

Reviews

Using new technologies in creating excitement in biology laboratory activities

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The rapid growth of biological knowledge is placing it prominence among the sciences. For this reason, biologists are realizing that their responsibilities have changed, as new technological devices are redefining biology. With new trend in information technologies, the biology teacher has to ensure that s/he is current in the content matter, method and technological devices. How sure and ready is the Nigerian secondary school biology teacher with the new technological devices in the laboratory activities? Biology teachers' indifference towards laboratory activities has remained a problem as most of them still use lecture style that has not changed in decades. It is not difficult to break away from this pattern and present activities with new technological devices to students in a manner that excites and sustains their interests. This will not only help them in changing the ambience in the lab, but also expand their talent pool, provide opportunities to enhance the educational value of the activity, and stimulate the desire to learn. The main focus of this paper is on the new technological devices that can be used by the biology teacher during laboratory activities. The paper also highlights the strengths in using these technological devices in some selected topics in biology. Challenges faced by biology teachers and students are also discussed.

Key words: Technologies, Creativity and Biology.

INTRODUCTION

Secondary school biology students in Nigeria, approach biology laboratory activities with mixed emotions (Onyegegbu, 2001). For some, these activities are windows on the world of biology, allowing them to gain experience with the techniques, concepts and emotions that go with real research. For some others, practicals in biology laboratories are exercises in preordination, tedious derivation of answers that are already known to questions that do not seem important.

From my personal experience as a classroom biology teacher, one of the major problems in the secondary school biology laboratory activities, is that teachers feel that demonstrating or carrying out activities in the laboratory amounts to inviting trouble, and tedious. Often this turns out to be a major cause of their indifference to practical work. Moreover, the topics are so restricted to examination scheduled curriculum that teachers must comply to if their students are to pass their external examination.

A survey of secondary school biology laboratories reveals that many of them are under funded with outdated equipment (Onyegegbu, 2001).

The classroom experience shows that a large number of the secondary school biology students face considerable difficulty in appreciating and learning biological concepts in a meaningful way, especially in laboratory activities. This is a clear reflection of their poor ability to solve simple day to day problems, make predictions in given situations and poor ability to apply biological concepts to explain ordinary natural phenomena. However, on the part of biology teachers, it is rather disturbing to note the apathy or indifference, with which biology practical activities is conducted in the biology laboratory. Practical biology activities if done in the laboratories are done with the mundane, unimaginative manner (Onyegegbu, 2001). If one goes into our biology practical lessons today, one will see a lecture style that has not changed in decades. Most of the teachers are masters of this style, engaging and inspiring their students, and adopting the lecture format mainly because it is the most familiar to them. Again, in this 21st century, our secondary school teachers still engage in "cookbook" laboratories with the textual discrimination of the experiments and thus alone remain

the sole guide for the teacher. This approach does not enhance the students' knowledge of biology and their confidence in them. Rather, it works antagonistically to the best practical biology approach in which students' pursue their own practical under the guidance of the teacher. Instead of the teacher showing students what it is like to do practical, why not confront them with real problems and ask them to come up their own solutions. Rather the excuse given by teachers is the non-availability of laboratory/equipment and the problem of large size-class. The problems be them as they appear, the majority reason, behind the present state of affairs in the secondary school biology practical laboratory activities to some extent, lie in the system, and largely in the effective characteristics of biology classroom teachers themselves.

It has been proven that secondary school students, irrespective of their age groups, location or even tribal character are equally hungry for science experiments which include biology (Felder and Brent, 2004). The number of students offering biology as a subject in the secondary school has soared in recent years, even though conditions in their laboratories have not improved. In part, students are being attracted to perceived rewards of career in health care. But less utilitarian forces also are at work. Many of the most pressing issues in the 21st century are likely to have biological roots: preventing and treating formidable diseases like AIDS, developing biological sources of materials and energy, and feeding a rapidly expanding world population.

Furthermore, biology seems on the verge of answering some of most tantalizing question in science: How do organisms grow and develop? To what extent can and should we manipulate the biological world?

To match the rapid growth of biological knowledge which is itself a powerful force for change, is a rapid evolution of information technologies underscoring the forces of this change. With new trends in information technologies, the common theme is to move beyond the passive learning and 'cookbook' activities that characterizes lectures towards more engaged, active and investigative practical lessons. When students are presented with such approach in the laboratory activities, they tend to develop traits such as curiosity, problem-solving, creativity and perseverance the very attributes essential in science.

Information technologies, ranging from videotapes and laser disks to powerful computing and communications technologies have the potential to recast the relationship between biology teachers and their students, during laboratory activities. The challenge facing Nigerian secondary school biology teachers is in the areas of knowledge in content matter and having access to the new set of devices for teaching biology.

To have a meaningful understanding of rapid growth of biological knowledge, interact and meet the demands and challenges in the fast technological changing world, there is need for secondary school biology teachers to make a

transition from their old methods to utilize modern technological devices and adopt different approaches to investigative laboratory activities. This can put a great excitement in the laboratory activities for the students and create opportunities to enhance their educational values.

Strengths of technological devices in biology laboratory activities

Teaching biology is challenging, but the practical activities in the laboratory have particular challenges that make it a demanding task, as it calls for advance skills. The new direction now in the biology laboratory, is to make use of new technological devices in enriching teaching and learning experiences for the students. This new direction has taken a wave more in secondary school biology laboratories in developed countries, where decisive and remarkable changes have occurred in how students learn. This is a story of tremendous importance not only to scientists and their counterparts in developing countries, but also, to a society facing difficult choices about health care, biotechnology, the environment and other issues involving biology.

New technological devices as resources in the biology laboratory activities are redefining biology education. Knowing what and how to use these devices is a very vital part of scientific knowledge both on the part of the teachers and their students. The strengths of the new technological devices have been recognized as they have been found to provide students with huge quantities of up- to- date information in new technologies for biology activities in the laboratory (Choppin, 2004). Laboratory instructions are emphasizing the flexibility that students need to master rapidly advancing specialties and techniques. And as biology itself assumes an increasing prominence among the sciences, biologists are realizing that their responsibilities have changed. They must produce not just the doctors and research scientists of the future but also, a biologically literate citizenry.

The introduction of electronic laboratory is becoming a reality as new computer programmes gain the ability to mimic laboratory experiences- a trend exemplified by the interactive lab manual. These devices are special media of instruction, which have both visual and aural appeal. They have great utility in making things clear to students. The utilization of these new technological resources will not only help in changing the ambience in the biology laboratory classroom, but will also, provide: Opportunities to engage students in critical thinking and problem-solving; Opportunities to enhance the educational value of the activity; Stimulate the desire of students to learn; Reasoning skills needed to acquire and apply new information throughout their lives.

One feature of the technologies that foster electronic learning is the ability to provide new ways of teaching students about writing practical/research reports, working in groups and acquiring scientific ethics.

The use of interactive computers/videodisc with laser player and colour TV monitors, micro computers based instruction, and computer assisted instruction has been very helpful in forms of drills and practice in biology activities (e. g. dissection of animals, etc). Biology students using these have consistently taken less time to complete the activity than equivalent instruction delivered by the biology teacher (Ulerich et al., 1998) . The students generally have positive attitude towards new technological devices and frequently showed gains in academic self-confidence. In all, new technological devices such as CD-ROMS, videodisc/tapes, computers, interactive vi-deos, internet etc present great possibilities for solutions of tasks in biology laboratory activities; making the laboratory experiences for students exciting and adding new productive dimension.

One feature of the new technologies in biology laboratory activities is the linking of microcomputers to other newer technologies such as a laser videodisc player, thus extending the realm of traditional CAI to what is now called 'computer-based instruction' [CBI]. Interactive videodisc instruction, the use of video disc player linked to a computer is one state-of- an-art form of CBI in which: 1. The computer provides the means for interaction between the learner and the instructional content; and 2. The videodisc player provides life-like images in which learners can respond and are of much higher resolution than those possible on a typical computer screen.

A good illustration of this is the use of microcomputer or video disc/ tape player in the biology laboratory activities such as: 1. Circulation of blood in humans; 2. Incorporating digital photographs taken from various laboratories demonstrations such as DNA gels into a series of tutorials that students use to learn basic biological concepts; 3. Unfolding of a flower bud captured with a powerful lens camera connected to video disc player; 4. Reproduction in animals, tropism in plants, osmosis, diffusion; 5. Mating behaviour in animals; 6. Erosion activities, polluted waters and streams; 7. Culturing of bacteria, etc.

We are in an era of technological devices that is revitalizing the biology education and thereby facilitating the teaching and learning and bringing out the realities of the subject to the students.

Challenges

Biology is building bridges among subjects like chemistry, physics, mathematics, information science and other disciplines requiring that its students become well grounded. The glaring challenge in Nigerian secondary school biology laboratory is the provision and utilization of new technological devices that will enable the students meet with the demands and challenges in the fast changing world. Biology students and teachers are faced with the following challenges: 1. Biology teachers are technologically unskilled and lack knowledge of using new de-

vices in their classroom/laboratories. Those who train teachers should provide them with clear goals and understanding of the content and knowledge of how to use new technologies in laboratory activities. Government authorities should create conditions, in-service training and encourage teachers to utilize these new technological devices. 2. Non-availability of new technological devices in the biology laboratory: Now, that some of these devices such as computers, C-ROMS, videodisc/tape players are becoming cheap and accessible, governments, philanthropists, Non-governmental Organizations [NGOs] can make donations to schools. 3. Large size-class. Since there are now ready-made package video disc/tapes, CD-ROMS, cassette tapes in various topics and drills, teachers can make use of them in large classes.

These are not easy challenges to meet. Nevertheless, it is important that they are met. The world is changing drastically in the area of technology and need people of highest potential who can teach biology with understanding, with enthusiasm and success, so that students being taught by them can fit into the new technological world. Let us do our part to meet that need and change our biology classroom laboratory from indifference to excitement. That is the challenge to us all.

Conclusion

As biology itself assumes an increasing prominence among the sciences, biologists are realizing that their responsibilities have changed as new technological devices are redefining the subject. They must produce not just the doctors and research scientists of the future, but also a biologically literate citizenry.

To meet up with the fast technological developing demands of the world, Nigeria must work to provide the new technological devices in their science classroom/laboratory. Despite the challenges to be met and realizing that change is rarely easy, there is great need for our secondary school biology teachers to be skilled and knowledgeable with the new technological devices for usage in their laboratory activities and more importantly engage the students. When this happens, it will not only expand the talent pool of the students, but will transform their laboratory activities from being tedious and indifference to excitement.

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