INNOVATIVE STRATEGIES FOR EFFECTIVE TEACHING OF SENIOR SECONDARY SCHOOL BIOLOGY

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Abstract
This paper examined innovative strategies that could be employed to make the teaching of senior secondary school biology effective. The strategies include, using variety of instructional methods, active participation of students, development of science process skills, integrating theories with regular practicals, making use of local environment, involving students in improvisation and preparation of specimens, enhancing ICT skills and good preparation by the teacher. The importance of innovations in teaching biology are also stated. It was concluded that adoption of these strategies may address the problem of incompetency and develop individuals capable of solving life problems that could contribute to the nation development as well as global progress.

Introduction

Science and technology are the driving force of global development. Every nation therefore, strive to produce scientifically literate citizenry that can effectively use scientific knowledge to solve problems and improve the quality of life for its development.

No wonder Olakuleh in (2007) asserted that for the technical development of the 21st century and for scientific literacy of our nation to be accomplished, effective teaching of science must be promoted especially in our secondary schools.

Biology is one of the science subjects taught in secondary schools in Nigeria. Biology is important in the economy of the nation in the fields of medicine, food production and processing, environmental health, genetic engineering and biotechnology. It is also relevant in addressing global challenges such as climate change, disease reduction and food security. Effective teaching and learning of biology helps students to develop objective reasoning, critical thinking ability and creativity to contribute meaningfully to the various sectors of the economy. Unfortunately biology teaching in Nigerian secondary schools has not been effective (Nwagbo, 2002; Okoli, 2006; Ukpai,2014) and poor performance has been consistently recorded. Nwagbo (2002) further reported that the approach to teaching science (biology) in Nigeria has not encouraged the achievement of scientific literacy goal in students. Researchers are of the opinion that the uninspiring teaching methods adopted by the science teachers biology inclusive lead to low achievement in the sciences and incapacitates students from developing required skills necessary for creative thinking (Okwilagwe, 2002; Oke,2005; Samba and Iortim, 2014).

The world is fast growing and challenging. Biology students therefore, require effective biology education to meet their individual and societal needs as well as to cope with global competition. This calls for the adoption of innovative strategies in teaching biology if the objective of acquiring meaningful and relevant biology knowledge and apply same in everyday life as stipulated in the national curriculum (FME, 2008) is to be achieved. This paper therefore, examines innovative strategies that could be adopted for effective teaching of senior secondary school biology.

Concept of Innovation in Teaching

Innovation as reported in Wikipedia (2015) is a new idea, more effective device or process. It can also be viewed as application of better solutions that meet new requirements, articulated needs or existing needs. It is accomplished through more effective products, processes, services, technologies or ideas that are readily available. Jasim (2014) defined innovation as the process of making improvement by introducing something new. Innovation has also been defined as the implementation of new and improved knowledge, ideas, methods, processes, tools, equipments and machinery which leads to new and better products, service

and processes (Williams, 1999). Roger (2003) opined that innovation may have been invented a long time ago, but if individuals perceive it as new then it may still be an innovation for them.

Innovation in teaching according to Partett (1979) in Gbadamasi (2013) includes what might be regarded as evolutionary changes, experiments and application of educational technology that may result entirely to new curricula or radically changed course curricula.

Gbadamasi (2013) elaborated further, innovation can be in using new teaching methods, addition of new ideas in the curriculum content, learning experiences, introducing new/modern instructional materials as well as adopting a new change in evaluating the outcomes of biology learning.

From the foregoing innovations in teaching biology should be all encompassing. It involves the following

- New ways of teaching or modification of teaching methods to promote students achievement.
- Reorganization of course content to improve students understanding of biological concept and ability to apply what they learn.
- Usage of relevant/modern instructional materials as well as improvising if the need arises.
- Employing assessment methods that could lead to greater student's engagement and achievement.

Strategies in these aspects of teaching and learning processes could be applied to enhance efficacy. The use of innovative teaching methods to teach biology effectively has been advocated by researchers (Gbadamasi, 2013, Ezenduka, Achifusi and Okoli 2014).

Innovative Strategies for Effective Teaching of Biology

For biology teaching in secondary school to be effective the following innovative strategies may be adopted.

- **Use variety of innovative instructional methods:** Teachers should vary their teaching methods to suit each concept or topic. Learner-centered and activity based methods such as laboratory work, field trip, project, inquiry, problem solving and computer assisted instruction should used. These will enable students to experience science in varied enjoyable ways to increase their level of motivation, curiosity and attention thus enhancing retention.
- **Encourage active participation of students in their own learning.** Learning activity should be well planned to ensure active participation of the students. Each student should be encouraged to participate even when working in groups. Active engagement of students in learning reduces boredom and linear thinking but encourages intellectual excitement and cognitive flexibility which according to Colman (2014) is one of the core mental executive function involved in creative problem solving as it enhances the capacity to apply ideas creatively and convert information to useable form.
- **Making use of cooperative learning**: Learning in small groups is collaborative. It facilitates the development of students' cognitive processes through their engagement in the active construction of meaning and knowledge. Communication skills and social skills such as leadership, trust building, decision taking and goal setting among others, all of which are essential for striving in any work place are developed.
- **Emphasize on the development of science process skills**. Many process skills are acquired in biology. The acquired basic skills can be applied to generate products and ideals in various productive activities. These skills also lead to the development of scientific attitudes which include critical thinking, objectivity, creativity among others (Ezenduka, Achufusi and Okoli, 2014).
- **Integrate theory with regular biology practical work**: The integration helps to equip the learners with adequate knowledge content and practicals that will enable them develop self-confidence and practical problem solving ability that prepare individuals to be honest and diligent.
- **Make good use of local examples and the students' environment**: Biology garden/school farm or their local environment should be utilized in teaching and learning relevant topics. Utilization of the local environment enables the students to interact freely with already familiar teaching materials to construct their ideas and generate knowledge with minimum teacher's involvement.

- **Use innovative skills to improvise:** Improvise and involve the students in the improvisation and preparation of teaching materials. Models of cells, organs and various systems of the body and some instruments can be made by the students. Specimens like bones can also be prepared from animals. The involvements motivate the students and promote their creativity and that of the teacher.
- **Adopt both summative and formative assessment methods:** In addition to periodic summative assessments, formative assessment in form of frequent ongoing testing during the lesson with aim of monitoring understanding and providing feedback should be employed.
- **Include activities/assessments that involve the use of** computer and internet. This enhances the learners' ICT skills and inculcates the habit of seeking detailed information on any subject matter.
- **Prepare well and organize each lesson:** One is more likely to inspire the students if he/she is well prepared, well organized, enthusiastic and friendly. Students' perception of the credibility of the teacher could strongly influence their interest and reactions, to the course content and to biology as a subject.

Importance of innovation in teaching biology

- Innovation motivates the students and make teaching and learning more effective.
- It promotes creativity of the students and the teacher.
- It minimizes the problems of large class size and inadequate teaching materials.
- It raises the students' awareness of their environment and promote their interest biology as a subject and in biology-based careers.

Conclusion

Innovation is required to make products and services efficient in all aspects of human life including food, clothing, shelter and health, all of which are biology based. Innovative strategies should therefore be adopted for effective teaching of biology in our secondary schools. This could address the problem of incompetency. It could also lead to the development of individuals capable of applying biological /scientific knowledge and skills in solving life problems and contribute to the development of the nation and global progress.

Recommendation

- Innovation require time and effort therefore, biology teacher should be hard working and committed to his/her job.
- Biology teacher should continue to develop himself/herself by attending seminars, workshops and conferences to update oneself with knowledge and skills of biology and teaching.
- School administrators should give maximum cooperation and grant teachers' requests for effective biology delivery.
- Government should provide adequate equipments/materials ICT facilities and enabling environment for learning teaching and learning of biology.
- Students should have free access to the school laboratory and internet, it should not be restricted to computer science lessons.
- Parents/guardians should give their wards all the necessary support required for their studies.

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