INTEGRATED SCIENCE TEACHING AND LEARNING IN JUNIOR SECONDARY SCHOOLS IN SIERRA LEONE: CHALLENGES AND THE WAY FORWARD

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Abstract

This paper discussed integrated science teaching and learning in secondary schools in Sierra Leone, challenges and way forward. The paper highlighted and further discussed the origins of integrated science in Sierra Leone, integrated science teaching and learning methods, some learning theorists and their impact on science teaching and learning, integrated science assessment in teaching and learning, some general observations on the subject. subject BECE integrates previous research work of foreign researchers, issues of science integrated teaching and learning and recommendations to government and other stakeholders on how to improve integrated science teaching and learning in secondary schools in Sierra Leone

Keywords: Integrated Science, Teaching and Learning, Challenges, the Way Forward

1.0 INTRODUCTION

1.1 Background to the Study

The introduction of Integrated Science curriculum at the junior secondary school level in Sierra Leone is aimed at producing academically sound and equipped junior secondary school graduates to feed into the senior secondary schools' pure sciences.
The subject (Integrated Science) has the usual boundaries of Physics, Chemistry and Biology not distinctly emphasized.
However, the curriculum has been criticized over the years by stakeholders for its inadequacies. Its main problem lies in the poor performance of candidates in the public examination. Teachers trained from the Teacher Training Colleges and Universities are specialized in specific basic science subjects (physics, chemistry and biology)
This makes the teachers bias in focus, especially in teaching one area of these basic science subjects; resulting to an unbalanced coverage of the syllabus, thereby reflecting on the students effort and interest in learning the three segments of Integrated Science. The inadequate handling and implementation of the Integrated Science Curriculum has made the situation alarming and of great concern to education stakeholders.

1.2 Statement of the Problem

The purpose of the study is to examine the teaching and learning of integrated science in the junior secondary schools in Sierra Leone: The challenges and way forward

1.3 Objectives of the Study

The objectives of this paper are:
1. To justify the importance of integrated Science as a core subject in the Junior Secondary School Curriculum in Sierra Leone;
2. To highlight the problems of teaching/learning of integrated Science as a core subject
3. To draw the attention of government and other stakeholders the need for integrated Science as a foundation subject for pupils' later choice to offer physics, chemistry and biology in the Senior Secondary Schools level
4. To recommend to government and other stakeholders that Integrated Science be given the priority as one of the core subject in the Junior Secondary Schools in Sierra Leone.

2.0 REVIEW OF RELATED LITERATURE

2.1 Meaning of Integrated Science

Integrated science has been defined differently. Gbamanja (1999) defines integrated science as "an approach to science teaching where concepts and principles are presented to express the fundamental unity of scientific thought and to avoid premature or excessive emphasis on disciplinary distinctions". This definition clearly divides integrated science from the past of general science. The content of general science comes from different departments, but is not uniform. Ruther and Garner, cited in Stan (1999), describe general science as: "Nothing but a collection of short units, several individual sciences, and cannot be considered a complete science. Brown, also cited in Gbamanja (1999), describes integrated science with four broad features. These include; a) the unity of all knowledge: this means that integrated science has a comprehensive vision of knowledge as essentially one and indivisible; b) the conceptual unity of science: this means that the different conceptual units that make up the framework are identified.; c) a unified process of scientific research: this feature emphasizes the methodological differences and similarities of the sciences;. d) Interdisciplinary learning: in other words, a collaborative project between departments, during which subjects or topics are studied from logically different perspectives, leaving the student to synthesize as he wishes. Gbamanja (1999) said that one of the main reasons why integrated science was created and why it so quickly gained public interest is based on the assumption that the universe is unified.

2.2 The Origin of Integrated Science in Sierra Leone

Integrated Science as the name suggests, is a core subjects offered in the junior secondary school, which aim to orient students after exposure to the world of learning and practicing scientific methods at the primary school level which is the basis of secondary school. Just as integrated science has been described or defined differently by different people, it has also been labeled and criticized in different ways. Some people consider it as a general science of the past and they do not see any difference between them that is the difference between general science and integrated science. Integrated science is unique from biology, chemistry, geography and physics because it is holistic in nature and fulfills the following: a) there are no traditional subject boundaries b) the course is taught to achieve a specific learning outcome, c) a logical sequence of topics/concepts is distinguishable d) there are many activities that make the student actively participate in the learning process. (Gbamanja -1992) The government of Sierra Leone, through the Ministry of Education, approved colleges with polytechnic status so that teachers who wanted to obtain integrated science qualifications could come to these institutions to study integrated science rather as a course. For example, a profession such as a physics, chemistry or biology teacher. This means that after the end of the course, they will be taught integrated science in secondary schools. According to (Wurie, 2002) in his presentation at the Freetown Principals' Conference there was a need to train teachers specializing in integrated science and there is an urgent need for this teacher training in Integrated Science, because it is expected that a teacher specializing in a particular subject or discipline knows the philosophy and objectives of the course and knows new strategies for teaching the subject, especially modern technologies and course evaluation. (Wurie, 2002). Integrated Science was first introduced in Sierra Leone in 1976 when the Science Curriculum Development Center (SCDC) was established at the then Njala University College. This center contributed to changes in science curricula in the country. This led to the birth of CCIS (Core Course Integrated Science), which is the science curriculum of the former education system of Sierra Leone, or (7-5-2- 4) system, where students were taught sciences for the first three years of high school. The basis of this implementation was the creation of a scientific teaching method that reflects child-centered activities instead of teacher-centered activities. The goal was also to correct the behaviour of students both in dealing with the problems of school science and in the outside world. Successful completion of the JSS level, this category of students would have acquired the product, process skills and methods of the subjects according to the curriculum.

2.3 Integrated Science Teaching and Learning Methods

Results from literature review showed that the main teaching method of integrated science teachers is questions and answers and the talk and chalk method. In terms of approach, integrated science teachers used a compartmentalized approach, where integrated science is taught by subject, that is a subject that is taught independently by specialist teachers from different subjects, for example physics, chemistry or biology. This result contradicts the results of Druger. (1999) that the need for "Integrative Conceptual Themes", science teacher training, student motivation and active participation in learning is emphasized as the most important aspect of integrated science teaching. He also pointed out the fact that integrated science teachers must conduct practical experiments, discuss results with other class members, draw conclusions and present conclusions to the whole class to ensure effective teaching. • prior knowledge influences learning • learning moves from concrete to abstract • learning requires practice in new situations • effective learning requires feedback; • learning is not necessarily the result of teaching. (AAAS, 1989). This is also confirmed by Gbamanja (1992), that integrated science teachers should show positive attitude to work, ready to improvise materials and explore their environment with children without fear of failure, and that the most important teaching strategies and teaching methods should generally include: • discovery learning techniques • the engagement of problem solving activities • the participation of students in the field of open laboratory practice. According to him, there is no single method for good teaching and the method used depends on the subject, students, teacher and environmental variables. And that there are conditions that apply to time, place and human nature for the student, teachers, parents and in general. The above discussion shows that the methods by which teachers provide integrated science in the classroom require a special orientation of both trained and qualified teachers in teaching and learning integrated science as science is dynamic, new scientific discoveries are developed every day.

Science teachers must participate in workshops. They must also continue their studies to stay abreast of the new scientific ideas and developments in the 21st century. The level of teaching of a teacher is related to his level of understanding (Diffy, 2002). There is no substitute for science teacher training (Bajah, 1997). Money must be invested to renew the education of science teachers. According to Gbamanja (1992) in his book "Teaching Integrated Science Effectively", he viewed teaching as circular and relevant means and guiding experiences and activities to facilitate meaningful learning. All this is achieved through appropriate teaching strategies, methods or techniques. He emphasized that recently many innovations have been introduced in the process of teaching and learning science. Such advanced approaches, he says, include simulation and games, continuous assessments, individualized learning, modular organizations, programmed instruction, computer-based instruction, and peer instruction. He continued that integrated science teachers must be very familiar with new science teaching strategies. As students' knowledge of natural sciences grows, the teacher must constantly remember the need to offer them real, real opportunities to apply natural science processes and real problems to be solved by their own experience.

An integrated science teacher must be able to show a positive attitude to work, being prepared to fearlessly improvise materials with students and explore their environment. Teacher strategies and teaching methods should include: • using discovery teaching tactics. • involving problem solving activities • involving students in field or laboratory exercises. There are various methods for teaching integrated science, but the important point is that the methods are based on the main questions mentioned above. Gbamanja (1992). The following were the methods mentioned by Gbamanja (1991) in his book Modern Methods in Science Education in Africa for teaching science in schools (i) Lecture method (ii) Discussion method (iii) Demonstration (iv) Project method

(v) excursion/excursion (vi) discovery/research (vii) laboratory techniques (viii) process approach (ix) individual learning method (x) research method. They emphasized the fact that there is no single good learning method. The method used depends on the subject, on the students, on the teacher and on the environmental variable, and on the fact that it is very important to know the prevailing conditions both in time, place and human nature in the form of students, teachers, parents and society in general. Druger (1999) "Integrated science education in perspective". His main concern was "How can we get students excited about science"? This longtime science professor championed integrated science and emphasized the need for integrative conceptual subjects, changes in science teacher training, and a focus on student motivation and active student participation in learning. In his editorial, he emphasized that most science educators agree that it is highly desirable for students to have basic knowledge of all major subjects, such as biology, chemistry, physics, and earth science. He said that in the United States earth science is taught in the ninth grade, biology in the tenth grade, chemistry in the eleventh grade and physics in the twelfth grade. In order to effectively teach integrated science, according to him, the way of training science teachers must be changed, so that more attention is paid to the integration of science. He advised that teachers should be encouraged to develop projects and activities that show the connection between the sciences. This is best done by choosing meaningful, interesting conceptual topics and lends itself to this approach. Integrated science teaching can be done effectively in a well-equipped laboratory. Ngaunu (1989) listed about 120 common laboratory equipment including beakers, burners, rulers, microscopes, bio-viewers, electricity meters, fire extinguishers, retort bases, scales, graduated cylinder, thermometer. Therefore, teachers should try to use the research method as effectively as possible with appropriate teaching materials.

2.4 Some Science Learning Theorists and their impact on science teaching and learning. According to Gbamanja (1999), four theorists had a major impact on the teaching and learning of science at primary and secondary levels. These theorists include Jean Piaget, David P. Ausubel, Jerome S. Bruner, and Robert Gagne. Jean Piaget- was a cognitive scientist who believed that an individual goes through four stages of mental development namely: • Sensory motor 0-2 years • Pre-operational 2-7 years • Concrete functional ability 7-11 years • Formal - operational age 11 - 1 years According to Piaget, developmental psychology has become an important indicator in the development of scientific materials, especially at the elementary and high school levels. Piaget believes that the student's rational understanding of the environment depends largely on the quality of his mental activity. His theory is important in the teaching and learning of science in both primary and secondary schools. In high school, modern science has moved from talking and sharing information, that is "absolute truth" to problem solving and rational inquiry. Piaget's prediction is that the natural science student should use the scientific method when learning about the environment. Ausubel's theory focuses on the importance of systematically guided activity in learning. He claims that it is easiest to learn and retain knowledge of the subject. According to him, meaningful learning occurs when appropriate elements in the student's existing knowledge and new learning materials interact. Implicitly, Ausubel says that in science, the instrumental sequence must begin with a structurally planned, organized statement. Bruner's theory focuses on learning through discovery activities performed by students. He believes that the student should acquire knowledge through the materials themselves and the mental process of the student. He focuses on the fact that the method used to achieve acceptable new knowledge is the problem-solving approach, which is also the focus of modern research. Bruner encourages teachers to expose the student to the problem that creates contradictions in the source of information given in their teaching. Gagne's learning hierarchy theory states that learning a new concept or skill depends on the mastery of prerequisite concepts or skills. Gagne (1965) believes that prior knowledge determines subsequent learning. He also states that the teacher should structure the student's materials from simple to complex

2.5 Evaluation in Integrated Science Teaching And Learning

Evaluation is the use of several strategies to find out how competently a student follows a teaching series or how widely the characteristics expected of a student after learning are manifested.The extent of manifestation can be expressed in numbers (ie quantitatively) or words (ie qualitatively) or as a word and numerical concept as legally appropriate Inyang (2005). According to Bloom, Hasting and Maudus (1971), evaluation can be done in two ways; the first is to decide in advance what the student should know (learn), usually called criterion reference. On the other hand, the result can be used to obtain a class rank and thus compare individual performances; it is a norm-referenced test. Evaluation can be formative if the correct procedure is given in the unit cause. When an assessment is used at the end of a unit or course to determine the effectiveness of the entire system, it is called a summative assessment. According to Inyang (2005), there are various assessment methods, namely; written assessment, practical skills assessment and on-site assessment method. Written assessment includes essays and objective tests. Assessment of practical skills is based on results, but an effective assessment of these skills is one that considers all the processes involved. Thus, the practical activities of science that deserve evaluation are: understanding the instrument, Evaluation, on the other hand, is defined as the process of delineating, obtaining and presenting useful information necessary to evaluate a decisive alternative (Stufflebeam et al, 1971) . The use of job evaluation refers to the important place of values in the evaluation process. The evaluation aims to assist the evaluation process by providing relevant, reliable and valid information. The need for estimated information arises from the decision maker's uncertainty. The choice of alternative courses of action is a function of the environment, value system, character, nature of uncertainty, available information of decision makers. According to Gbamanja (1992), we value the following reasons: • to improve education, either to help the curriculum project, to develop its materials or to help the teacher develop his own teaching • to determine the effectiveness of teaching. about the program, its strengths or limitations. • protect and reassure in order to obtain crucial information about student behavior According to him, a teacher does not fulfill the task of teaching before he has ascertained the activity of his students. He described the following: Integrated Science Assessment Methods i. Test and Examination ii. Questionnaires iii. Classroom Observations iv. Oral inquiry v. interviews vi. Meetings and discussions vii. Teacher's diaries

2.5.1 Test and Examinations

These are measuring devices in which the person provides samples of his or her own behaviour by answering questions or solving problems. Tests and examinations serve as:

- teaching instrument
- act as instrument of assessment.

Tests could be classified as essay test and Objective test. The Essay test are further divided into two, namely free response essay and restricted essay. All of these are used by Integrated Science teachers to evaluate the performance outcome of their pupils.

2.5.2. Questionnaires and Interviews:

Questionnaires and Interviews are assessment methods that play obtain information from pupils especially their project work. An evaluator of a science programme like Integrated Science may like to examine project document, statement of policy, records of meetings. These evaluation methods help the evaluator to identify the strength and weakness of a programme

2.5.3 Classroom Observation

According to Gbamanja (1992), this assessment technique focuses on problems as they arise. Observation takes into consideration the five senses, these include:

Seeing, tasting, smelling, touching, feeling etc.

2.5.4 Oral Questioning and Discussion

This forms an integral part of evaluation, Carin and Sund (1964) pointed out that discussion provides unlimited opportunities for classroom interaction and that most science curricula incorporate opportunities for classroom interaction.

2.6 Continuous Assessment

Is another mode of assessment of students in Integrated Science; STAN (1979) defines continuous assessment as a mechanism whereby the final grading of a student in the cognitive, affective and psychomotor domains or behaviour takes into account in a systematic way, all his or her performances during a given period of schooling.

Continuous Assessment possesses five main characteristics

- It is systematic
- It is comprehensive
- It is cumulative
- It requires the use of a variety of evaluation techniques to take account of all domains
- It is guidance oriented. Gbamanja (1992)

Continuous assessment is important for the following reasons:

- It gives the classroom teacher greater involvement in the overall assessment of his or her pupils;
- To provide a more valid assessment of the child's over all ability and performance;
- To enable teachers to be more flexible and innovative in their instruction
- To provide a basis for more effective guidance of the pupils;
- To reduce examination malpractices.

Continuous assessment in Integrated Science can be done in four main areas:

- by examining the theory
- by examining the practical
- by making use of science projects
- by using out-of-school scientific activities (Gbamanja, 1992)

According to the Handbook for Junior Secondary Schools (1994), there are four methods of assessment of integrated science in Sierra Leone, These include:

- Continuous Assessment
- Written Examination
- Practical Examination
- Oral/Aural Examination

Three modes of assessment are used with a combination of the four methods above. These modes are as follows:

Mode A

- One written paper of two parts incorporating multiple choice objective items and short answer/structured questions or calculations.
- Continuous Assessment of theory and projects

Subjects examined using Mode A, are as follows:

- Business Studies
- Mathematics
- Religious and Moral Education
- Social Studies

Mode B

- One written paper of two parts incorporating multiple choice objective items and short answer/structured questions or calculations
- Continuous Assessment of theory and practical work. Subjects examined using Mode B, are as follows:
- Agriculture

- Creative Arts
- Electronics
- Home Economics
- Integrated Science
- Introductory Technology
- Local Crafts
- Physical and Health Education

Mode C

- One written paper of two parts incorporating multiple choice objective items and short answer/structured questions or calculation
- One written paper containing essay/continuous writing questions
- Oral/Aural assessment
- Continuous assessment in theory and projects to be examined using mode

C, are as follows:
1.Arabic
2.French
3.Language Arts (English)
4.Sierra Leone Languages
Competence in written and spoken English, contributes to the final continuous assessment score for each subject. The appropriate grading of performance of each candidate in terms of assessment, for every subject offered is graded as follows:
Excellent =1
Very good =2
Good =3
Credit =4
Credit =5
Pass =6
Below Criteria=7
According to Kyalo (2005) in his article "The Role of Assessment in the Teaching/Learning Process Looking specifically at assessment in mathematics and science" presented at the Third SMASSE - WECSA Third Country Training Program at the African Center for Mathematics, Science and Technology. Education (CEMASTA), he stated in his introduction, that every educational system, teaching is incomplete without evaluation. Whether assessment is conducted in the classroom or at the national level, the primary purpose of any assessment is to measure the level of learning. If used well, external or institutional evaluation can be a tool to improve the quality of teaching and learning. He defined evaluation as the process of obtaining information for decision-making • Knowledge, attitudes and skills of students • Curricula • Educational policies
• Teaching strategies. He introduced evaluation methods in this sense that the evaluation of achievements can imply the use of several different methods, which can be classified into two main groups. These include:
2.6.1 Formative assessment method - it includes a teacher-administered test, exercises, assignment, audio test (listening) and oral (speaking). Formative assessment is an integral part of the teaching/learning program in the classroom with opportunities for feedback.
2.6.2 Summative assessment method - this refers to an examination at the end of the study cycle, leading to the award of a certificate. Kyalo, (2005)

2.7 General comments on the BECE Integrated Science Paper, External Examiner
According to the External Examiner's Report (WAEC, 2020), the integrated science paper covered the entire curriculum and was remarkably balanced. As an integral scientific subject. The level of the magazine matched the level of previous years. The questions were simple and understandable according to the BECE WAEC syllabus and the scoring system was very open and flexible according to the candidates' answers. The overall performance of the Annual Edition was relatively weak compared to 2003. According to the report, this could be due to insufficient coverage of the curriculum. The chemical and physical subsections of each question were not well answered, showing a bias towards biology and earth sciences. The inspector recommended encouraging school administrators to hire teachers who are able to teach all subjects, or to hire more than one teacher qualified in a particular subject. According to the report, candidates performed better in section C than in section B, although some candidates still had problems following the instructions in section C. The editor further emphasized that scientific method and writing The number of tests was seriously lacking and that in particular was evident in the poor performance of candidates who attempted question 8. Part B is the theoretical part of the work and part C is the practical exams. The BECE Integrated Science external examiner identified the following weaknesses: • Candidates showed carelessness in spelling science words and this is getting worse every year. Some candidates cannot even spell the words in the questionnaire correctly, he asked the teachers to emphasize the need for accurate spelling of scientific terms. • Writing chemical symbols of elements, chemical formulas of compounds and balancing chemical equations caused problems for candidates, most candidates do not represent symbols and subscripts of chemical formulas of compounds and therefore cannot balance chemical equations. • He also suggested that knowledge of the valence of common elements and radicals and the balance of simple chemical equations would greatly contribute to worsening the situation. He further emphasized that the candidates cannot represent the components of the nuclear core. • Misunderstanding questions and giving wrong answers were some weaknesses. • The candidates lacked a simple calculation of workload, power and heat and their corresponding SI unit. He suggested that candidates should study mathematical tables and practice simple

arithmetic operations based on multiplication, division, addition and subtraction and independent of calculators. He encouraged the candidates to practice answering the short answer question and the need for spelling. Regular practice of exercises, spelling and short answers is recommended. According to the report of the external inspector, the work was within the requirements set in the curriculum and in general the performance of the candidates was better than in previous years. Individual questions reflected adequate coverage of aspects of physics, chemistry and biology in integrated science, without bias towards any of the three options. Most of the questions in this year's paper required simple direct answers like definitions, statement of properties of functions etc. The performance of candidates was relatively better.

2.7.1 Weaknesses of the candidates

As in previous years, there are still errors in the writing of technical terms in the candidates' answers, to the extent that the candidates cannot correctly transfer the working conditions of the questions to their answer sheets. It was careless to use the correct units and some candidates did not follow the instructions given for individual questions. The students also lacked laboratory equipment. English expressions were generally poor, as most answers were poorly presented and unclear. Therefore, the examiner suggested that teachers teaching integrated science give their students a clear picture of the presentation by clearly explaining how many questions must be answered in parts B and C. Routine spelling tests and correctly labeled important diagrams must be practiced. Also, when possible, teachers should try to introduce students to common laboratory equipment and how to use them

.2.7.2 Candidates Strengths

Candidate in this year's paper did very well in questions requiring direct and simple recall answers. In terms of recommendation candidates were encouraged to practice answering short – answer questions and the need for correct spelling. Regular assignments, and drills on spelling and short answers is recommended. WAEC (2020).

2.8 Other General Comments on Integrated Science - BECE Paper as a Whole

According to the report, the standard of work this year was adequate and the questions were distributed in proportion to the research fields mainly in Biology, Chemistry and Physics subjects. Candidates had to answer a total of eight questions, and over the years there have been request to extend the time from two hours to two and a half hours. The performance of candidates has decreased considerably this year compared to previous years. Overall, most responses were sparse and in most cases candidates attempted only part of the questions, leaving others unanswered, reflecting their curriculum coverage. In general, candidates performed poorly on questions that required application of knowledge rather than mere memorization of points. The Balancing Chemical Equations question had incorrect sections which may have affected candidates' performance. Most of the candidates did not understand what was asked in the question and presented conflicting thoughts which cost them valuable marks. In the case of states of matter, the properties of matter, the effect of heat on matter as forms of heat transfer were misunderstood.WAEC, (2000)

2.9 Problems of integrated science teaching and learning

According to FAWE (2004), there are many reasons. based on poor participation and performance of girls in mathematics and science, and the reasons for both low participation and poor performance are usually cited. Briefly, they are as follows:

Attitudes:

- Parental attitudes - Teacher attitudes - Student attitudes - Unfamiliar teaching ♣ Didactic approach to learning mathematics and science ♣ Inappropriate models and role models ♣ Lack of models and role models and support materials for laboratories - textbooks other teaching aids - have shown that there are many problems in teaching and learning natural sciences. Most of the problems identified by Jegede (1982) are: • lack of understanding of what integrated science is

• lack of work of improvised materials • lack of well-equipped laboratories • time constraints: very little time allotted to integrated science on the school timetable • lack of trained integrated science teachers: • lack of necessary and recommended textbooks among students, especially in rural and suburban schools • teachers have too few scientific magazines and other materials necessary for professional growth • lack of money to maintain accessories and necessary equipment • insufficient introduction to the public • Some teachers still use more traditional didactic teaching methods instead of the recommended modern methods. This is because many teachers who teach integrated science are not trained teachers in the subject, but are asked by principals to teach the subject. • Teachers do not understand continuous assessment procedures to assess the subject, which should be an essential practice in integrated science, so they adopt only the end-of-semester exam to determine the student's annual performance. •

According to Kamara (2004), the following factors are responsible for the poor performance of integrated science. • some teachers serve those who easily understand math and integrate science and forget others. • incorrect methodology introduced in the teaching of mathematics and natural sciences • teachers do not comply with the integrated curricula of mathematics and natural sciences • poor quality of mathematics and natural sciences textbooks • insufficient teaching and learning material • massive promotion of students. • lack of continuous teacher training in schools • lack of time for students for personal study • indifference of students in math and science classes • inability of students to complete tasks given in math and science class. It is noticed that most important factors are the following. : • poor salary structure of teachers • lack of study materials/learning materials • employment procedure of the Ministry of Education • irregularity in teacher promotion • lack of incentives • insufficient personal resources • additional workload of integrated science teachers. • lack of professional development This is in line with the argument of Ekpenyong (1996).

In order to have dedicated and committed integrated science teachers to meet the challenges of the classroom, the standards and morale of these teachers must be raised. Conditions of service must be improved. Ekpenyong, (1996) Joof (2002) argued that integrated science and technology teaching in school is boring and unchallenging. Too many students drop out of science education because they lack the knowledge they have acquired. Many teachers enter the teaching profession ignorant, lacking a

real understanding of what science is and lacking the joy of discovery, confidence and ability to motivate children in integrated science. Many graduates leave the workforce ill-prepared to solve problems, lacking the skills and motivation to continue learning.

Joof further stated that the laboratory facilities in the college are inadequate and trained teachers are not exposed to such facilities, which indicates poor teaching methods and approaches in the secondary school. Thus, there is a vicious circle of insufficient skills and knowledge to advance science. Ohuche (1991) also argues that poor teacher pay is a major factor in the decline in educational achievement. Iwowi, Okebukula, Oludotun and Akpan (1992) argued that teachers' teaching methods were one of the factors affecting student performance. Several authors argue that the status of teachers has been declining for several decades. In Sierra Leone, for example, the status of the teaching profession has been degraded and degraded to the extent that teachers feel humiliated as professionals. Societies do not respect the teacher and do not pay him a new salary. He is at the bottom of the professional hierarchy. According to Jegede (1982), there are some conditions of integrated scientific teaching:

• absence lack of trained and qualified teachers teaching integrated

- wrong methodology in teaching Integrated Science
- science the syllabus is not completed before the examination
- poor quality and unavailability of Integrated Science textbooks
- lack of laboratory
- lack of laboratory equipment
- mass promotion of pupils leading to class congestion
- lack of teaching/learning materials in Science
- lack of incentives for science teachers
- problems of class size and space
- no time for Pupils for personal study
- time allocated for integrated science is not enough
- weak primary foundation in science
- students unseriousness with school work
- low teacher motivation.
- high teacher attrition
- some teachers just read out notes to pupils
- bribery and corruption in admission and promotion of pupils
- poor salary structure of teachers
- recruitment procedure of the Ministry of Education
- irregularity in the promotion of teachers
- lack of incentives
- inadequate personal resources
- under staffing of integrated science teachers
- lack of professional development in attending seminars, workshops
- lack of trained and qualified teachers in Integrated Science.
- wrong methodology adopted in teaching Integrated Science
- the syllabus is not completed before the examination
- Poor quality and unavailability of Integrated Science textbooks
- lack of laboratory
- lack of laboratory equipment
- mass promotion of pupils leading to class congestion.
- lack of teaching and learning materials in science
- lack of incentives for science teachers
- problem of class size and space
- no time for pupils for personal study
- time allocated for Integrated Science teaching is not enough
- weak primary foundation in Science

The above mentioned problems confirm with the several problems that confront the teaching and learning of integrated science among most of the problems identified by Jegede (1982) include:

- lack of understanding of what Integrated Science is about
- lack of workshop centers
- lack of well-equipped laboratories,
- time constraints
- lack of trained Integrated Science teachers
- lack of recommended textbooks
- teachers lack scientific journals
- readability problem of Integrated Science text
- lack of funds for the supplies and maintenance of necessary equipment
- inadequate orientation

- some teachers use some traditional didactic methods of teaching
- Continuous Assessment procedure is not well understood by teachers,

This is also in line with Kamara (2004) who identified the following factors responsible for poor performance in science

- some teachers cater for those who easily understood Integrated Science,
- wrong methodology in teaching,
- teachers do not complete the syllabus,
- poor quality of textbooks,
- inadequate teaching and learning materials,
- mass promotion of pupils,
- no in-service training courses for teachers,
- lack of time for pupils for personal study,
- in attentiveness of pupils during lesson,
- failure of pupils to do assignment

Joof (2002) further asserted that laboratory facilities are inadequate and trained teachers are not exposed to such facilities, indicating poor teaching methods and approaches in secondary schools and thus a vicious cycle of insufficient skills and knowledge to advance science. Otuka, Okebukola and Jegede (1998) argue that academic competence of science teachers is one of the factors that cause poor performance of students in science. According to Nwaokolo (1998), low status and quality of the teacher shows that poor service conditions and the negative influence of the wider society are the determinants. Poor conditions of service range from irregular and inadequate pay, poor physical environment, poor promotional opportunities and stagnation (Nwaokolo, 1998). These underserved teachers cannot endure like others; they are treated with contempt and lack of respect. The public despises them; therefore, they lose a sense of belonging. Observations of teacher constraints such as lack of teaching materials due to remote location of some schools, poor transport facilities, inadequate classrooms, libraries, laboratories and laboratory equipment hinder the professional development of these teachers. Related to this is a poor learning environment and other environmental problems.. The above discussion shows that teachers face various problems in the teaching and learning of integrated science as a subjects in secondary school. Education stakeholders need to sit down and discuss further. All these problems are consistent with the findings of Jegede (1982) in the study of the conditions of integrated science teaching. He confirmed the following conditions; Lack of improvised materials, lack of well-equipped laboratories, lack of trained integrated science teachers; the science teacher only teach the science subject in his department, at the expense of other subjects.Integrated science subjects are taught without textbooks by students, this is the situation in rural and suburban schools. Most teachers lack scientific journals and other material necessary for professional growth. Almost entirely didactic, with classes dominated by lectures, note-taking and question-and-answer sessions. Little or no practical work is done due to lack of equipment and supplies.

Conclusion

The limits of integrated science teaching and learning are related to many factors, some of which are: lack of trained and qualified integrated science teachers, methodology, materials, class size, inadequate classrooms, libraries, equipment. Sometimes teachers do not understand the methods of teaching integrated science and do not use improvised teaching materials in their teaching. As professional science teachers, they are expected to use appropriate methods, materials and equipment in their teaching while also improvising their environment. The teaching of integrated science must therefore take place in an atmosphere where teachers understand the methods; he is motivated, knows the method used and uses appropriate teaching materials. In such an environment, the quality of teaching would improve and this would always affect student performance in integrated science. Integrated science teaching in schools is not enough only because most schools lack laboratories, teaching materials are not enough, students do not practice science, poor service conditions due to salary irregularity, lack of teaching materials and poor physical environment to name but a few.

Recommendations for Improving Student Achievement in Integrated Science in Secondary Schools in Sierra Leone

In order to achieve the JSS integrated science curriculum, curriculum developers curriculum developers should ensure that JSS integrated science curriculum is revised to make it more functional. Teachers should be directed to obtain qualifications in integrated science in higher education teaching institutions, so that they create a high-level foundation of science. This should be done with the support of the state. Trainings, seminars and conferences should be organized for teachers of integrated science, so that they can get use to different methodologies, new teaching strategies, evaluation methods and new developments in teaching integrated science. If there is an opportunity to develop skills through integrated science workshops, school leaders must ensure that this group of teachers should have equal opportunity to attend such workshops or seminar without favour or biane3ss in the selection to attend such training. This training gives these teachers the opportunity to develop their proficiency skills according to modern trends in teaching science in schools.

Integrated science should be taught by graduates of integrated science at the JSS level, this would eliminate the prejudice that experts in the basic sciences (physics, chemistry, biology) may have in teaching integrated science.

The Sierra Leone Association of Mathematics and Science Teachers (SLAMAST) should regularly organize workshops, seminars and in-service training for integrated science teachers. Adequate funds should be allocated for laboratory equipment and other facilities. The government should equip schools with laboratory equipment so that students can gain more practical knowledge of science. Integrated science teaching should take place in science laboratories to expose these students to science literacy process skills. Every year, the Ministry of Education should give scholarships to students who do very well in BECE to encourage them to work harder. The Government should fund teacher training institutions so that science teachers are adequately trained and teachers' salaries and allowances are paid promptly and promotions are made on time. School authorities must make the teaching environment conducive to effective implementation of integrated science teaching and learning procedures to promote interest

and success in science education. The government should pay attention to the education sector with thorough monitoring because it will make the society respect this profession.

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