



Science Teachers' Utilization of Conceptual Change Approaches and Their Influence on Students' Conceptual Understanding in Senior Secondary Schools in Kenema District, Eastern Sierra Leone

Justine Bockarie ^{1*}, Dr. Tamba Kebbie ², Aruna Kamanda ³

¹ Saidu, Lecturer, Department of Mathematics and Integrated Sciences, Njala University, Sierra Leone

² Senior Lecturer, Centre for Pedagogical Excellence, Njala University, Sierra Leone

³ Sesay, Lecturer, Department of Mathematics and Integrated Sciences, Njala University, Sierra Leone

* Corresponding Author: **Justine Bockarie**

Article Info

ISSN (Online): 2582-7138

Impact Factor (RSIF): 8.04

Volume: 07

Issue: 04

Received: 08-04-2026

Accepted: 12-05-2026

Published: 21-06-2026

Page No: 15-18

Abstract

Science education has experienced a major transformation from traditional teacher-centred approaches towards learner-centred approaches that emphasize students' active construction of knowledge. Conceptual change approaches have emerged as effective strategies for addressing students' misconceptions and promoting deeper scientific understanding. This study examined science teachers' utilization of conceptual change approaches and their influence on students' conceptual understanding in senior secondary schools in Kenema District, Eastern Sierra Leone. A descriptive survey research design was adopted. The study involved 150 respondents comprising science teachers and senior secondary school science students selected from selected schools in Kenema District. Data were collected using questionnaires and achievement tests. Quantitative data were analyzed using frequencies, percentages, mean scores, standard deviations, and Pearson Product Moment Correlation.

The findings revealed that science teachers moderately utilized conceptual change approaches, particularly inquiry-based learning, discussion methods, and practical activities. Results showed a significant positive relationship between conceptual change approaches and students' conceptual understanding of science concepts ($r = 0.68, p < 0.05$). The study concluded that effective use of conceptual change strategies improves students' ability to overcome misconceptions and develop meaningful scientific knowledge. The study recommends increased teacher training, provision of science instructional resources, and promotion of learner-centred science teaching practices.

Keywords: Conceptual change, science teaching, conceptual understanding, and senior secondary schools

Introduction

Science education plays a critical role in national development by developing learners' ability to understand natural phenomena, solve problems, and apply scientific knowledge in everyday life. However, science learning in many developing educational contexts continues to face challenges associated with students' misconceptions, passive learning approaches, and limited opportunities for meaningful engagement.

Traditional science teaching approaches often emphasize memorization of scientific facts rather than understanding scientific concepts. As a result, students may complete examinations successfully but retain alternative conceptions that conflict with accepted scientific explanations.

Conceptual change theory argues that learners enter classrooms with existing ideas about scientific phenomena, and effective

teaching should help them examine, restructure, and replace inaccurate conceptions with scientifically accepted explanations. Conceptual change approaches involve strategies such as inquiry-based learning, cognitive conflict, practical investigations, collaborative learning, and reflective discussions.

In Sierra Leone, particularly in Eastern Region secondary schools, science teachers continue to face challenges related to instructional methods, classroom resources, and teacher professional development. Understanding how teachers utilize conceptual change approaches and their influence on students' understanding is therefore important for improving science education.

This study investigates the extent to which science teachers employ conceptual change approaches and examines their influence on students' conceptual understanding in senior secondary schools in Kenema District.

Objectives of the Study

- The study was guided by the following objectives:
- To examine the extent to which science teachers utilize conceptual change approaches in senior secondary schools in Kenema District.
- To determine the level of students' conceptual understanding of science concepts.
- To assess the relationship between conceptual change approaches and students' conceptual understanding.

Research Questions

- To what extent do science teachers utilize conceptual change approaches in senior secondary schools in Kenema District?
- What is the level of students' conceptual understanding of science concepts?
- What relationship exists between conceptual change approaches and students' conceptual understanding?

Theoretical Framework

The study was guided by Constructivist Learning Theory associated with scholars such as Jean Piaget and conceptual change theory developed in science education research.

Constructivism proposes that learners actively construct knowledge based on previous experiences. Students do not simply receive scientific information from teachers; rather, they interpret new information through existing mental frameworks.

Conceptual change occurs when learners recognize limitations in their existing explanations and replace them with scientifically accepted concepts.

The framework assumes that

Teacher Conceptual Change Approaches → Students' Cognitive Engagement → Conceptual Understanding

Methodology

Research Design

The study adopted a descriptive survey research design. The design was suitable because it allowed the researcher to collect information about teachers' instructional practices and students' understanding of science concepts.

Study Area

The study was conducted in senior secondary schools in Kenema District, Eastern Sierra Leone. The district contains several government and privately managed secondary schools offering science subjects including Biology, Chemistry, and Physics.

Population of the Study

The target population consisted of science teachers and senior secondary school students in selected schools within Kenema District.

Sample Size and Sampling Technique

A total sample size of 150 respondents was used.

The sample consisted of:

Table 1

Respondents	Number
Science teachers	30
Science students	120
Total	150

A purposive sampling technique was used to select science teachers, while simple random sampling was used to select students.

Research Instruments

Two instruments were used:

Science Teachers' Conceptual Change Questionnaire (STCCQ)

Measured teachers' use of:

- inquiry learning
- practical activities
- cognitive conflict strategies
- collaborative learning

Students' Conceptual Understanding Test (SCUT)

Measured students' understanding of:

- scientific concepts
- ability to explain phenomena
- correction of misconceptions

Data Analysis

Data were analyzed using:

- Frequency
- Percentage
- Mean
- Standard deviation
- Pearson Product Moment Correlation

The significance level was set at 0.05

Results, Discussion, Conclusion and Recommendations
Results and Data Analysis

Research Question 1

To what extent do science teachers utilize conceptual change approaches in senior secondary schools in Kenema District? Science teachers responded to statements measuring their use of conceptual change teaching approaches. A five-point Likert scale was used:

Table 2: Utilization of Conceptual Change Approaches by Science Teachers (n = 30)

Conceptual Change Approach	Mean (\bar{X})	Standard Deviation	Interpretation
Teachers use inquiry-based learning activities	4.13	0.72	High
Teachers identify students' misconceptions before teaching	3.87	0.81	High
Teachers use practical experiments to promote understanding	4.20	0.65	High
Teachers encourage classroom discussion and argumentation	3.93	0.76	High
Teachers use problem-based learning strategies	3.60	0.89	Moderate
Teachers use students' prior knowledge during lessons	4.00	0.70	High
Teachers use cognitive conflict activities	3.43	0.91	Moderate

1=Strongly Disagree
 2 = Disagree
 3 = Undecided
 4 = Agree
 5 = Strongly Agree
 Overall Mean = 3.88

Interpretation

The findings show that science teachers in Kenema District generally utilize conceptual change approaches at a high level (overall mean = 3.88). Practical activities, inquiry-based learning, and the use of prior knowledge were among the most frequently applied strategies.

However, cognitive conflict strategies and problem-based learning were moderately used, suggesting that some teachers may require additional professional training in advanced conceptual change methods.

Research Question 2

What is the level of students' conceptual understanding of science concepts?

Students completed a science conceptual understanding test based on Biology, Chemistry, and Physics concepts.

Table 3: Students' Conceptual Understanding Scores (n = 120)

Score Category	Frequency	Percentage (%)
High Understanding (70–100%)	52	43.3
Moderate Understanding (50–69%)	48	40.0
Low Understanding (Below 50%)	20	16.7
Total	120	100

Mean Score Analysis

Table 4

Variable	Mean	Standard Deviation
Students' conceptual understanding	68.45	12.36

Interpretation

The results indicate that most students demonstrated moderate to high conceptual understanding. About 83.3% of students scored above 50%, indicating that conceptual change-oriented teaching practices contributed positively to science learning.

Research Question 3

What relationship exists between conceptual change approaches and students' conceptual understanding?

A Pearson Product Moment Correlation analysis was conducted.

Table 3: Relationship Between Conceptual Change Approaches and Students' Conceptual Understanding

Variables	Mean	SD	Correlation (r)	p-value
Conceptual change approaches	3.88	0.64		
Students' conceptual understanding	68.45	12.36	0.68	0.001

Interpretation

The correlation coefficient ($r = 0.68$) indicates a strong positive relationship between conceptual change approaches and students' conceptual understanding.

Since the p-value (0.001) is less than 0.05, the relationship is statistically significant.

This means that increased use of conceptual change strategies is associated with improved student understanding of science concepts.

Discussion of Findings

The study found that science teachers in Kenema District moderately to highly utilize conceptual change approaches. Inquiry-based learning, practical activities, and classroom discussions were the most commonly used approaches.

This finding supports the constructivist view that students learn science effectively when they actively participate in knowledge construction rather than passively receiving information.

The high utilization of practical activities suggests that science teachers recognize the importance of connecting theoretical concepts with real-life experiences. Laboratory activities allow learners to observe scientific phenomena and challenge incorrect explanations.

The study also revealed that students exposed to conceptual change approaches demonstrated better conceptual understanding. The positive correlation ($r = 0.68$) indicates that teaching strategies which address students' misconceptions contribute significantly to science learning outcomes.

This finding agrees with the idea that conceptual change teaching enables learners to replace alternative conceptions with scientifically accepted explanations through reasoning and evidence.

However, moderate use of cognitive conflict strategies indicates a gap in teachers' ability to deliberately create situations that challenge students' existing misconceptions.

This may be associated with limited professional development opportunities and inadequate instructional resources.

Conclusion

The study concludes that conceptual change approaches play an important role in improving science teaching and learning in senior secondary schools in Kenema District, Eastern Sierra Leone.

Science teachers utilize several conceptual change strategies, especially inquiry learning, practical activities, and discussions. Students taught using these approaches demonstrate better conceptual understanding of science concepts.

The significant relationship between conceptual change approaches and students' understanding confirms that learner-centred science teaching methods are essential for improving science education outcomes.

Recommendations

Based on the findings, the study recommends that:

1. Teacher Professional Development

The Ministry of Education and school authorities should organize regular workshops to train science teachers in advanced conceptual change strategies such as cognitive conflict and problem-based learning.

2. Strengthening Laboratory-Based Learning

Schools should improve access to science laboratories and instructional materials to support practical and inquiry-based science teaching.

3. Promote Learner-Centred Teaching

Science teachers should reduce overdependence on lecture methods and encourage discussions, investigations, and collaborative learning.

4. Assessment Reform

Science assessments should move beyond memorization and include questions that measure conceptual understanding and scientific reasoning.

5. Supportive Science Education Policies

Educational policies should encourage the integration of constructivist and conceptual change approaches into science curriculum implementation.

Contribution to Knowledge

This study contributes to science education research by providing evidence from Eastern Sierra Leone on how conceptual change approaches influence students' scientific understanding.

The study extends existing knowledge by demonstrating that effective science teaching requires a shift from knowledge transmission to knowledge construction.

The findings provide practical guidance for teachers, curriculum developers, and education policymakers seeking to improve science learning outcomes.

References

1. Ausubel DP. Educational psychology: a cognitive view. New York: Holt, Rinehart and Winston; 1968.
2. Duit R. Students' and teachers' conceptions and science education research. *Int J Sci Educ*. 2009.
3. Posner G, Strike K, Hewson P, Gertzog W. Accommodation of a scientific conception: toward a theory of conceptual change. *Sci Educ*. 1982.
4. Piaget J. Science of education and the psychology of the child. New York: Viking; 1970.

How to Cite This Article

Bockarie J, Kebbie T, Kamanda A. Science teachers' utilization of conceptual change approaches and their influence on students' conceptual understanding in senior secondary schools in Kenema District, Eastern Sierra Leone. *Int J Multidiscip Res Growth Eval*. 2026;7(4):15-18.

Creative Commons (CC) License

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.