability testing using Cronbach's Alpha produced a coefficient of 0.82, confirming strong internal consistency. Descriptive statistics (mean and standard deviation) were used to address the research questions. A criterion mean of 2.50 served as the benchmark for acceptance. All 75 questionnaires were administered and fully returned.

Results

Research Question 1: What are hands-on instructional pedagogical strategies by teachers for improving pupils' performance in mathematics in Education District 5A, Grand Bassa County, Liberia?

Table 1: Mean ratings and standard deviation of respondent on hands-on instructional pedagogical strategies by teachers for improving pupils' performance in mathematics in Educational District 5A, Grand Bassa County, Liberia.

S/N	Hands-on instructional pedagogical strategies include;	Mean	SD	Decision
1	Using physical objects like blocks, and counters for mathematical using geometric shapes to help pupils visualize and understand abstract mathematical concepts.	3.30	0.54	Agreed
2	Incorporating activities that require pupils to actively engage with the material, such as measuring objects around the classroom to learn about units of measurement	3.00	0.72	Agreed
3	Use natural elements (like leaves, stones) for counting and sorting exercises outside.	3.12	0.67	Agreed
4	Integrate math problem into stories and have pupils solve them as part of the narrative.	3.20	0.62	Agreed
5	Encouraging group work and peer-to-peer teaching through math games, puzzles, and problem-solving tasks.	3.15	0.65	Agreed
6	Hands-on instructional approach significantly enhances cooperative learning and teamwork among primary school children in mathematics classes.	3.11	0.69	Agreed
	Grand Mean	**3.14**		**Agreed**

Table 1 shows that respondents agreed items 1–6 represent hands-on instructional strategies for improving pupils' performance in mathematics. Each mean score was above the criterion mean of 2.50, ranging from 3.00 to 3.30, with standard deviations between 0.54 and 0.72. The grand mean of 3.14 indicates strong agreement among respondents.

Research Question 2: What are problem-solving pedagogical strategies by teachers for improving pupils' performance in mathematics in Education District 5A, Grand Bassa County, Liberia?

Table 2: Mean ratings and standard deviation of respondent on problem-solving pedagogical strategies by teachers for improving pupils' performance in mathematics in Educational District 5A, Grand Bassa County, Liberia.

S/N	Problem-solving pedagogical strategies includes;	Mean	SD	Decision
7	Pupils to explore and discover solution on their own by providing them with problems that require critical thinking and exploration.	3.12	0.72	Agreed
8	Presenting pupils with problem that are relevant to real-life situations.	3.15	0.70	Agreed
9	Organizing pupils into small groups to work on project together.	3.20	0.68	Agreed
10	Set up activities where pupils used to solve math problems to progress in the narrative	3.21	0.68	Agreed
11	Teaching pupils to break down problems into smaller, manageable steps.	3.24	0.67	Agreed
12	Pupils taught using the problem-solving approach exhibit improved communication skills during mathematics activities compared to those taught using traditional methods.	2.40	0.86	Disagreed
	Grand Mean	**3.05**		**Agreed**

Table 2 indicates that respondents agreed items 7–11 represent problem-solving strategies, with mean scores ranging from 3.12 to 3.24. Item 12, however, had a mean score of 2.40, below the acceptance benchmark, suggesting disagreement. Overall, the grand mean of 3.05 reflects general agreement that problem-solving strategies positively impact pupils' performance.

Research Question 3: What are collaborative pedagogical strategies by teachers for improving pupils' performance in mathematics in Education District 5A, Grand Bassa County, Liberia?

Table 3: Mean ratings and standard deviation of respondent on collaborative pedagogical strategies by teachers for improving pupils' performance in mathematics in Educational District 5A, Grand Bassa County, Liberia.

S/N	Collaborative learning pedagogical strategies includes;	Mean	SD	Decision
13	Have pupils work together on counting, sorting, and pattern activities using toys or classroom items.	3.20	0.68	Agreed
14	. Introduce games that require teamwork to solve math challenges, making learning fun and interactive.	3.30	0.64	Agreed
15	The collaborative method leads to higher engagement and participation in mathematic classes, resulting in better performance compared to traditional teaching method.	3.11	0.70	Agreed
16	Set up activities where pupils used to solve math problems to progress in the narrative	3.24	0.68	Agreed
17	Pair more advanced pupils with those who need help, fostering a sense of responsibility and cooperation.	3.40	0.60	Agreed
18	Create story problems that require group input to solve, encouraging discussion and teamwork.	3.15	0.72	Agreed
	Grand Mean	**3.23**		**Agreed**

Table 3 shows that respondents agreed items 13–18 represent collaborative learning strategies, with mean scores ranging from 3.11 to 3.40 and standard deviations between 0.60 and 0.72. The grand mean of 3.23 confirms strong agreement that collaborative learning strategies enhance pupils' performance in mathematics.

Discussion of Findings

The findings confirm that teachers in District 5A recognize hands-on instructional strategies as highly effective in improving pupils' mathematical performance. Manipulatives such as blocks, counters, and geometric shapes help pupils visualize abstract concepts, making mathematics more concrete and accessible. Studies such as Furner (2024) emphasize that manipulatives and digital tools like GeoGebra foster deeper conceptual understanding and confidence in mathematics, bridging the gap between abstract reasoning and practical application. Incorporating real-world activities, such as measuring classroom objects or using natural elements like leaves and stones, aligns with experiential learning principles. Vale and Barbosa (2023) highlight that active learning strategies integrating physical and contextual tasks significantly

enhance comprehension and retention. In District 5A, where resources are limited, leveraging locally available materials provides cost-effective yet impactful opportunities for meaningful learning.

Hands-on strategies also encourage collaborative engagement through games and puzzles, which improve both motivation and achievement. Belle (2015) notes that instructional approaches combining physical activities with peer interaction foster cognitive and social growth. The findings in District 5A resonate with this, showing that pupils benefit not only academically but also socially when mathematics is taught through interactive, activity-based methods. The strong agreement among teachers underscores the contextual appropriateness of hands-on strategies in Liberia, where resource constraints demand creativity in teaching. As Accelerate Learning (2024) reports, instructional methods emphasizing engagement and interaction are critical for boosting mathematics outcomes globally, and the District 5A findings demonstrate that such approaches can be adapted effectively even in low-resource environments.

The study revealed that problem-solving strategies are widely accepted as effective in enhancing pupils' mathematical achievement. Encouraging pupils to explore solutions independently fosters critical thinking, resilience, and ownership of learning. Santos-Trigo (2024) argues that advances in mathematics education occur through problem formulation and exploration, highlighting the importance of guiding learners to break down complex tasks into manageable steps. Teachers in District 5A emphasized real-life problem contexts as particularly effective, making mathematics meaningful and applicable to everyday situations such as farming, trading, and household activities. Fülöp (2015) demonstrated that problem-solving activities grounded in variation theory improve students' ability to transfer mathematical knowledge to real-world scenarios, reinforcing the relevance of contextualized learning.

Group-based problem-solving activities further enhance collaboration and communication, aligning with Vale and Barbosa's (2023) findings that active learning strategies combining problem-solving with peer interaction foster both cognitive and social development. Pupils working in groups in District 5A demonstrated improved engagement and performance, underscoring the value of collaborative problem-solving. However, one item related to communication skills scored below the acceptance benchmark, suggesting challenges in facilitating mathematical discourse. Research indicates that effective problem-solving requires structured opportunities for communication and reflection (Santos-Trigo, 2024). Addressing this

gap through targeted teacher training could strengthen the overall impact of problem-solving strategies, ensuring that pupils not only solve problems but also articulate their reasoning and engage in meaningful mathematical dialogue.

The findings strongly support collaborative learning strategies as effective in improving pupils' mathematical performance. Activities such as group counting, sorting, and pattern recognition foster peer-to-peer learning and collective problem-solving. Muhamad Fadzil and Osman (2025) highlight that collaborative learning methods in mathematics enhance pedagogy by promoting shared responsibility and interdependence. In District 5A, teamwork-based games and interactive challenges were identified as impactful, reducing mathematics anxiety and transforming learning into a shared, enjoyable experience. Jabaka (2025) reports that collaborative teaching strategies, including cooperative learning and structured group tasks, significantly improve achievement, engagement, and retention in mathematics, findings that align closely with the district's outcomes.

Pairing advanced pupils with those needing support emerged as particularly effective, fostering responsibility, empathy, and mutual achievement. Firdaus and Satriawan (2025) emphasize that collaborative learning develops critical thinking by encouraging students to share ideas and co-construct solutions. Peer tutoring not only benefits struggling learners but also reinforces the knowledge of advanced pupils, creating a mutually beneficial dynamic. Beyond immediate academic gains, collaborative learning strategies prepare pupils for future academic and professional challenges by cultivating higher-order skills such as teamwork, negotiation, and critical thinking. As Jabaka (2025) and Muhamad Fadzil and Osman (2025) argue, collaborative approaches are essential for equipping students with 21st-century competencies. The findings in District 5A demonstrate that embedding collaboration into mathematics instruction fosters both cognitive and social growth, positioning pupils for success in an increasingly interconnected world.

Conclusion

In conclusion, the study from Education District 5A, Grand Bassa County, Liberia, demonstrate that hands-on instructional strategies, problem-solving approaches, and collaborative learning methods are all effective in enhancing pupils' mathematical performance, each contributing uniquely to comprehension, engagement, and achievement. Hands-on strategies

contextualize abstract concepts through tangible experiences, problem-solving approaches cultivate critical thinking and resilience by linking mathematics to real-life scenarios, and collaborative learning fosters teamwork, peer support, and motivation, equipping pupils with essential 21st-century skills. Together, these pedagogical strategies not only improve mathematical proficiency but also address the socio-economic and educational challenges of the district, offering evidence-based pathways for teachers and policymakers to strengthen mathematics education and prepare learners for future academic and professional success.

Recommendations

1. Strengthen Hands-on Instructional Practices: Teachers should consistently integrate manipulatives, real-life objects, and locally available materials (e.g., stones, leaves, classroom items) into mathematics lessons. This approach contextualizes abstract concepts, enhances comprehension, and ensures cost-effective learning in resource-constrained environments.
2. Enhance Problem-Solving Pedagogy: Professional development programs should train teachers to design problem-solving tasks that connect mathematics to pupils' daily experiences, such as farming, trading, and household activities. Structured opportunities for mathematical discourse should also be emphasized to strengthen communication skills and collaborative reasoning.
3. Promote Collaborative Learning Models: Schools should adopt collaborative learning strategies such as peer tutoring, group projects, and teamwork-based games. Pairing advanced pupils with those needing support fosters responsibility, empathy, and shared achievement, while reducing mathematics anxiety and improving motivation.
4. Policy and Curriculum Integration: Education authorities should embed hands-on, problem-solving, and collaborative learning strategies into the mathematics curriculum and teacher training frameworks. This ensures consistency across schools and aligns classroom practices with global best standards for 21st-century skills development.

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