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INVESTIGATING LEARNER-CENTERED TEACHING APPROACHES IN BIOLOGY CLASSROOMS IN ZAMBIA: INSIGHTS FROM CENTRAL PROVINCE

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Abstract
This study explores the implementation of learner-centered teaching (LCT) approaches in Biology education across selected secondary schools in Zambia's Central Province. A qualitative descriptive design was used, incorporating interviews, classroom observations, and questionnaires with 12 Biology teachers and 120 students. Findings revealed mixed understanding and application of LCT strategies. While group work and discussions were frequently cited, many educators conflated LCT with laboratory-based instruction only. Teachers reported challenges including large class sizes, limited teaching materials, syllabus overload, and lack of training. Despite these barriers, positive links were found between LCT-aligned lesson planning, delivery, and student learning. The study concludes that while LCT is recognized as beneficial, effective implementation requires systemic support including ongoing teacher training, reduced class sizes, and improved curriculum resources.

Keywords
*Learner-Centered Teaching, Biology Education, Secondary Schools, Pedagogical Strategies, Central Province, Zambia, Teacher Training, Curriculum Implementatio*n.

1. Introduction

In recent decades, education systems globally have shifted toward pedagogical models that emphasize active learner engagement, critical thinking, and collaborative knowledge construction. This transition from traditional teacher-centered instruction to learner-centered teaching (LCT) reflects a broader commitment to equipping students with 21st-century skills such as inquiry, creativity, communication, and autonomy in learning. In science education—and biology in particular—learner-centered methodologies are especially vital due to the subject's practical, exploratory, and interdisciplinary nature. Zambia's Ministry of Education, through various policy reforms and curriculum updates, has promoted learner-centered approaches at all levels of the education system. The Revised Zambian Curriculum and teacher education frameworks explicitly advocate for active, participatory, and inclusive classroom environments. In biology, these reforms are intended to support learners in connecting theoretical concepts with real-life applications,

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fostering both conceptual understanding and scientific literacy. However, despite these progressive policy directions, the actual implementation of learner-centered teaching remains inconsistent across many schools, particularly in resource-constrained regions.

In Central Province—one of Zambia's key educational regions—biology remains a core subject within the natural sciences cluster. Yet anecdotal evidence and periodic assessments suggest that traditional pedagogies continue to dominate many classrooms, limiting opportunities for students to engage meaningfully with content. Teachers often cite challenges such as large class sizes, rigid syllabi, limited laboratory equipment, and a lack of in-service training as barriers to adopting more interactive teaching strategies. This study investigates the extent to which learner-centered teaching approaches are understood, practiced, and sustained in biology classrooms across selected secondary schools in Central Province. By analyzing the experiences of teachers and students, and observing classroom dynamics, the research aims to provide grounded insights into the enablers and constraints of effective LCT implementation. Understanding these dynamics is essential not only for improving biology education but also for informing broader pedagogical reforms across Zambia's secondary education sector.

2. Research Objectives and Questions

This study was designed to evaluate the understanding, application, and effectiveness of learner-centered teaching (LCT) strategies in biology classrooms across secondary schools in Zambia's Central Province. It also aimed to identify the structural and pedagogical challenges faced by educators and assess the impact of these strategies on student engagement and learning outcomes.

2.1 General Objective

To investigate the implementation of learner-centered teaching approaches in biology education in selected secondary schools in Central Province, Zambia.

2.2 Specific Objectives

- To examine biology teachers' understanding and interpretation of learner-centered teaching strategies.
- To evaluate how frequently and effectively LCT approaches are integrated into classroom instruction.
- To identify the challenges that hinder the practical application of learner-centered methodologies in biology teaching.
- To explore students' perceptions and experiences with LCT-based lessons.
- To propose actionable strategies to support and sustain effective LCT implementation in biology education.

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2.3 Research Questions

- How do biology teachers in Central Province conceptualize and define learner-centered teaching?
- What LCT strategies are commonly used in biology classrooms, and how effectively are they implemented?
- What institutional, logistical, or pedagogical barriers prevent effective adoption of learner-centered methods?
- How do students perceive and respond to learner-centered instruction in biology?
- What interventions can be introduced to promote and strengthen learner-centered teaching in secondary biology education?.

3. Theoretical and Conceptual Framework

This study is grounded in Constructivist Learning Theory, which posits that learners actively construct their own understanding and knowledge of the world through experience and reflection. Constructivism shifts the focus of education from the transmission of facts to the facilitation of meaningful learning, where learners are central agents in the process. This theory underpins the principles of learner-centered teaching (LCT) and provides a foundation for analyzing its implementation in biology education.

3.1 Theoretical Underpinning: Constructivist Learning Theory

Constructivism, championed by educational theorists such as Jean Piaget and Lev Vygotsky, emphasizes the importance of prior knowledge, active engagement, and social interaction in learning. In the biology classroom, this means moving away from passive lectures toward instructional methods such as inquiry-based learning, group discussions, peer teaching, laboratory investigations, and project-based activities. These approaches encourage students to explore, question, hypothesize, and derive meaning through experiential tasks. Vygotsky's concept of the Zone of Proximal Development (ZPD) is particularly relevant to LCT. It highlights the role of scaffolding—guidance provided by teachers or peers to support learners in achieving tasks just beyond their current ability. In biology education, effective scaffolding can involve guiding students through complex processes like scientific investigations, model analysis, or problem-solving exercises that integrate real-life contexts.

3.2 Conceptual Framework

The conceptual framework guiding this study positions learner-centered teaching as the independent variable and its influence on student engagement, conceptual understanding, and classroom participation as the dependent outcomes. The framework also accounts for moderating variables, such as: Teacher competence and training in LCT methods,

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Availability of teaching and learning materials (e.g., lab equipment, charts, ICT), Class size and classroom management dynamics, Curriculum flexibility and institutional support.

This framework was instrumental in developing the research tools and in analyzing how LCT is applied in varying school contexts across Central Province. It also guided the identification of specific practices (e.g., group work, questioning strategies, use of models and experiments) that reflect or deviate from core LCT principles. In summary, by linking theoretical foundations with practical instructional contexts, this framework supports a holistic analysis of the extent, quality, and impact of learner-centered teaching in secondary biology education.

4. Methodology

This study utilized a qualitative descriptive design to explore the understanding and application of learner-centered teaching (LCT) approaches in biology classrooms in Central Province, Zambia. The qualitative approach was selected to capture the nuanced perceptions, experiences, and practices of biology teachers and students within their authentic classroom contexts.

4.1 Research Sites and Participants

The research was conducted in six secondary schools across Central Province, selected to represent a mix of urban, peri-urban, and rural settings. Participants included 12 biology teachers with varying years of experience and 120 students from Grades 10 to 12 enrolled in biology classes. The sample was purposively chosen to ensure diversity in teaching experience, school resources, and student demographics.

4.2 Data Collection Methods

Multiple methods were employed to gather rich data:

Semi-structured interviews with biology teachers explored their knowledge, attitudes, and implementation of learner-centered strategies. Questions probed definitions of LCT, lesson planning, and instructional challenges. Classroom observations were conducted using a structured checklist focusing on LCT indicators such as group activities, student questioning, use of teaching aids, and active student participation. Questionnaires administered to students assessed their perceptions of teaching methods, engagement levels, and learning experiences in biology classes.

4.3 Data Analysis

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Qualitative data from interviews and observations were transcribed and analyzed thematically using inductive coding to identify common patterns and divergences related to LCT understanding and practice. Quantitative data from questionnaires were subjected to descriptive statistical analysis to summarize student responses regarding instructional experiences. Triangulation of data sources was employed to enhance the validity of findings by cross-verifying teacher and student perspectives alongside observed classroom behaviors.

4.4 Ethical Considerations

Informed consent was obtained from all participants, and confidentiality was strictly maintained. The study adhered to ethical research standards, ensuring voluntary participation and respect for all respondents.

5. Findings and Analysis

The findings reveal a complex landscape regarding the understanding and implementation of learner-centered teaching (LCT) approaches in biology classrooms across the sampled schools in Central Province. Data from teacher interviews, classroom observations, and student questionnaires provide complementary perspectives on current practices, challenges, and outcomes.

5.1 Understanding of Learner-Centered Teaching

Teacher interviews indicated a mixed understanding of LCT. While most educators recognized the importance of active student participation and collaboration, many conflated LCT primarily with laboratory-based instruction or group work alone. Only a few teachers explicitly described LCT as a comprehensive pedagogical approach involving differentiated instruction, student autonomy, and critical inquiry. For example, several teachers emphasized practical activities but did not mention strategies such as formative assessment, scaffolding, or reflective dialogue. This suggests a partial adoption of LCT principles rather than a full pedagogical shift.

5.2 Implementation of LCT Strategies

Classroom observations showed that group work and class discussions were the most common LCT strategies employed, observed in approximately 70% of lessons. Teachers frequently used questioning techniques to engage students, though these often involved closed questions with limited opportunities for deeper reasoning. Laboratory activities were present but varied widely in quality and frequency, often constrained by lack of materials and time. Use of multimedia and other teaching aids was minimal, primarily due to resource limitations. Students' questionnaire responses indicated moderate levels

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of engagement during biology lessons. Around 65% reported enjoying group activities, and 60% felt that lessons helped them understand concepts better than traditional lectures. However, some students expressed frustration with overcrowded classes and the difficulty of receiving individual support.

5.3 Challenges Affecting LCT Adoption

Teachers reported several barriers impacting their ability to fully implement learner-centered approaches:

Large Class Sizes: Many classrooms had 50+ students, making individualized instruction and active participation difficult.

Limited Teaching Materials: Shortages of lab equipment, textbooks, and audiovisual aids restricted the scope of hands-on and interactive activities.

Syllabus Overload: Teachers felt pressured to cover extensive content, often resorting to teacher-centered methods to meet curriculum deadlines.

Insufficient Training: Many had not received specific professional development focused on LCT methodologies, limiting confidence and expertise.

5.4 Positive Links Between LCT and Student Learning

Despite these challenges, the study identified positive associations between lessons that aligned with learner-centered principles and improved student outcomes. Observed classrooms with well-planned group work, inquiry tasks, and formative questioning reported higher student participation and clearer conceptual understanding during discussions. Students in these settings showed more enthusiasm for biology and expressed greater confidence in applying concepts to real-world scenarios.

6. Challenges and Implications

The study identified several significant challenges that hinder the effective implementation of learner-centered teaching (LCT) approaches in biology classrooms within Central Province, and these have implications for both teaching quality and student learning outcomes.

6.1 Large Class Sizes and Overcrowding

Large student populations, often exceeding 50 learners per classroom, limit opportunities for meaningful individual interaction, personalized feedback, and active participation. Overcrowded classrooms force teachers to adopt lecture-based methods to maintain

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control and cover the syllabus efficiently, thereby restricting the use of collaborative and inquiry-based activities fundamental to LCT.

6.2 Inadequate Teaching and Learning Resources

A lack of sufficient laboratory equipment, teaching aids, and technological tools undermines the ability to conduct practical, hands-on activities essential for learner-centered biology instruction. Without these resources, lessons tend to rely heavily on theoretical explanations, reducing student engagement and conceptual understanding.

6.3 Syllabus Overload and Time Constraints

The breadth of the biology syllabus, coupled with tight instructional timelines, pressures teachers to prioritize content coverage over depth of learning and skill development. This compromises opportunities for reflective learning, formative assessment, and scaffolding—key components of learner-centered pedagogy.

6.4 Insufficient Professional Development

Many teachers lack access to continuous professional development programs focused specifically on learner-centered methodologies. This gap results in limited pedagogical skills and reduced confidence in applying student-centered techniques effectively.

6.5 Implications for Student Learning

These challenges translate into classrooms where student engagement and autonomy are often limited. Without adequate support and conducive learning environments, students miss critical opportunities to develop inquiry skills, scientific reasoning, and collaborative competencies that are vital for success in biology and beyond..

7. Recommendations

To overcome the challenges identified and enhance the implementation of learner-centered teaching (LCT) approaches in biology classrooms, the following recommendations are proposed:

7.1 Reduce Class Sizes

Efforts should be made to reduce student-teacher ratios by hiring additional biology teachers or creating more class sections. Smaller classes will allow for more personalized instruction, active participation, and effective classroom management conducive to LCT.

7.2 Improve Teaching and Learning Resources

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Schools and education authorities must prioritize the provision of adequate laboratory equipment, teaching aids, and digital tools. Access to these resources will enable teachers to conduct meaningful practical activities and use varied instructional strategies aligned with LCT principles.

7.3 Curriculum Review and Time Management

Curriculum developers should consider streamlining the biology syllabus to balance content breadth with depth. Additionally, timetabling should allocate sufficient instructional time to allow for inquiry-based learning, formative assessments, and collaborative projects.

7.4 Strengthen Teacher Professional Development

Comprehensive in-service training programs focusing on learner-centered methodologies, classroom management, and curriculum integration should be regularly provided. Teacher training should include practical workshops, peer mentoring, and ongoing support to build pedagogical competence and confidence.

7.5 Foster a Supportive School Culture

School leadership should encourage an environment that values innovative teaching practices, supports collaboration among teachers, and recognizes efforts to implement LCT. Establishing communities of practice can facilitate sharing of best practices and collective problem-solving.

7.6 Integrate Technology to Support LCT

Where feasible, technology should be incorporated as a tool to facilitate interactive learning, simulations, and research projects. Training teachers to effectively use ICT can enhance student engagement and support diverse learning styles.

8. Conclusion

This study highlights the critical role of learner-centered teaching (LCT) approaches in improving biology education in Zambia's Central Province. While the benefits of LCT—including enhanced student engagement, deeper conceptual understanding, and development of scientific skills—are recognized by both teachers and students, several structural and pedagogical challenges impede its full implementation. Large class sizes, resource shortages, syllabus overload, and inadequate teacher training limit opportunities for active, inquiry-based learning. Despite these barriers, instances of effective LCT practice demonstrate its potential to transform biology classrooms into dynamic learning environments where students take ownership of their education. To realize this potential

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at scale, systemic interventions are necessary to equip teachers, upgrade resources, and create supportive institutional cultures. Ultimately, fostering learner-centered classrooms aligns with Zambia's educational reforms and broader goals of developing scientifically literate, critical-thinking citizens. By addressing the challenges identified, education stakeholders can strengthen biology education and contribute to sustainable development through empowered learners.

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