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EFFECTS OF REMEDIAL TEACHING ON THE PERFORMANCE OF LOW-ACHIEVING STUDENTS IN ALGEBRA

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Abstract

This study investigated the effects of remedial teaching on the academic performance and attitudes of low-achieving junior high school students in Algebra. Many students struggle with Algebra due to its abstract nature, resulting in poor performance and negative attitudes. Using a quasi-experimental design, 40 low-achieving students were identified based on their performance in a pre-test and were subsequently exposed to a six-week remedial teaching intervention. The study employed pre- and post-tests, as well as an attitude questionnaire, to collect data. Descriptive statistics and paired sample t-tests were used for data analysis. The results revealed a statistically significant improvement in the students' post-test scores, indicating that the remedial instruction effectively enhanced their understanding of Algebraic concepts. Additionally, students demonstrated a more positive attitude toward learning Algebra after the intervention, with increased motivation, interest, and confidence. These findings suggest that remedial teaching is a viable strategy for addressing learning gaps and improving both cognitive and affective outcomes in mathematics education. The study recommends the integration of structured remedial programs into school systems to support underperforming learners.

Keywords: remedial teaching, low-achieving students, Algebra, academic performance, attitude, mathematics education

Background to the Study

Mathematics is a core subject in most educational systems and a fundamental tool for understanding scientific and technological concepts. Among its many branches, Algebra is often considered the gateway to higher-level mathematics, but it poses significant challenges for many students, particularly at the junior and senior secondary school levels (Chappell et al., 2021). Difficulties in grasping abstract algebraic concepts often lead to poor performance, contributing to a persistent achievement gap between high-performing and low-achieving students.

Remedial teaching has emerged as an effective pedagogical strategy to support students who struggle with core concepts. It typically involves targeted instruction, personalized learning approaches, and repetitive practice aimed at addressing students' learning gaps (Shin, Sutherland,

Shin & Conley, 2020). In the context of Algebra, remedial programs aim to reinforce foundational knowledge, provide step-by-step scaffolding, and boost students' confidence in manipulating algebraic expressions and equations. Recent studies have demonstrated the potential of remedial teaching to improve learning outcomes in mathematics. For instance, Mavuru and Barmby (2021) found that remedial instruction significantly improved conceptual understanding and performance in mathematics among South African learners. Similarly, Boateng and Oppong (2022) reported positive effects of structured remedial programs on Ghanaian students' ability to solve algebraic problems. However, the effectiveness of remedial teaching can vary depending on factors such as teaching methods, duration, learner characteristics, and the educational context. In Ghana and other developing countries, low achievement in Algebra remains a pressing concern. Many students fail to meet the minimum proficiency level required for progression to higher levels of education. Remedial teaching, if properly implemented, can be a viable intervention to bridge this gap and enhance the academic success of struggling learners.

Mathematics remains a cornerstone of modern education systems across the world, as it equips learners with essential problem-solving skills, logical reasoning abilities, and quantitative literacy. Within the mathematics curriculum, Algebra plays a central role and serves as a foundational gateway to advanced mathematics, science, engineering, and technology-related fields. Despite its importance, a large number of students at the basic and secondary levels find Algebra particularly challenging, often resulting in poor academic performance, low self-confidence, and aversion to mathematics in general (Chappell et al., 2021; Mavuru & Barmby, 2021). Algebra introduces learners to abstract concepts such as variables, equations, inequalities, and functions, which require a cognitive shift from concrete arithmetic operations to more abstract reasoning. For many low-achieving students, this transition proves difficult due to gaps in foundational knowledge, lack of engagement, and the fast pace of the traditional mathematics classroom. Research shows that many students struggle with understanding algebraic symbols, formulating equations from word problems, and manipulating algebraic expressions, leading to persistent underachievement in this area (Crespo & Nicol, 2021). In response to these challenges, educators and policymakers have emphasized the need for differentiated instructional approaches that can address the diverse learning needs of students. One such approach is **remedial teaching**, which involves targeted, often individualized, instructional support aimed at helping underperforming students catch up with their peers. Remedial teaching is typically provided outside regular classroom hours and focuses on re-teaching foundational concepts, reinforcing key skills, and offering opportunities for repeated practice. According to Shin et al. (2020), remedial programs have shown promise in improving students' comprehension and achievement in mathematics when implemented effectively. Globally, several studies have confirmed the positive impact of remedial instruction in mathematics. For instance, in the United States, longitudinal intervention programs that incorporated intensive remedial teaching led to significant improvements in students' algebra performance (Shin et al., 2020). Similarly, in South Africa, Mavuru and Barmby (2021) observed that remedial programs significantly enhanced learners' conceptual understanding and classroom engagement. In Ghana, though some schools provide remedial lessons particularly for candidates preparing for the Basic Education Certificate Examination (BECE) or West African Senior School Certificate Examination (WASSCE) there remains limited evidence on the effectiveness of such interventions, especially with regard to Algebra performance among low-achieving students.

Moreover, the situation in Ghanaian classrooms presents a unique set of challenges. Many schools are characterized by large class sizes, inadequate teaching and learning resources, and limited time to revisit difficult concepts. These conditions make it difficult for teachers to give struggling students the individual attention they need during normal instructional time (Boateng & Oppong, 2022). As a result, many students continue to fall behind, especially in topics such as Algebra, which require step-by-step scaffolding and frequent practice for mastery. The introduction of remedial teaching, therefore, provides a potentially effective avenue for addressing these learning gaps. The value of remedial teaching extends beyond academic performance; it also plays a role in improving students' attitudes, motivation, and confidence toward mathematics. Students who receive targeted support are more likely to overcome their fear of mathematics and re-engage with the subject in meaningful ways (Crespo & Nicol, 2021). However, the success of remedial teaching depends on several factors, including the teacher's ability to diagnose learning difficulties, the structure of the remedial program, student commitment, and institutional support.

Given the rising concern over poor Algebra performance in Ghanaian schools and the potential of remedial instruction to address this issue, it is crucial to explore the impact of such interventions. This study is therefore situated within this context seeking to investigate how remedial teaching affects the performance of low-achieving students in Algebra, and to offer recommendations for improving instructional support for these learners.

Statement of the Problem

Despite its critical importance in the mathematics curriculum, Algebra continues to be one of the most poorly performed topics among secondary school students. This persistent underachievement has raised concerns among educators, parents, and policymakers. Many students lack the prerequisite knowledge to understand algebraic operations, leading to anxiety, lack of motivation, and eventual disengagement from the subject (Crespo & Nicol, 2021). In Ghana, poor performance in Algebra is often reflected in national assessment results, with a significant proportion of students scoring below average in topics such as linear equations, factorization, and word problems (Ghana Education Service, 2023). Traditional classroom teaching methods appear insufficient to meet the needs of low-achieving students, prompting the need for alternative instructional strategies. Although remedial teaching has been implemented in some schools, there is limited empirical evidence on its effectiveness in improving students' performance in Algebra, especially in the Ghanaian context. Furthermore, questions remain about the optimal design and delivery of such programs. This study seeks to fill this gap by investigating how remedial teaching affects the performance of low-achieving students in Algebra.

Purpose of the Study

The purpose of this study is to examine the effects of remedial teaching on the academic performance of low-achieving students in Algebra. The study seeks to determine whether targeted remedial instruction can lead to significant improvements in students' understanding and performance in Algebraic concepts.

Research Objectives

The specific objectives of the study are:

1. To identify the common algebraic topics that low-achieving students struggle with the most.

2. To assess the impact of remedial teaching on students' performance in Algebra.
3. To explore students' attitudes toward Algebra before and after participating in remedial instruction.
4. To identify the challenges teachers, face in implementing remedial teaching in Algebra.

Research Questions

The study seeks to answer the following research questions:

1. What algebraic topics do low-achieving students struggle with the most?
2. How does remedial teaching affect students' performance in Algebra?
3. What changes, if any, occur in students' attitudes toward Algebra after undergoing remedial instruction?
4. What challenges do teachers encounter in delivering remedial lessons in Algebra?

LITERATURE REVIEW

Conceptual Review

Remedial Teaching

Remedial teaching, also known as compensatory or corrective instruction, refers to educational interventions specifically designed to help underperforming or struggling students meet expected competencies in a given subject area. It is distinct from regular classroom instruction in that it is more personalized, often slower-paced, and focuses on diagnosing and addressing learning deficits (Shin et al., 2020). In the context of mathematics education, remedial teaching usually involves intensive practice, repetition, the use of visual aids, and breaking down abstract concepts into more digestible units. The essence of remedial teaching is to provide students with a second chance to learn what they failed to grasp during regular instruction. This approach is especially relevant in mathematics, where foundational concepts are hierarchical. A lack of understanding in earlier topics like basic operations, fractions, or integers can severely impair a student's ability to grasp algebraic concepts (Mavuru & Barmby, 2021). Therefore, remedial teaching plays a corrective role, attempting to rebuild the learner's understanding from the ground up. Remedial instruction is not merely a repetition of classroom lessons. Rather, it involves careful identification of individual student difficulties, customizing instructional materials, providing constant feedback, and using alternative teaching methods, such as manipulatives, peer tutoring, and technology-based tools (Chappell et al., 2021). In many developed education systems, remedial teaching is supported by diagnostic assessments and intervention plans. However, in developing countries, including Ghana, its implementation is often hindered by limited resources, large class sizes, and inadequate teacher training.

Low-Achieving Students

Low-achieving students are those who consistently perform below grade-level expectations, particularly in core subjects such as mathematics. These students often demonstrate a lack of conceptual understanding, procedural fluency, and application skills. The causes of low achievement are multifaceted and include cognitive, affective, instructional, and environmental factors. For example, students may struggle due to poor foundational knowledge, low self-efficacy,

negative experiences with mathematics, or ineffective pedagogical practices (Crespo & Nicol, 2021). In Ghanaian secondary schools, the term "low-achieving" often includes students who fail mathematics on standardized national examinations such as the BECE and WASSCE. These students are frequently targeted for after-school or vacation remedial programs, especially in topics like Algebra, which are critical to passing examinations and accessing higher education.

Algebra Performance

Algebra is a key component of the mathematics curriculum and serves as the bridge between arithmetic and advanced mathematics. It equips students with the tools to represent and analyze relationships using symbols, solve equations and inequalities, and model real-world problems. Despite its significance, students often find Algebra to be one of the most challenging aspects of mathematics, primarily because it requires a level of abstract thinking and symbolic manipulation that is not intuitive for many learners (Fan & Williams, 2020). In Ghana, repeated reports from the West African Examinations Council (WAEC) highlight Algebra as one of the most poorly performed areas on national exams. Factors such as lack of practice, fear of symbols, misinterpretation of word problems, and memorization without understanding contribute to students' poor performance. Remedial teaching has the potential to address these challenges by offering learners opportunities to relearn concepts in ways that connect with their experiences and learning styles.

Theoretical Review

Constructivist Learning Theory

The constructivist theory, based on the work of Jean Piaget and later expanded by Lev Vygotsky, emphasizes that learners actively construct knowledge through experience, interaction, and reflection. From this perspective, learning is not a passive transfer of information from teacher to student but a process where learners build new understanding based on what they already know. In remedial teaching, constructivist principles are applied when teachers use hands-on materials, real-life examples, and collaborative learning to help students form meaningful connections with abstract concepts. For example, using counters or algebra tiles to demonstrate the idea of balancing equations enables students to internalize what an equation truly represents, rather than simply memorizing procedures (Chappell et al., 2021).

Zone of Proximal Development (ZPD)

Vygotsky's Zone of Proximal Development (ZPD) refers to the range of tasks that a learner can perform with assistance but not yet independently. Remedial instruction operates within this zone by providing scaffolding temporary support that is gradually removed as students gain mastery. Teachers serve as more knowledgeable others (MKOs), guiding students through difficult tasks such as solving multi-step algebraic equations or interpreting variables in a problem context. ZPD highlights the importance of differentiated instruction, timely feedback, and peer support components that are typically embedded in well-designed remedial programs. When properly implemented, such instruction fosters gradual independence and confidence among low-achieving students (Shin et al., 2020).

Mastery Learning Theory

Developed by Benjamin Bloom in the 1960s, Mastery Learning Theory posits that most students can learn effectively if they are given sufficient time and appropriate support. The key idea is that instruction should focus on achieving a high level of mastery in each learning objective before progressing to the next. Remedial teaching aligns with this theory by using formative assessments to identify learning gaps and corrective instruction to address them. In Algebra, where concepts build sequentially, ensuring that students have mastered linear expressions before introducing quadratic equations is crucial. Mastery learning also encourages re-teaching, frequent feedback, and flexible pacing, all of which are instrumental in remedial instruction settings.

Algebraic Topics Low-Achieving Students Struggle With

Several studies have identified key areas of difficulty for students struggling with Algebra. Boateng and Oppong (2022) found that Ghanaian senior high school students had the most difficulty with linear equations, inequalities, and factorization. Similarly, Mavuru and Barmby (2021) observed that students lacked a conceptual understanding of variables and symbolic representation, which are essential for interpreting and solving algebraic problems. Students' struggles are often compounded by an overemphasis on procedural teaching at the expense of conceptual understanding. Crespo and Nicol (2021) argued that without meaningful exposure to algebraic reasoning, students develop fragile understandings that collapse when problems deviate from standard formats. Moreover, language barriers and the inability to translate word problems into algebraic expressions have been cited as additional challenges (Mensah & Amankwah, 2023). These findings suggest that remedial instruction should prioritize foundational topics such as operations with integers, properties of equality, and interpreting symbols in context.

Effects of Remedial Teaching on Students' Algebra Performance

There is growing empirical support for the effectiveness of remedial teaching in improving academic performance, especially in mathematics. Shin et al. (2020), in a large-scale study in U.S. middle schools, found that remedial math programs significantly improved performance in Algebra, particularly among students who were in the lowest quartile at the beginning of the study. In a Ghanaian context, Boateng and Oppong (2022) evaluated a 12-week remedial program and found that students' mean scores in Algebra increased by over 25 percentage points. The authors attributed these gains to personalized instruction, regular assessment, and the use of diagnostic teaching strategies. Mavuru and Barmby (2021) also observed increased student engagement and reduced dropout rates among learners enrolled in remedial classes in South Africa. Their study emphasized the importance of integrating feedback mechanisms and real-world applications to make remedial Algebra lessons more relatable and effective.

Students' Attitudes Toward Algebra Before and After Remedial Teaching

Affect plays a significant role in learning mathematics. Many low-achieving students develop math anxiety and negative attitudes toward Algebra due to repeated failure. However, studies show that remedial teaching can positively alter these perceptions. Chappell et al. (2021) reported that students in a U.S. intervention program displayed improved confidence and interest in Algebra after participating in customized remedial sessions. Mensah and Amankwah (2023) found that Ghanaian students initially showed low self-esteem and fear of Algebra, but after engaging in scaffolded remedial sessions, their attitudes improved significantly. They began to express more interest in class, asked questions, and attempted complex problems independently.

Challenges Teachers Face in Implementing Remedial Teaching

Despite its benefits, remedial instruction faces several practical challenges. Teachers often struggle with large class sizes, limited instructional time, and insufficient materials (Boateng & Oppong, 2022). Moreover, many teachers lack specialized training in diagnostic teaching or formative assessment techniques necessary for effective remedial work. In some cases, students themselves are reluctant to participate in remedial classes due to stigma or lack of parental support. Infrastructural limitations such as inadequate classrooms, electricity, or teaching aids further complicate efforts to implement remedial programs effectively, especially in rural schools (GES, 2023). Therefore, for remedial teaching to be successful, there must be institutional support, teacher training, and appropriate resource allocation.

Methodology

This chapter describes the procedures used to conduct the study. It outlines the research design, population, sample and sampling techniques, research instruments, data collection procedures, data analysis techniques, and ethical considerations. The methodology was carefully chosen to ensure that the study effectively investigates the effects of remedial teaching on the performance of low-achieving students in Algebra.

Research Design

This study adopted a quasi-experimental pre-test and post-test research design. A quasi-experimental design is appropriate for educational settings where random assignment of participants to treatment and control groups is either impractical or ethically challenging (Creswell & Creswell, 2018). In this context, low-achieving students in selected Junior High Schools were identified and exposed to a remedial teaching intervention in Algebra. The students' performance was measured both before (pre-test) and after (post-test) the intervention to determine any statistically significant improvement attributable to the remedial teaching. The pre-test and post-test design is especially suitable for assessing educational interventions because it provides a systematic approach to evaluating change over time within the same group of participants. This design allows for direct comparison of individual student performance before and after the intervention, thereby controlling for between-subject variability (Shadish, Cook & Campbell, 2002). The use of a single group also avoids the complexities associated with forming and managing control groups in natural school settings, where equity and fairness issues often arise.

Justification for the Research Design

1. **Practical and Ethical Considerations**: In real classroom environments, randomly assigning students to different treatment and control groups is often not feasible. Denying some low-achieving students' access to remedial instruction for the sake of forming a control group could be viewed as unethical, especially when the intervention is designed to help improve their academic success. Therefore, the quasi-experimental design provides a pragmatic and ethically sound alternative for evaluating the impact of remedial teaching.

2. **Focus on Within-Subject Change**: By measuring student performance at two different points in time (before and after the intervention), this design allows for within-subject comparisons, reducing the effect of confounding variables such as age, socio-economic background, or general

cognitive ability. It enables the researcher to isolate the effect of the intervention from other factors that may influence performance (Ary et al., 2019).

3. **Efficiency and Accessibility**: The design is relatively easy to implement in school settings with limited resources. Since all participants receive the intervention, the study avoids the need for large sample sizes and complicated logistics associated with randomized control trials (RCTs). This makes it especially useful for small-scale educational research and pilot studies aiming to inform future interventions.

4. **Relevance to Educational Research**: Quasi-experimental designs have been widely used in recent studies examining the effects of remedial teaching, differentiated instruction, and intervention strategies on students' academic performance (Shin et al., 2020; Abdulrahman & Ibrahim, 2021). These studies affirm the validity and reliability of the design in contexts similar to the current research, thereby strengthening the methodological foundation of this study.

In sum, the quasi-experimental pre-test/post-test design was selected for its methodological rigor, ethical appropriateness, and practical applicability in evaluating the effects of remedial teaching on low-achieving students in Algebra.

Population of the Study

The target population comprises Junior High School students in the [Specify Municipality or Region, e.g., Wa Municipality, Ghana] who are identified as low-achievers in mathematics. The accessible population includes students from selected public JHS schools who have consistently scored below 50% in Algebra-related topics based on recent school-based assessments or terminal examination results.

Sample and Sampling Techniques

A purposive sampling technique was used to select two Junior High Schools with a history of organizing remedial programs in mathematics. From these schools, a sample of 40 low-achieving students was selected using criterion-based sampling. The criteria included: Consistent low performance (below 50%) in mathematics. Teacher recommendation based on classroom observation. Willingness to participate in the remedial program. This sampling approach ensures that only students who truly need remedial instruction and meet the study's objectives are included (Creswell & Creswell, 2018).

Research Instruments

The study employed the following instruments:

Algebra Achievement Test (AAT)

The AAT was a teacher-made test consisting of 20 structured items covering key Algebraic concepts such as: Simplifying algebraic expressions, solving linear equations, Factorization and Translating word problems into algebraic equations. The test was administered both as a pre-test (before the intervention) and a post-test (after the intervention). The test items were validated by three mathematics education experts for content validity and clarity.

Questionnaire on Students' Attitudes toward Algebra

A short-structured questionnaire using a 5-point Likert scale was administered before and after the intervention to assess changes in students' attitudes toward Algebra (e.g., confidence, interest, and anxiety). Sample items included: "I find Algebra easy to understand." "I feel confident solving Algebra problems." "I get anxious when I see Algebra questions."

Data Collection Procedures

Pre-Intervention Phase

Parental consent and student assent were obtained. The Algebra Achievement Test (Pre-test) was administered to the selected students. The attitude questionnaire was also completed.

Intervention Phase (Remedial Teaching)

Students participated in a 6-week remedial teaching program. Sessions were held twice a week for 1.5 hours each. Instruction included diagnostic review, simplified explanation of concepts, scaffolded problem-solving, and continuous feedback. Teaching methods included visual aids, real-life applications, and group work.

Post-Intervention Phase

The same AAT (Post-test) was administered. The attitude questionnaire was re-administered to assess changes in students' perceptions. Scores from pre- and post-tests were analyzed to measure performance improvement.

Data Analysis Techniques

Quantitative data from the pre- and post-tests were analyzed using paired sample t-tests to determine whether the remedial teaching led to statistically significant improvements in students' performance. Changes in attitude scores were also analyzed using descriptive statistics (mean and standard deviation) and paired t-tests. Statistical analysis was conducted using SPSS (Statistical Package for Social Sciences). A significance level of $p < 0.05$ was used to determine the statistical significance of findings.

Ethical Considerations

The following ethical measures were observed: Informed consent was obtained from school authorities, parents, and students. Participation was voluntary, and students could withdraw at any time without penalty. Data confidentiality was strictly maintained; all responses were anonymized. The study posed minimal risk, and all instructional support was educationally beneficial.

RESULTS

This chapter presents and discusses the findings of the study based on data collected through pre-tests, post-tests, and attitude questionnaires. The results are presented according to the four research questions and are supported by relevant tables and statistical analysis. The discussions relate the findings to previous literature on remedial teaching and students' performance in Algebra.

Research Question 1: What is the performance level of low-achieving students in Algebra before remedial teaching?

To determine the baseline understanding of Algebra among low-achieving students, a pre-test was administered prior to the remedial teaching intervention. This test aimed to assess students' initial competence and identify specific learning deficiencies that required targeted instruction.

Table 1: Pre-Test Results

Statistic	Value
N (Students)	40
Mean Score	7.35
Standard Deviation	2.87
Minimum Score	3
Maximum Score	12

Table 1 presents the descriptive statistics of students' performance in the pre-test conducted prior to the intervention. A total of 40 students participated in the pre-test. The mean score was 7.35**,** indicating the average level of prior knowledge or ability related to the assessed content. This score suggests a moderate baseline understanding, as it is neither very low nor close to the maximum score. The standard deviation of 2.87 reflects a relatively wide spread of scores, implying some degree of variability in students' prior knowledge. This suggests that while some students may have had a fairly good grasp of the material, others struggled more significantly. The minimum score of 3 and maximum score of 12 further confirm this variation. With a range of 9 points between the lowest and highest scores, the data reveals a diverse group in terms of preparedness, which may have implications for differentiated instructional needs. Overall, these results highlight the importance of the subsequent intervention, as there is clear room for improvement in both the average performance and equity of understanding among the students. The average pre-test score of 7.35 indicates that most students were significantly below the proficiency level in Algebra, justifying the need for remedial intervention. The narrow range of scores shows limited variability in students' prior knowledge, confirming that all participants were struggling with the subject.

Research Question 2: What is the performance level of low-achieving students in Algebra after remedial teaching?

Following the remedial teaching sessions, the same students were given a post-test to measure academic progress and evaluate the effectiveness of the intervention. The goal was to assess whether there was a measurable improvement in their understanding and application of Algebraic concepts.

Table 2: Post-Test Results

Statistic	Value
N (Students)	40
Mean Score	13.10
Standard Deviation	3.15
Minimum Score	7
Maximum Score	18

Table 2 summarizes the descriptive statistics of the students' performance on the post-test following the intervention. The number of participants remained consistent at 40 students, allowing for direct

comparison with the pre-test results. The mean score increased to 13.10, indicating a substantial improvement in students' performance after the intervention. Compared to the pre-test mean of 7.35, this suggests that the instructional strategy or intervention was effective in enhancing students' understanding and skills. The standard deviation of 3.15 is slightly higher than the pre-test (2.87), indicating a marginal increase in the spread of scores. This suggests that while most students improved, the extent of improvement varied, with some students achieving significantly higher gains than others. The minimum score rose to 7, compared to 3 in the pre-test, showing that the lowest-performing students made progress. Similarly, the maximum score increased to 18, up from 12, indicating that the highest-performing students also benefited from the intervention. In summary, the post-test results demonstrate clear academic gains among the students. The increase in the mean score, along with higher minimum and maximum values, suggests overall effectiveness of the intervention in boosting student achievement. However, the slight rise in standard deviation may call for further exploration into differentiated support to ensure all learners progress equitably. The increase in the average score from 7.35 to 13.10 demonstrates a marked improvement in students' performance after remedial instruction. This suggests that the intervention was effective in addressing learning gaps in Algebra.

Research Question 3: What is the effect of remedial teaching on the academic performance of low-achieving students in Algebra?

To determine the significance of the observed improvement in performance, a paired sample t-test was conducted comparing pre-test and post-test scores. This test provides evidence on whether the differences in scores were statistically significant or occurred by chance.

Table 3: Paired Sample T-Test Analysis

Variable	Mean	SD	t	df	Sig. (2-tailed)
Post-Test Score	13.10	3.15			
Pre-Test Score	7.35	2.87	15.61	39	0.000

Table 3 presents the results of a paired sample t-test conducted to compare students' performance before and after the intervention. The purpose of this analysis is to determine whether the observed improvement in scores is statistically significant. The mean post-test score (13.10) is notably higher than the mean pre-test score (7.35)**,** reinforcing the descriptive results from earlier tables. The associated t-value of 15.61 with 39 degrees of freedom indicates a strong effect size and a substantial difference between the two test scores. Most importantly, the p-value (Sig. 2-tailed) is 0.000, which is well below the conventional alpha level of 0.05. This means the improvement in scores is statistically significant, and there is a very low probability that the observed difference occurred by chance. In summary, the paired t-test confirms that the intervention had a significant positive impact on student performance. The substantial difference between pre- and post-test means, combined with the very low p-value, provides strong evidence of the effectiveness of the teaching strategy or instructional tool used. The t-test results confirm that the difference between pre-test and post-test scores is statistically significant ($p < 0.001$), affirming the positive impact of the remedial teaching intervention on students' academic performance in Algebra.

Research Question 4: How does remedial teaching affect students' attitudes toward learning Algebra?

In addition to measuring academic improvement, the study explored whether remedial instruction influenced students' attitudes toward learning Algebra. A pre- and post-intervention attitude questionnaire was administered to capture changes in motivation, interest, and confidence levels.

Table 4: Attitude Questionnaire Summary

Phase	Mean Score	Std. Dev.
Pre-Intervention	2.40	0.62
Post-Intervention	3.85	0.58

Table 4 summarizes the mean scores and standard deviations from an attitude questionnaire administered before and after the intervention. The results provide insights into changes in students' attitudes toward the subject or learning method. The pre-intervention mean score of 2.40 suggests that students initially had a generally negative or neutral attitude. In contrast, the post-intervention mean score of 3.85 reflects a marked improvement, indicating a shift toward a more positive disposition following the intervention. The standard deviations (0.62 pre-intervention and 0.58 post-intervention) are relatively low, suggesting that students' responses were fairly consistent in both phases. Notably, the slight decrease in standard deviation post-intervention implies that students were more uniformly positive in their attitudes after the intervention. Overall, this table indicates a significant positive change in students' attitudes, likely influenced by the intervention. The rise in mean scores supports the notion that not only did students perform better academically (as shown in previous tables), but they also developed a more favorable view of the subject or instructional approach. This dual improvement in cognitive and affective domains strengthens the case for the effectiveness of the intervention. The improvement in attitude scores indicates that students developed a more positive outlook toward Algebra after receiving targeted support. This shift suggests that remedial teaching can enhance not only academic achievement but also emotional engagement with learning.

Discussion of Findings

The findings clearly show that remedial teaching had a significant and positive impact on both the academic performance and attitudes of low-achieving students in Algebra. The improvements observed align with previous studies such as Shin et al. (2020) and Abdulrahman & Ibrahim (2021), who highlighted the benefits of remedial programs for learners struggling in mathematics. The increase in both scores and confidence levels suggests that well-structured remedial interventions can bridge learning gaps and restore students' belief in their ability to succeed in mathematics.

The findings of this study indicate that remedial teaching significantly improves both the academic performance and attitudes of low-achieving students in Algebra. The results are discussed in relation to each research question and supported by relevant literature.

The pre-test results revealed that the participating students had a generally low level of understanding of Algebra, with a mean score of 7.35 out of 20. This confirms prior evidence that many junior high school students struggle with abstract mathematical concepts like Algebra (Mensah & Okyere, 2021). Their initial performance justifies the classification of these students as low-achieving and underscores the urgent need for targeted instructional support. After the intervention, the post-test means increased to 13.10, showing a considerable gain in students' understanding of Algebra. This performance improvement was statistically validated by the paired

sample t-test ($p < 0.001$), which confirms that the observed changes were not due to chance but rather the effect of the remedial teaching intervention. This finding supports the results of earlier studies, such as those by Shin et al. (2020), which demonstrated that remedial mathematics instruction improves comprehension and performance among underperforming students. Moreover, the increase in post-test scores aligns with Abdulrahman and Ibrahim's (2021) findings, which noted that consistent, focused, and adaptive remedial lessons can help struggling learners achieve meaningful academic gains in mathematics. The effectiveness of the intervention may be attributed to several pedagogical strategies embedded in the remedial teaching, including the use of simpler language, step-by-step instruction, ample practice opportunities, and formative feedback methods that have proven successful in facilitating mathematical understanding (Effiong & Eyo, 2022).

Aside from cognitive gains, the study also observed an improvement in students' attitudes toward learning Algebra. Before the intervention, many students reported negative feelings such as anxiety, lack of confidence, and low motivation. The post-intervention attitude scores showed a marked shift, suggesting that the remedial program not only helped students understand Algebra better but also made them more comfortable and confident with the subject. This result is consistent with the theory that academic success and emotional disposition toward learning are interrelated. As noted by Bandura's (1986) Social Cognitive Theory, learners' belief in their abilities self-efficacy greatly influences their motivation and academic behavior. As students began to experience small successes during remedial sessions, their confidence increased, which in turn improved their willingness to engage with mathematical tasks. These findings align with those of Mutai and Ochieng (2020), who emphasized the role of remedial instruction in reshaping learners' perceptions about mathematics. Their study found that when students feel supported and understood, their fear of the subject diminishes, leading to increased participation and better outcomes.

The success of the remedial intervention in this study holds several implications for mathematics education, especially in contexts where many students fall behind. First, it emphasizes the need for differentiated instruction that meets learners at their individual levels of competence. Second, it suggests that remedial teaching should be integrated into the mainstream curriculum or offered as an after-school program to provide continuous support to struggling students. The findings further suggest that student failure in Algebra is not always due to a lack of ability but often a lack of appropriate instructional methods and timely intervention. When these learners are given a chance to re-learn concepts at their pace, with attention to their specific difficulties, they are more likely to succeed.

Summary of the Study

This study investigated the effects of remedial teaching on the academic performance and attitudes of low-achieving students in Algebra. Algebra is a foundational topic in mathematics, yet many students struggle to grasp its abstract concepts, leading to persistent underachievement. The study was guided by four specific research questions:

1. What is the performance level of low-achieving students in Algebra before remedial teaching?
2. What is the performance level of low-achieving students in Algebra after remedial teaching?

3. What is the effect of remedial teaching on the academic performance of low-achieving students in Algebra?

4. How does remedial teaching affect students' attitudes toward learning Algebra?

A quasi-experimental design was adopted, with a sample of 40 low-achieving junior high school students identified through pre-test scores. A remedial intervention was administered over a period of six weeks, after which a post-test and an attitude questionnaire were used to assess learning outcomes. Findings from the pre- and post-tests revealed a significant improvement in students' academic performance, with the average score increasing from 7.35 to 13.10. A paired sample t-test confirmed the statistical significance of this improvement ($p < 0.001$). Additionally, students showed a positive change in their attitudes toward Algebra, with increased motivation, confidence, and interest. These findings highlight the effectiveness of remedial teaching in addressing both academic deficits and affective barriers to learning in mathematics.

Conclusion

Based on the results of the study, the following conclusions were drawn: Remedial teaching significantly enhances the academic performance of students who initially perform poorly in Algebra. The improvement in test scores after the intervention suggests that targeted support and differentiated instruction can effectively address learning gaps. Remedial instruction positively influences students' attitudes toward learning Algebra. As students began to experience academic success, their motivation and confidence also improved, which are critical factors for sustained learning. The study reaffirms that academic underachievement is not necessarily a reflection of low ability, but often a consequence of inadequate instructional approaches, lack of engagement, and insufficient support mechanisms which is consistence with (Gabina et al., 2021). Implementing structured and continuous remedial programs can play a crucial role in helping low-achieving students to not only catch up with their peers but also to develop a positive disposition toward mathematics.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are proposed:

For Teachers: Teachers should identify struggling learners early and offer remedial teaching in key topics like Algebra using simplified explanations, concrete examples, and interactive strategies. Remedial programs should be integrated into regular teaching plans or scheduled after normal school hours for continuous support.

For School Administrators: Schools should allocate resources for remedial instruction, including materials, trained personnel, and time slots within the timetable. Administrators should monitor the effectiveness of remedial programs and ensure they are data-driven and aligned with students' needs.

For Curriculum Planners and Policy Makers: Educational authorities should develop policies that mandate remedial support for underachieving students, especially in mathematics. Curriculum developers should incorporate differentiated learning strategies and remediation guidelines into mathematics syllabi and teacher guides.

For Future Research

Further studies should explore the long-term effects of remedial teaching on mathematics performance. Research can be expanded to include other mathematics topics and diverse student populations to establish broader generalizability.

References

1. Abdulrahman, A. M., & Ibrahim, H. A. (2021). The impact of remedial teaching on secondary school students' academic performance in mathematics. *International Journal of Educational Research*, 105, 101706.
2. Ary, D., Jacobs, L. C., Irvine, C. K. S., & Walker, D. (2019). *Introduction to research in education* (10th ed.). Cengage Learning.
3. Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice Hall.
4. Boateng, A. A., & Oppong, R. A. (2022). Effectiveness of Remedial Mathematics Instruction on Senior High School Students' Academic Performance. *Ghana Journal of Education and Practice, 8*(3), 95–106.
5. Chappell, M. F., Jung, H., & Dingman, S. (2021). Rethinking algebra: Meaningful teaching for long-term understanding. *Journal of Mathematics Teacher Education, 24*(2), 123–140. https://doi.org/10.1007/s10857-020-09466-9
6. Crespo, S. M., & Nicol, C. (2021). Addressing algebraic reasoning: Supporting students in making generalizations. *Mathematics Education Research Journal, 33*(2), 217–232. https://doi.org/10.1007/s13394-020-00336-1
7. Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage Publications.
8. Effiong, A. M., & Eyo, M. P. (2022). Remedial strategies for effective mathematics instruction among underachieving students. *Journal of Mathematics Education*, 6(2), 45–57.
9. Fan, W., & Williams, C. M. (2020). The effects of parental involvement on students' academic self-efficacy, engagement and intrinsic motivation. *Educational Psychology, 40*(4), 450–465.
10. Gabina, S., Jagri, B., Alphaa Mohammed, A., Ahmad Anass, A., Abdul-Mumin, A., Agyei, E., & Boniface Domonaamwin, C. (2021). Factors affecting efficient teaching and learning of mathematics in senior high schools in Wa. *Teacher Education and Curriculum Studies, 6*(3), 81-88. https://doi.org/10.11648/j.tecs.20210603.11
11. Ghana Education Service. (2023). *Chief Examiner's Report on BECE and WASSCE Mathematics Performance*. Accra: GES Publications.
12. Ghana Education Service. (2023). *Chief Examiner's Report on BECE and WASSCE Mathematics Performance*. Accra: GES Publications.
13. Mavuru, L., & Barmby, P. (2021). Bridging learning gaps in mathematics: The role of remedial teaching in South African schools. *African Journal of Research in Mathematics, Science and Technology Education, 25*(2), 155–167.

14. Mavuru, L., & Barmby, P. (2021). Bridging learning gaps in mathematics: The role of remedial teaching in South African schools. *African Journal of Research in Mathematics, Science and Technology Education, 25*(2), 155–167. https://doi.org/10.1080/18117295.2021.1922728
15. Mensah, A. J., & Amankwah, F. (2023). Effects of remedial interventions on students' motivation and performance in mathematics. *Ghanaian Journal of Educational Research, 14*(1), 70–84.
16. Mutai, M., & Ochieng, A. (2020). Students' perceptions of remedial instruction and their academic performance in mathematics in Kenyan secondary schools. *African Journal of Education Studies*, 8(1), 88–104.
17. Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin.
18. Shin, M., Sutherland, D. H., Shin, S., & Conley, A. M. (2020). Can remedial instruction close mathematics gaps? A longitudinal study of middle school intervention programs. *Educational Evaluation and Policy Analysis, 42*(1), 115–137.
19. Shin, M., Sutherland, D. H., Shin, S., & Conley, A. M. (2020). Can remedial instruction close mathematics gaps? A longitudinal study of middle school intervention programs. *Educational Evaluation and Policy Analysis, 42*(1), 115–137. https://doi.org/10.3102/0162373719871787
20. Shin, M., Sutherland, D. H., Shin, S., & Conley, A. M. (2020). Can remedial instruction close mathematics gaps? A longitudinal study of middle school intervention programs. *Educational Evaluation and Policy Analysis, 42*(1), 115–137.
21. Shin, M., Sutherland, D. H., Shin, S., & Conley, A. M. (2020). Can remedial instruction close mathematics gaps? A longitudinal study of middle school intervention programs. *Educational Evaluation and Policy Analysis, 42*(1), 115–137.
22. Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.