An Appreciative Inquiry into the Experiences of Teachers and Students in Science Education in Liberian High Schools

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INTRODUCTION

The Republic of Liberia has experienced three distinct stages of educational development. The first stage consisted of informal and formal education practices prior to the nation's independence in 1847 (Trye, 2020). The second stage spanned from independence through the end of the civil war in 2003, a period characterized by both the growth and decline of Western-style education (Trye, 2020). The third stage began in the post-civil war era, from 2003 to the present, marked by efforts to reconstruct and reform the national education system.

Politically, Liberia has made steady progress since the civil war, which lasted from 1989 to 2003. The National Elections Commission successfully conducted three democratic elections in 2005, 2011, and 2017, with a fourth post-war election anticipated in October 2023. Despite these political achievements, the educational sector continues to face numerous challenges, including limited resources, inadequate infrastructure, poorly equipped laboratories, and insufficiently trained science teachers.

Science education plays a critical role in national development, as it provides learners with the knowledge and skills necessary for technological advancement, innovation, and problem-solving. However, in Liberia, science education has often been neglected, leading to poor performance in science subjects and low interest among students. Previous studies on education in Liberia have largely focused on literacy, governance, and policy reform, with limited attention given to the actual teaching and learning processes within science classrooms. This gap underscores the need to explore how science education is currently being delivered and experienced in Liberian high schools.

Therefore, this study sought to explore the teaching and learning processes of science education in selected high schools in Liberia, with emphasis on schools known for their focus on science instruction. A qualitative research design, guided by the Appreciative Inquiry approach, was employed to gain in-depth insights from both educators and students. Some of the findings were further supported by existing literature on science education.

Purpose of the Study

The primary purpose of this study was to examine how science education is taught and learned in selected Liberian high schools and to identify strategies that can be employed to improve science teaching and learning outcomes.

Research Questions

This study was guided by the following research questions:

1. How do educators and students describe science education in Liberian high schools?
2. What strategies can be implemented to improve science education in Liberian high schools?

LITERATURE REVIEW

The literature review covered four subdivisions. They are the (a) importance of science education at the high school level(b) Science education in Africa (c) Curricula and the importance of teaching science at the high

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school level (d)West African Examinations Council (WAEC) and Student Performance in Science Subject.

Importance of science at high schools

Science education at the high school level is vital to both to students studying science and the country at large. One of the importance of science education at the high school level has to do with preparing students to contribute to national development. According to Gilbert (2006) science education is an important part of science strategy, and this is to ensure that more people study science to standards that will help meet the future need of the country and the world at large. Added to that, the major concern is sharing the content and process with individuals that are not traditionally considered part of the scientific community (Gilbert,2006).

Similarly, Temechegn (2006b) states that in teaching science subject the aim is to encourage and enable students to be curious about science and nature, to develop inquiring minds, skills to solve problems, to acquire knowledge and good understanding and to help them learn to make informed decisions is scientific context on their own. This is what makes science subjects important in secondary schools due to its relevance to students' lives and the universally applicable problem solving and critical thinking skills. According to Temechegn (2006b), in the modern world, everyone needs some knowledge of science, and is important to teach science because science provides a laboratory of common experience for the development of language, logic, and problem-solving skills in the classroom. Besides, science is a significant part of human culture and represents one of the pinnacles of human thinking capacity.

Science Education in Africa

Elsewhere, Temechegn (2006c) stated that in ensuring sustainable development and eradicating poverty in Africa, it is of great importance that sscience education is well invested in, by providing well equipped laboratories and professional teachers with good teaching skills. He further argued that science education in Africa must be based on the reality and context of Africa countries (Temechegn 2006c). Studying science from the Africa context is necessary because Africa is unique. At the high school levels, there are usually four intertwined and equally important strands in science proficiency. According to Schwartz (2006), all science schools are expected to offer students opportunities to engage in these four strands:

1. Developing the ability to know, use, and interpret scientific explanation of the natural world.
2. Generating and evaluating scientific evidence.
3. Understanding the development of scientific knowledge

Learning to participate productively in scientific practices and discussion

Circular and Instruction of Science to high School students

Generally, science subjects taught at the high school levels include (a) General Mathematics (d) Physics (e) Biology (f) Chemistry (g) Agricultural Science (f) Animal Husbandry. According to Parchmann *et al* (2006) in the teaching of science to student, it is important to teach them the scientific way of thinking, and actively involving them in their own learning. While helping them to develop a conceptual framework as well as to develop problem solving skills, teachers should encourage them to be actively involved in discussion and group activities. Hence, instructional strategies for education should be varied, interesting, and enjoyable (Parchmann *et al,*2006).

The subjects offer at the high school level are determined by the ministry of education of the country. Students are required to study two curricula, at every level for the last three years of high school in most West African countries. When students are in the last class of high schools, SSS3 or the 12th Grade they do have a compulsory exam that can qualify them to proceed into college or University.

West Africa Examination Council (WAEC)

The West African Examinations Council (WAEC), a non-profit-making organization, with its headquarters in

Accra, Ghana. It was established in 1952 after the Governments of Ghana (then Gold Coast), Nigeria, Sierra Leone and The Gambia enacted the West African Examinations Council Ordinances in 1951. The Ordinance agreed to the coordination of exams, and issuing of certificates to students in individual countries by the West African Examination Council. Liberia later issued their ordinance in 1974, at the annual meeting held in Lagos, Nigeria. Hence candidates are required to enter and sit for a minimum of eight and a maximum of nine subjects.

The West African Examination Council is also responsible in the conducting of WASSCE. It is standardized test taken across all WAEC member countries. The result of this public exam is also used in most countries as a requirement for admission to universities. WASSCE was first introduced in the Gambia in 1998 and was later adopted by Nigeria in 1999. By 2000, the Republic of Sierra Leone joined Gambia and Nigeria to administer WASSCE exam. Ghana joined in 2006, while Liberia was the last country to adopt WASSCE in 2011. WASSCE is usually given to candidates twice a year, in May/June, and in November and December.

The WASSCE exams usually contains nine subjects. The results from 2010 to 2018 showed that the average of 1.5 million students registered for the exam, 822, 941 of the candidates were males while the remaining 748595 were females. About 1.06 million of the candidates had 5 credits and above in Mathematics (National Bureau of Statistics,2019). Since WAEC/WASSCE play a key role in the education system of West Africa countries, the researchers made used of the 2016 and 2017 WASSCE Results. The methodology of the study is explained in the section of this paper.

RESEARCH METHODOLOGY

The researchers of this study employed a qualitative research method. Qualitative researchers do study phenomena in their natural settings. Besides, they explore their research problems by making use of any of these subdivisions: (a) Grounded Study, (b) Case Studies, (c) Phenomenology, (d) Ethnography, or (e) Narrative Study

An appreciative inquiry could serve as an alternative method of the Strength, Weakness, Opportunities, and Threats (SWOT) Analysis research method (Trye, 2017). The primary purpose for conducting an appreciative inquiry study is to explore the issue from a positive perspective (Trye, 2017).

Appreciative inquiry has five stages known as the (a) definition, (b) discovery, (c) dream, (d) design, and(e) destiny.

Appreciative interviews, literature reviews, and observation were the research instruments used for the study. The population of the study were staff and students who attended and work at best high schools in Liberia. By making use of a purposive sampling, the study comprised the sample size of 22 participants. Five out of the 22 participants were staff, and the 17 were students.

Ethical procedures were followed by writing to the Ministry of Education in Liberia to obtain the best 10 schools who has passed in WASSCE. We able to obtain the 2016, and 2017 WASSCE result. Upon receiving the document from the ministry of Education, three of the best six schools that had 100% passing rate in all subjects were traced and studied. An informed consent letter was taken to the administrators and students of three schools. During the visits to each of the schools, the researchers interviewed the staff first, later interviewed the students, and then observed the science facilities on those campuses. The study was conducted between from January 2020 to March 2021. Thus, the research questions of the study were:(b) how do educators and students describe science education in Liberian High schools? (b) What could be done to improve Science Education in Liberian High Schools?

The research made use of two days to collect the data from three different schools. Two of the schools were located in Montserrado County Liberia, and another one was located in Margibi country. Interestingly, all three of the study were Christian schools. The participants were welcoming and friendly. The staff interviews lasted between ten to fifteen minutes while the student interviews lasted from 25 to 30 minutes each.

Data collection & Data Collection

The three schools were coded as School A, School B, and School C. The five staff were interviewed individually,

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and they were coded as, Staff 1, Staff 2, Staff 3, Staff 4, and Staff 5. Staff 1 and Staff 2 were from School A. Staff 3 was from School B, while Staff 5 and Staff 6 were from School C. Unlike the staff, the 17 students were interviewed in three groups. The groups were coded as Student Focus Group (SFG)1, SFG 2, and SFG 3. Each of the seventeen participants was individually coded from S1 to S17.

Besides, there were three major sections on the research instrument. The first section covered questions about the demography of the research participants. The section part of the interview was about the discovery of participants' experiences pertaining to science education at their school. The last part of the instrument covered the dreams or wishes of both staff and students.

Description of Participants' Experiences of Science Education in Schools AB and C

Staff Participant

A total of **five staff members** participated in this study. Two participants were drawn from **School A**, one from **School B**, and two from **School C**. The ages of the participants ranged from **25 to 78 years**. Of the five staff members, **four were male** and **one was female**.

In terms of roles, **two participants were administrators**, **two were science teachers**, and **one was a laboratory demonstrator**. Regarding educational qualifications, the **laboratory demonstrator** was a graduating senior pursuing a bachelor's degree at a university in Liberia. The **two administrators** each held **master's degrees**, while the **two science teachers** possessed **Bachelor of Science degrees**.

After coding and thematic analysis of the staff responses, **six key themes** emerged concerning their experiences with science education: 1. Rigorous study requirements, 2. Students' interest in science education, 3. Availability of science materials, 4. Student support 5. Administrative support for staff 6. Staff motivation and development

In addition, the staff participants expressed aspirations for the improvement of science education in Liberian high schools. Their envisioned goals included: Increased access to science resources and technology, Establishment of science clubs, Development of well-equipped and sophisticated science laboratories, Improved staff salaries and Opportunities for professional advancement and qualification upgrades

Student Participants

A total of **seventeen students** participated in the study, including **ten females** and **seven males**. The students' ages ranged from **14 to 20 years**, and they were selected from **grades 10 through 12**. Most of the participants reported a strong interest in **biology**, and many expressed aspirations to become **medical doctors**.

From the analysis of the students' responses, **five major themes** emerged: Rigorous study efforts, Interest in science education and teacher qualification, Availability of science materials, Student support, and Teacher salary concerns

The students also shared their dreams for improving science education in their schools, which included: Establishment of a modern, well-equipped science laboratory, Creation of a secure and supportive educational environment, Access to adequate science resources and technology, Organization of science projects and fairs, and Development of a science library on school campuses

Interpretation of Finding

From the analysis of the data collected from both staff and students, **seven major themes** emerged concerning their experiences with science education in Liberian high schools. These themes included: Rigorous study, Student interest in science education, Availability of science materials, Student support, Staff support, Salary, and Staff qualification.

It is important to note that the **first four themes**—rigorous study, student interest, science materials, and student support—were common to both staff and students. The **fifth theme**, staff support, was identified exclusively by

staff participants, while the **last two themes**, salary and staff qualification, were mentioned only by students.

When participants' *dreams and aspirations* for improving science education were analyzed, **eight additional themes** emerged: Establishment of sophisticated science laboratories, Access to science resources and technology, Improved staff salaries, Enhanced staff qualifications, Creation of science clubs, Development of a secure learning environment, Organization of science projects and fairs, and Establishment of school-based science libraries.

Among these, the **first two themes**—sophisticated science laboratories and access to science resources and technology—were common to both staff and students. The **third, fourth, and fifth themes** (staff salary, staff qualification, and science clubs) were emphasized primarily by staff participants, while the **last three themes** (secure environment, science projects and fairs, and science library) were identified exclusively by students.

In total, the study revealed **fifteen distinct themes** that reflect both the **current realities** and the **future aspirations** of staff and students regarding science education in Liberian high schools. These findings highlight critical areas for policy intervention, educational reform, and resource investment to strengthen science education across the country.

DISCUSSION OF FINDINGS

The purpose of this study was to explore the teaching and learning of science education in selected high schools in Liberia using a qualitative Appreciative Inquiry approach. The findings revealed fifteen themes in total—seven describing the *current experiences* of staff and students, and eight representing their *dreams and aspirations* for improving science education. These findings provide valuable insights into the present condition, challenges, and opportunities for strengthening science education in Liberia.

Current Experiences of Science Education

Rigorous Study and Student Interest

Both staff and students emphasized the demanding nature of studying science subjects. The perception of science as a "severe" or difficult area of study aligns with previous research suggesting that students in developing countries often find science abstract and intimidating due to limited practical exposure (Okebukola, 2019). Despite these challenges, many students demonstrated genuine interest in science and aspired to pursue science-related careers, particularly in medicine. This positive attitude reflects a recognition of science as a pathway to personal and national development (UNESCO, 2021).

Availability of Science Materials and Student Support

The lack of adequate science materials, including laboratory equipment and teaching aids, was a consistent concern among both staff and students. According to Adedayo (2020), limited access to instructional resources remains one of the major barriers to effective science learning in sub-Saharan Africa. Students also reported minimal support structures such as tutorials, mentorship, or remedial programs that could enhance comprehension of complex scientific concepts. These gaps suggest that the effectiveness of science education in Liberia is constrained by both material shortages and limited pedagogical support.

Staff Support, Salary, and Qualification

Themes unique to staff participants—such as inadequate administrative support and insufficient salaries—reflect systemic issues within Liberia's education sector. Low remuneration and limited professional development opportunities can demotivate teachers and hinder effective instruction (World Bank, 2020). Similarly, the theme of *staff qualification*—raised by students—indicates learners' awareness of the connection between teacher expertise and the quality of science instruction. Studies have consistently shown that well-trained science teachers significantly influence students' achievement and interest (Tobin & Fraser, 2018).

Aspirations for Improved Science Education

Sophisticated Laboratories and Science Resources

Both staff and students envisioned the establishment of modern, well-equipped laboratories and access to up-to-date technological resources. This aspiration highlights a collective recognition that experiential, hands-on learning is essential for meaningful science education. Laboratory facilities not only improve understanding but also stimulate curiosity and innovation (Hofstein & Lunetta, 2017). Such facilities are currently lacking in most Liberian schools, making their inclusion a critical priority for educational reform.

Staff Welfare and Professional Development

Staff participants highlighted improved salaries and professional qualifications as essential to enhancing science education quality. This finding aligns with research indicating that teacher motivation and continuous professional training are central to sustaining high-quality education (OECD, 2019). Addressing teacher welfare would likely improve retention and performance within Liberia's science education workforce.

Science Clubs, Projects, and Fairs

Both groups of participants expressed enthusiasm for extracurricular science initiatives such as clubs, projects, and fairs. These activities can foster teamwork, creativity, and a sense of ownership of learning—skills necessary for 21st-century learners (Bybee, 2013). Encouraging student-led scientific inquiry through such platforms could help bridge the gap between theoretical learning and practical application.

Secure Learning Environment and Science Libraries

Students emphasized the need for a secure and conducive learning environment as well as dedicated science libraries. Safety and resource accessibility are vital components of effective learning environments (UNICEF, 2020). A well-equipped science library would serve as a central hub for student research, reading, and exploration beyond classroom instruction.

SUMMARY OF DISCUSSION

Overall, the findings reveal that science education in Liberian high schools is hindered by inadequate resources, low teacher motivation, and insufficient institutional support. Nevertheless, both staff and students exhibit a strong commitment to improving the situation and envision a future characterized by modern facilities, professional growth, and innovative learning opportunities. These aspirations underscore the potential for transformation through targeted interventions in teacher development, infrastructure investment, and policy reform.

CONCLUSION

This study sought to answer two key questions: (a) How do educators and students describe science education in Liberian high schools? and (b) What could be done to improve science education in Liberian high schools? Through a qualitative appreciative inquiry conducted in selected schools in Montserrado County, fifteen major themes emerged regarding science education in Liberia.

Seven of these themes described participants' **experiences** of science education—highlighting factors such as rigorous study habits, student interest, availability of science materials, student and staff support, salary, and teacher qualification. Similar findings in African contexts suggest that teacher competency, learning resources, and motivation strongly shape science learning outcomes (Kasanda et al., 2005; Temechegn, 2002).

The remaining eight themes reflected participants' **aspirations** for science education—emphasizing the need for well-equipped laboratories, access to modern science resources and technology, improved teacher salaries, higher qualifications, science clubs, secure environments, science fairs and projects, and dedicated science

libraries. These aspirations align with prior research emphasizing the importance of context-rich, inquiry-based, and well-resourced science learning environments (Gilbert, 2006; Parchmann et al., 2006; Schwartz, 2006).

From these findings, three generalizations were drawn. First, science education in Liberian high schools is demanding and challenging for both students and teachers. Second, the effectiveness of science learning largely depends on students' interest and institutional support. Third, there is a strong desire among stakeholders to improve the quality and structure of science education. These findings echo Temechegn's (2000c) argument that African science education must evolve to reflect contextual realities and capacity-building priorities.

Recommendations from the Study

Based on the results, the study offers the following recommendations:

1. **Develop postgraduate programs in Biology, Chemistry, and Physics** (M.A. and Ph.D.) in Liberian universities to improve the qualifications of high school science teachers. This would address the need for a more professional and skilled teaching workforce (Temechegn, 2000a, 2002).

2. **Establish and equip functional science laboratories** in all high schools. Adequate laboratory experiences enhance scientific understanding and promote hands-on learning (Braund & Reiss, 2006; Gilbert, 2006).

3. **Provide competitive compensation for science teachers** to motivate and retain qualified educators who can mentor and inspire students (Trye, 2020).

4. **Encourage science clubs and extracurricular activities** within and beyond school campuses to foster creativity, collaboration, and sustained interest in scientific inquiry (UNESCO PROAP, 2001).

5. **Ensure the consistent availability of science resources and instructional materials** through government and private school proprietors (Kasanda et al., 2005).

6. **Promote science fairs and creative student projects** at the high school level, supported by teachers, administrators, parents, and the wider community (Parchmann et al., 2006; Schwartz, 2006).

7. **Conduct a nationwide quantitative study** to determine how many high schools in Liberia currently offer science education and to compare the adequacy of their infrastructure, facilities, and teacher qualifications (Nick, 2015; NBS, 2019).

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