

Influence of Biology Remedial Instruction on Students' Academic Achievement in Secondary Schools in Kimaeti Sub-County, Bungoma County, Kenya

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ABSTRACT

The study sought to determine the effect of remedial teaching on students' academic performance in Biology. The study was guided by the Constructivist Theory of Learning advanced by Jean Piaget and Lev Vygotsky. The study adopted a descriptive survey research design. The target population comprised 315 students, 80 teachers, and 20 school administrators drawn from public secondary schools in Kimaeti Sub-County, for a total of 415 respondents. Questionnaires were used to collect quantitative data from students and teachers, while interview schedules were administered to school administrators to collect qualitative data. The validity of the research instruments was established through expert judgment, and reliability was determined using the Cronbach Alpha coefficient. Quantitative data were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 26 and presented using frequencies, percentages, means, and standard deviations. Pearson Product-Moment Correlation was used to determine the relationship between remedial teaching and students' academic achievement in science. Qualitative data were analyzed thematically and presented in narrative form. The study established that remedial teaching had a positive and significant relationship with students' performance in Biology ($r = 0.684$, $p = 0.000$). The findings further revealed that remedial teaching enabled teachers to revisit difficult concepts, provide individualized instruction, and increase students' mastery of scientific concepts, thereby improving academic achievement in science. The study concluded that remedial teaching significantly contributes to improved students' academic achievement in Biology in secondary schools in Kimaeti Sub-County. The study recommends that school administrators institutionalize remedial teaching programs, the Ministry of Education formulate clear guidelines on remedial instruction, and teachers adopt learner-centered remedial approaches that address students' specific learning difficulties in science subjects.

Keywords: Biology remedial instruction, academic achievement, remedial teaching, secondary schools

INTRODUCTION

The academic performance of students in secondary schools is a key area of concern for educators, policymakers, and researchers alike. Academic underperformance in sciences has continued to affect many students in secondary schools in Kimaeti sub-county, Bungoma County. Remedial teaching has been largely adopted as a strategy to address this learning problem. Remedial teaching, defined as targeted instruction designed to help learners who are unable to meet academic standards. These tailored instructional approaches are made to assist and support learners who fall behind their peers in mastering curriculum content. In United Kingdom (UK), United States of America (USA) and Sweden, remedial programs are often known as "intervention classes" or "bridge courses" has been made part of the formal school's curriculum.

Research done in the United States by Johnson et al. (2023) examined the impact of a structured remedial program on students struggling with mathematics. The study involved two groups: one receiving remedial

instruction and a control group receiving standard curriculum. The results showed that learners in the remedial group showed a statistically significant improvement in their mathematics scores, with an increase of 15% compared to the control

group. This study highlights the potential of targeted remedial teaching to enhance academic performance in specific subject areas. A study in the United Kingdom by Smith and Thompson (2024) explored the effects of remedial teaching on reading comprehension among secondary school students. The researchers implemented a tailored reading intervention program over six months. The findings revealed that students who participated in the remedial program demonstrated a marked improvement in reading comprehension skills, with average scores rising by 20%. The study concluded that individualized remedial teaching strategies could effectively address literacy challenges and improve overall academic outcomes.

Research conducted in Australia by Lee and Patel (2025) focused on the long-term effects of remedial teaching on student performance across multiple subjects. This longitudinal study traced students over a period of three academic years, comparing those who received remedial support with their peers who did not. The results indicated that students who engaged in remedial teaching not only improved in the targeted subjects but also exhibited enhanced performance in other areas, suggesting a broader impact of remedial interventions on overall academic achievement. The authors emphasized the importance of sustained support and follow-up to maximize the benefits of remedial teaching.

According to Anderson and Sjoberg (2024) a study done in Sweden reported that structured remedial instructions significantly improved mathematics achievement among underperforming secondary school students, particularly when integrated with formative assessment practices. In the USA, a study done by the National Centre for Education Statistics (NCES, 2022) showed that remedial programs in community and low-income school districts had a statistically significant effect on learners' retention and graduation. Asio and Jimenez (2020), conducted a study in Philippines found out that there are significant differences in the scores of students after remedial intervention and it concluded that remedial activities can positively improve the academic performance of students.

UNICEF (2021-2023) Initiated a remedial learning program in Rwanda which reached out to 25000 students, 150 schools showed improved literacy and numeracy skills among learners. In Nigeria, a study by Olanrewaju and Yusuf (2021) found out that remedial classes offered outside regular school hours improved students' performance in core subjects, especially for learners from underprivileged backgrounds. Another study by Mugo (2021) done in Uganda indicated that remedial programs have led to improved students' retention and performance.

Nyandivi, Muigiranzi and Letanzio (2024) in Rwanda found out that participation in remedial classes was strongly correlated with improved academic performance among secondary school students. Masengesho and Adala (2024) reported that remedial programs significantly improved the performance in mathematics of slow learners in lower secondary schools. Niyibizi and Kazinyiro (2024) found out that remedial strategies in mathematics and sciences positively affected senior one student's academic achievement.

In Kenya, the ministry of education has recognized the importance of remedial teaching in its policies putting a lot of weight on the need for targeted support for struggling learners (Kenya Ministry of Education -MOE 2021). A study by Ochieng and Okwach (2021) highlights that remedial programs significantly improve students' understanding of core subjects such as mathematics and sciences, which are often perceived to be challenging to students. Aching and Kamau (2023) explored the relationship between students' motivation and academic performance in a remedial setting; the study indicated that students who perceived remedial teaching as a supportive rather than punitive measure showed high level of engagement and improved academic outcomes.

Wekesa and Nyongesa (2023) examined socio-economic status and the effectiveness of remedial teaching. The researchers established that students from lower socioeconomic backgrounds benefited greatly from remedial interventions, as these programs provided additional academic support that was often lacking in their home environment. According to a study by Mwangi et al. (2023), remedial teaching has been shown to significantly improve students' understanding of core concepts, thereby boosting their overall academic performance. The study highlights that students who took part in structured remedial programs exhibited a marked improvement in their grades compared to those who did not receive such interventions. Otieno and Wanjiru (2024) emphasizes that differentiated instruction within remedial programs can cater to the unique learning styles of students, thereby enhancing engagement and retention of knowledge. This aligns with Vygotsky's theory of the Zone of Proximal Development, which posits that learners benefit from guidance that is tailored to their current level of understanding.

A study conducted by Kamau et al. (2025) reveals that students from disadvantaged backgrounds often face additional barriers to academic success, such as lack of resources and support at home. The study advocates for the integration of socio-emotional learning components within remedial programs to deal with these challenges holistically. By fostering a supportive learning environment, educators can enhance the efficacy of remedial teaching and promote better academic outcomes. According to a study by Njeri and Muthoni (2024), the incorporation of digital tools in remedial teaching engages students and also provides immediate feedback, which is essential for reinforcing learning. This technological integration is particularly relevant in the context of the corona pandemic, which has necessitated a shift towards blended learning approaches. Study will be interested in sciences subjects which has remained a challenge to both teachers and students in secondary schools in Bungoma county and particularly Kimaeti Sub County. Most students in schools from this sub county have underperformed in national examination despite regular additional time for remedial classes to encourage low performing students to improve on their academic achievement especially in KCSE examinations.

Problem Statement

Biology remains one of the most important science subjects in Kenya's secondary school curriculum because it provides foundational knowledge for numerous science-based careers and contributes significantly to national scientific and technological development. Despite its importance, many students continue to perform below expectations in the Kenya Certificate of Secondary Education (KCSE) Biology examination. In Kenya, the system of education is designed in such a way that secondary school students are expected to attain satisfactory academic achievement in science subjects Biology, through effective classroom instruction that accommodates diverse learning needs. Remedial teaching, when properly planned and implemented, should systematically identify learners with learning gaps and provide focused, individualized support to enable them to master foundational scientific concepts. Such instructional interventions are expected to reduce performance disparities, improve overall achievement, and strengthen students' preparedness for advanced scientific studies and science-related careers.

Nevertheless, the current situation in Kenya, particularly in public secondary schools in Kimaeti Sub-County, Bungoma County, reveals persistent underachievement in science subjects as evidenced by national examination results and school-based assessments. A significant proportion of students consistently perform below average in Biology. While remedial teaching is occasionally implemented in some schools, it is often non-targeted, irregular, inadequately resourced, and teacher-dependent, lacking a clear framework for diagnosing learners' specific academic needs. In many cases, remedial lessons are generalized, exam-oriented, or conducted without empirical evidence of their effectiveness, thereby limiting their potential impact on learners' academic achievement. If this situation remains unaddressed, there shall be far-reaching consequences. Continued poor performance in science subjects may lead to low enrollment in science-based courses, diminished interest in STEM careers, increased school dropout rates, and reduced competitiveness of Kenyan learners in science and technology fields. At the local level, students in Kimaeti Sub-County risk

being marginalized in postsecondary education and employment opportunities that increasingly demand strong scientific competencies. For teachers and schools, ineffective remedial practices may result in wasted instructional time, learner demotivation, and persistent achievement gaps despite increased academic support efforts. Despite the critical role that targeted remedial teaching is presumed to play in improving academic achievement, there is limited empirical evidence documenting its effectiveness across the three core science subjects at the secondary school level within the Kenyan context, and specifically in Kimaeti Sub-County. Therefore, this study seeks to investigate the influence of remedial teaching on students' academic achievement in Biology in secondary schools in Kimaeti Sub-County, Bungoma County, Kenya, giving information that will help in teaching strategies and educational policy.

THEORETICAL LITERATURE

Constructivist Learning Theory

This study is anchored on **Constructivist Learning Theory**, advanced principally by **Jean Piaget (1952)** and later enriched by **Lev Vygotsky (1978)**. The theory posits that learning is an active process in which learners construct new knowledge by integrating new experiences with existing cognitive structures rather than passively receiving information from teachers. Effective learning therefore occurs when learners actively engage with concepts, solve problems, reflect on their experiences, and receive appropriate instructional support that enables them to reconstruct their understanding. Constructivism emphasizes learner-centred instruction, continuous interaction, collaborative learning, and guided discovery as essential conditions for meaningful learning.

According to Piaget (1952), learners progress through stages of cognitive development, with knowledge acquisition occurring through the processes of assimilation and accommodation. Assimilation involves integrating new information into existing cognitive structures, while accommodation requires modifying existing knowledge structures to incorporate new experiences. Biology contains numerous abstract concepts, including genetics, evolution, ecology, physiology, and cellular processes, which often require learners to reorganize their existing understanding. Learners who fail to achieve this cognitive restructuring may develop misconceptions that hinder subsequent learning. Biology remedial instruction provides additional opportunities for learners to revisit challenging concepts, receive clarification, and gradually reconstruct accurate scientific understanding.

Vygotsky (1978) extended constructivist thinking through the concept of the **Zone of Proximal Development (ZPD)**, which refers to the difference between what learners can accomplish independently and what they can achieve with guidance from more knowledgeable individuals such as teachers or peers. Within remedial instruction, teachers scaffold learning by providing explanations, demonstrations, guided practice, questioning techniques, and timely feedback until learners develop sufficient competence to solve problems independently. Constructivist Learning Theory further emphasizes the importance of social interaction in knowledge construction. Biology learning is enhanced when learners participate in discussions, practical investigations, collaborative experiments, peer tutoring, and problem-solving activities. Remedial instruction creates smaller and more interactive learning environments where learners freely ask questions, receive individualized assistance, and participate actively in classroom activities. Such environments promote deeper conceptual understanding than traditional teacher-centred instruction.

The theory also recognizes that learners differ in their cognitive abilities, learning pace, prior knowledge, and educational needs. Consequently, effective instruction should be differentiated to accommodate individual learning differences. Biology remedial programmes embody this principle by allowing teachers to identify specific learner weaknesses and design targeted instructional interventions. Through differentiated instruction, teachers can employ multiple teaching strategies, including practical demonstrations, visual

representations, laboratory activities, concept mapping, simulations, and individualized coaching to address diverse learning needs.

Recent educational research continues to support the relevance of Constructivist Learning Theory in science education. Studies have demonstrated that learner-centred instructional approaches improve conceptual understanding, critical thinking, scientific reasoning, and long-term knowledge retention. Biology learners exposed to inquiry-based learning, collaborative problem-solving, laboratory investigations, and continuous formative assessment consistently demonstrate higher academic achievement than learners taught primarily through lecture-based instruction.

The application of Constructivist Learning Theory is particularly relevant within Kenyan secondary schools, where Biology remains one of the most conceptually demanding science subjects. Many learners experience difficulties understanding abstract biological concepts due to large class sizes, limited laboratory experiences, inadequate instructional time, and diverse learner abilities. Biology remedial instruction provides opportunities to overcome these challenges by allowing teachers to reinforce difficult concepts, provide individualized support, and promote active learner participation beyond regular classroom instruction. Despite its strengths, Constructivist Learning Theory has certain limitations. The theory assumes that teachers possess adequate professional competence and sufficient instructional resources to facilitate learner-centred instruction effectively.

Empirical Literature Review

Globally, remedial instruction has become an important educational intervention for addressing learning difficulties and improving students' academic achievement. Educational systems increasingly recognize that learners progress at different rates and therefore require differentiated instructional support beyond regular classroom teaching. In science education, remedial programmes have been widely implemented to strengthen conceptual understanding, improve practical competencies, and enhance examination performance.

A systematic review by **Hattie (2023)** identified targeted remedial instruction as one of the instructional strategies associated with substantial improvements in learner achievement. The review concluded that individualized feedback, additional instructional time, continuous assessment, and differentiated teaching significantly enhance learners' understanding of complex concepts. The study emphasized that remedial programmes are most effective when they address learners' specific academic weaknesses rather than merely repeating regular classroom lessons.

Similarly, **Slavin (2021)** found that structured small-group remedial instruction significantly improved science achievement among struggling learners. Students who participated in teacher-guided remedial programmes demonstrated greater conceptual understanding, improved problem-solving skills, and higher examination scores than students receiving only conventional classroom instruction. The study attributed these improvements to individualized attention, active learner participation, and continuous formative assessment.

Research conducted by **OECD (2023)** further demonstrated that schools implementing targeted academic support programmes recorded improved learner outcomes in science subjects. The report emphasized that early identification of learning difficulties followed by structured remedial interventions reduces achievement gaps while improving learner confidence and classroom engagement.

Although these international studies provide strong evidence supporting remedial instruction, their findings originate largely from developed educational systems characterized by relatively adequate instructional resources, lower teacher-learner ratios, and well-equipped laboratories. Consequently, direct generalization to developing countries should be undertaken cautiously.

Across Africa, improving science education has become a strategic priority because scientific knowledge contributes directly to economic development, technological innovation, and improved healthcare. Nevertheless, Biology remains one of the subjects in which many learners continue to experience persistent academic difficulties.

A study by **Adu-Gyamfi and Ampofo (2022)** in Ghana established that Biology remedial instruction significantly improved learners' conceptual understanding and examination performance. The researchers reported that learners participating in structured remedial programmes demonstrated greater confidence, improved classroom participation, and higher academic achievement than learners who did not receive additional instructional support.

Similarly, **Mahlobo and Nkosi (2023)** investigated supplementary science instruction in South African secondary schools and found that remedial programmes focusing on difficult Biology concepts significantly improved learner achievement. Teachers reported that individualized coaching, practical demonstrations, and frequent formative assessment enabled learners to overcome misconceptions that had previously affected examination performance.

In Uganda, **Kato, Namusoke, and Ssempala (2022)** reported that learners attending structured Biology remedial classes achieved significantly higher scores in national science examinations than their counterparts. The researchers attributed these improvements to increased instructional time, learner-centred teaching approaches, collaborative learning, and continuous teacher feedback.

Mwangi (2021) found that remedial Biology lessons significantly enhanced learners' understanding of difficult concepts through individualized instruction and continuous teacher support. Learners participating regularly in remedial programmes demonstrated improved classroom participation and higher examination performance compared to those who relied solely on regular classroom instruction.

Similarly, **Ochieng (2022)** established that differentiated remedial instruction improved Biology achievement by allowing teachers to diagnose individual learning difficulties and provide targeted academic assistance. The study concluded that remedial programmes were particularly beneficial for learners experiencing persistent conceptual challenges in genetics, ecology, and human physiology.

Research by **Karanja (2022)** further demonstrated that teacher professional competence significantly influences the effectiveness of remedial instruction. Schools employing qualified Biology teachers who utilized learner-centred instructional approaches achieved better learner outcomes than schools relying primarily on lecture-based revision methods.

Ndung'u (2023) observed that Biology remedial programmes incorporating practical laboratory demonstrations produced significantly higher learner achievement than programmes emphasizing theoretical revision alone. Practical investigations enhanced conceptual understanding by enabling learners to relate theoretical knowledge to observable biological processes.

Likewise, **Wanjiru (2023)** established that learner motivation positively influenced participation in remedial classes. Students who perceived remedial instruction as supportive rather than punitive attended lessons more consistently and achieved better examination results. The study recommended strengthening learner motivation through positive teacher attitudes, individualized encouragement, and continuous academic feedback.

Although these Kenyan studies consistently support the effectiveness of Biology remedial instruction, they also identify persistent implementation challenges, including inadequate laboratory resources, teacher shortages, overcrowded classrooms, learner absenteeism, and limited administrative support. Moreover, relatively few studies have focused specifically on secondary schools in Bungoma County, particularly

Kimaeti Sub-County. Most available studies have concentrated on urban counties or examined science education generally without isolating Biology as an independent subject.

Synthesis of the Literature and Research Gap

The reviewed literature consistently demonstrates that Biology remedial instruction positively influences students' academic achievement through individualized support, differentiated teaching, guided practice, continuous assessment, and reinforcement of difficult concepts. Constructivist Learning Theory provides an appropriate explanation for these outcomes by emphasizing active learner participation, scaffolding, and knowledge construction. Empirical evidence from developed countries, African nations, and Kenya generally supports the effectiveness of remedial instruction in improving learners' conceptual understanding, confidence, and examination performance.

However, important knowledge gaps remain. First, many previous studies have investigated remedial teaching generally without focusing specifically on Biology, despite the subject's unique conceptual and practical demands. Second, relatively few studies have examined the effectiveness of Biology remedial instruction within rural secondary schools in western Kenya. Third, contextual factors influencing the implementation and effectiveness of remedial programmes in Kimaeti Sub-County remain insufficiently documented. Consequently, this study sought to determine the influence of Biology remedial instruction on students' academic achievement in secondary schools in Kimaeti Sub-County, Bungoma County, thereby providing context-specific evidence to inform educational policy and instructional practice.

Conceptual Framework

INDEPENDENT VARIABLE

BIOLOGY REMEDIAL INSTRUCTION

- Instructional strategies (one-on-one tutoring)
- Content focus (Biology topics)
- Duration and frequency of sessions
- Teacher feedback techniques
- Use of practical learning

DEPENDENT VARIABLE

ACADEMIC ACHIEVEMENT

- Scores in Biology

METHODOLOGY

This study adopted a mixed-methods research design integrating quantitative and qualitative approaches to determine the influence of Biology remedial instruction on students' academic achievement in secondary schools in Kimaeti Sub-County, Bungoma County. The study was conducted in public secondary schools within Kimaeti Sub-County, where remedial teaching programmes have been implemented to improve learners' performance in science subjects. The target population comprised secondary school students, Biology teachers, principals, and Heads of Science Departments. A representative sample was selected using stratified random sampling for students and purposive sampling for teachers and school administrators to ensure that respondents possessed adequate knowledge regarding remedial instruction practices. Data were collected using structured questionnaires administered to students and teachers, interview schedules for principals and Heads of Science Departments, classroom observation schedules, and document analysis of students' academic records. The research instruments underwent expert review to establish content validity. At the same time, a pilot study conducted in secondary schools outside the study area was used to assess reliability using Cronbach's Alpha coefficient, with a coefficient of $\alpha \geq 0.70$ considered acceptable. . Pearson

Product Moment Correlation was employed to examine the relationship between Biology remedial instruction and students' academic achievement at the 5% level of significance ($p < 0.05$). Qualitative data obtained through interviews were analysed thematically, and the findings were triangulated with quantitative results to provide a comprehensive interpretation of the influence of Biology remedial instruction on students' academic achievement.

RESULTS AND DISCUSSION

Table 1 Descriptive Findings on Influence of Remedial Teaching on Students' Performance in Biology

Statement	Mean	Std. Dev	Interpretation
Remedial lessons focus on difficult biology topics.	4.15	0.81	Agree
Teachers use different teaching methods.	4.08	0.84	Agree
Practical demonstrations are used.	3.92	0.88	Agree
The duration of remedial lessons is adequate.	3.78	0.92	Agree
My performance in biology has improved after attending remedial classes.	4.24	0.75	Strongly agree

Composite Mean = 4.03

Source: Field data 2026

The composite mean score of 4.03 indicates that respondents generally agreed that remedial teaching positively influences Biology performance. The relatively low standard deviations (0.75–0.92) indicate consistency in respondents' opinions, suggesting that most students shared similar perceptions regarding the effectiveness of remedial teaching. The highest-rated statement was that students' performance improved after attending remedial classes ($M = 4.24$), implying that remedial instruction contributes substantially to better understanding of Biology concepts. The findings also demonstrate that focusing on difficult topics, employing varied teaching methods, and incorporating practical demonstrations enhance students' mastery of Biology.

Correlation Analysis

Table 2 Correlation Analysis of Influence of Remedial Teaching on Students' Performance in Biology

Variables	Pearson Correlation (r)	Sig.
Remedial Teaching and Biology Performance	0.684	0.000

Table 2 shows that there was a strong positive and statistically significant relationship between remedial teaching and students' academic performance in Biology ($r = 0.684$, $p = 0.000$). The positive Pearson correlation coefficient indicates that as the quality and frequency of remedial teaching increase, students' performance in Biology also improves. Since the significance value ($p = 0.000$) is less than the 0.05 level of significance, the relationship is statistically significant and is unlikely to have occurred by chance.

The findings imply that remedial teaching contributes substantially to improving students' understanding of Biology concepts by providing additional instructional time, individualized support, revision of difficult topics, and continuous teacher guidance. Biology requires learners to understand complex scientific processes and practical applications, and remedial lessons provide opportunities for reinforcement that may not be possible during normal classroom instruction. The strength of the correlation suggests that remedial teaching is an effective intervention for improving Biology achievement among secondary school students in Kimaeti

Sub-County. These findings therefore answer the first research objective by demonstrating that remedial teaching has a significant positive influence on students' academic performance in Biology.

CONCLUSION

The study established that Biology remedial instruction exerts a significant positive influence on students' academic achievement in secondary schools in Kimaeti Sub-County, Bungoma County. Descriptive findings demonstrated that learners perceived remedial instruction as beneficial in improving conceptual understanding, strengthening revision of difficult topics, enhancing teacher support, and increasing examination preparedness. Inferential analysis further confirmed a strong positive and statistically significant relationship between Biology remedial instruction and academic achievement ($r = 0.684$, $p < 0.05$), indicating that improvements in remedial teaching are associated with improved learner performance. The findings support Constructivist Learning Theory by demonstrating that individualized guidance, active learner participation, and continuous instructional support enhance meaningful learning and academic success. Biology remedial instruction therefore represents an effective pedagogical intervention capable of addressing learning difficulties and improving students' academic achievement when implemented systematically and supported by qualified teachers and adequate instructional resources.

Recommendations

Based on the findings, the study recommends that school administrators institutionalize structured Biology remedial programmes that focus on difficult concepts, practical demonstrations, individualized learner support, and continuous formative assessment. Teachers should adopt learner-centred instructional approaches that encourage active participation, collaborative learning, and timely feedback during remedial sessions. The Ministry of Education and the Teachers Service Commission should strengthen teacher capacity through regular professional development programmes focusing on remedial instructional strategies and differentiated teaching methods. Schools should also invest in adequate Biology laboratory facilities, instructional materials, and learning technologies to support effective remedial instruction. Finally, students should be encouraged to participate consistently in remedial classes, while parents should provide moral and academic support that reinforces learners' commitment to improving their performance in Biology.

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