IMPLEMENTING SCIENCE, TECHNOLOGY, SOCIETY (STS) APPROACH TO SCIENCE TEACHING AS A PANACEA FOR STUDENTS POOR PERFORMANCE IN SCIENCE

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Abstract

Nigerians have expressed concern over students' poor achievement, negative attitude and low enrolment in science and technology in Nigeria. Developed countries and some developing countries of the world are addressing these and other related problems of science education through a paradigm shift called Science, Technology, Society (STS) approach to science teaching. Research has shown that the impact of STS approach in countries implementing it has been overwhelming. STS approach to science teaching is versatile in content, coverage, relevance, skills acquisition and attitudinal orientation. This paper gives an overview of STS, highlighting contrasts between STS and traditional science teaching. Some challenges of implementing STS approach to science teaching were examined. It was recommended that STS be implemented in Nigeria because of its robustness in facilitating science teaching and learning.

Students' poor performance and negative attitude to science and technology are some of the major concerns of Nigerians which could be traced to, among other factors, the teacher. Teachers are sometimes blamed for students' poor performance (Alofetekun, 2011) due to their inability to select appropriate teaching strategies and methodologies, poor interactions with students, poor organisation of classroom experiences, non use of technology to extend and enhance learning, and poor motivation of students to learn.

To promote students performance through effective science teaching, Science, Technology, Society (STS) teaching method was introduced. STS is recognised as a reform in science education and is being implemented across the world by both developed and some developing countries (Azeke, 2002). Developing countries such as Botswana, Zambia, Hong Kong, Western Samoa among others have adopted some aspects of STS in their educational systems. The Science Teachers Association of Nigeria (STAN) has spearheaded the call for the implementation of STS in Nigeria by establishing the STS panel that has been organising workshops on STS every year.

STS Approach to Science Teaching

STS is a worldwide shift of emphasis from the integrated science approach to science teaching (Teetito, 2000 Ivowi, 2000). This shift according to Teetito was necessitated by the need to teach science in the context of human experience to match

the increasing rate of science and technological advancement in our society. Unlike the traditional teaching approach, it is a learner centred approach to science teaching. Aikenhead (1994) explained that traditional science teaching methods tend to be characterized by convergent thinking and lecture demonstrations. STS science instruction on the other hand demands a repertoire of teaching strategies such as divergent thinking, small group work, students' centred class discussion, problem solving, simulation, decision making, controversies, debating and using media and other community resources.

Yager (1996) observed that constructivism is the learning theory that underlies the teaching strategy of STS. Constructivist classroom presents the learner with opportunities to build on prior knowledge and understanding to construct new knowledge from authentic experience. Students are allowed to confront problems full of meaning because of their real-life context. In solving these problems students are encouraged to explore possibilities, invent alternative solutions and collaborate with other students (or external experts) to try out ideas and hypothesis, revising their thinking and finally presenting the best solution they can derive.

STST provides a teaching strategy that is both effective and flexible. The six basic steps for STS teaching according to Yager (1996) are:

1. Brainstorm an issue or topic;
2. Define specific questions or phenomenon;
3. Brainstorm resources for obtaining information
4. Use the resources to collect information;
5. Analyse, synthesise, evaluate, create; and
6. Take action.

It should be noted that the students take steps; the teacher is primarily a facilitator. When students take action, their action should be based on substantiated information discovered and learned through their studies and experiments.

STS do not limit students understanding of science content as findings by Mayers (1992) reveals that the acquisition of traditional science content was the same or significantly better for STS students compared with the control group. STS method may be effective where traditional approaches fail because students start with their own problems, collect their own data, apply it to their problems and make decisions regarding their actions (Binaja, 1992). In summary, STS instruction consistently appears to augment students' achievement on STS content without interfering significantly with their acquisition of traditional science subject matter.

When science is taught using STS, the students come up with better mastery of basic concepts, use of basic process skills, ability to apply, interpret and synthesise information, enhancement of creative skills and improved attitude towards science study, school classes, teachers and careers, This is possible because the "the teacher places students in more central position in the whole instructional programme" (Teetito, 2000. p 34).

STS and Traditional Science Teaching

STS is a reform in science teaching aimed at correcting the deficiencies of traditional science teaching, The National Science Teachers Association (NSTA, 1991) defined STS as teaching and learning of science and technology in the context of human experience. The report states that the bottom line of STS is the involvement of learners in experiences and issues, which are directly related to their lives. STS develop students with skills, which allow them to become active, responsible citizens by responding to issues, which impact their lives. The experience of science education through STS strategies will create a scientifically literate citizenry for the twenty-first. STS focuses on social issues in homes, schools communities as well as global problems that concerned all mankind. STS also uses human resources in identifying and resolving local issues. These efforts are important in meeting the basic needs of the society.

Traditional science teaching focuses on textbooks readings, teacher lecture and verification type "laboratories." This approach to science education has failed to produce adequate and qualified cadre of scientists and engineers in the United Kingdom and United States of America (Aikenhead, 1994). What this means is that scientific and technological development of Nigeria cannot be guaranteed through traditional approach to science teaching which prevalent in schools today.

Yager (1996) lamented that students taught by the traditional science teaching methods could not use the information (concepts) they seem to know in classes and examinations, nor could they use the process skills they learned and practiced in laboratories. This is because students were not provided with the opportunity to interact and construct their knowledge in the context of their environments. When science is not taught in the context of students' cultural milieu, achievement and attitudinal orientation becomes low. Yager (1996) provided contrasts between STS and traditional classes dealing with concepts, processes, attitudes, creativity and application as outlined in tables 1-5.

Table 1 Contrast of Concepts Emerging from STS and Traditional Classes

Traditional	STS
Concepts are really bits of information mastered for a teacher test	Students see concepts as personally useful
Concepts are seen as outcome commodity for dealing with problems	Concepts are seen as needed
'Learning' is principally for testing	Learning occurs because of activity; it is an important happening but not a focus in and of itself
Retention is very short lived	Students who learn by experience retain it and often relate it to new situations

Table 2 Contrasts of Processes Emerging from STS and Traditional Classes

Traditional	**STS**
Students see science [and technology] processes as skills scientists [and technologist] possess	Students see science [and technology] processes as skills they can use
Students see processes as something to practice as a course requirement	Students see processes as skills they need to refine and develop more fully for themselves
Teacher concerns for process are not understood by students, especially since they rarely affect the course grades	Students readily see the relationship of science [and technology] process to their own actions
Students see science [and technology] processes as abstract, glorified, unattainable skills that are unapproachable for them	Students see process as a vital parts of what they do in science [and technology] classes

Table 3 Contrasts of Attitudes Emerging from STS and Traditional Classes

Traditional	**STS**
Student interest declines at a particular grade level and across grade levels	Student interest increases in specific courses and from grade to grade
Science [and technology] seems to decrease curiosity	Students become more curious about the material world
Students see [the] teacher as a purveyor of information	Students see [the] teacher as a facilitator or guide
Students see science [and technology] as information to learn	Students see science [and technology] as a way of dealing with problems

Table 4 **Contrasts of Creativity Emerging from STS and Traditional Classes**

Traditional	**STS**
Students decline in their ability to question; the questions they do raise are often ignored because they do not fit into the course outline	Students ask more questions; such questions are used to develop activities and materials
Students rarely ask unique questions	Students frequently ask unique questions that excite their own interests, that of other students, and that of the teacher
Students are ineffective in identifying possible causes and possible effects of specific situations	Students have skills in suggesting possible causes and effects of certain observations and actions
Students have few original ideas	Students seem to effervesce with ideas

Table 5 Contrasts of Applications Emerging from STS and Traditional Classes

Traditional	STS
Students see no value or use of their science [and technology] study to their lives	Students can relate their science [and technology] to their daily lives
Students see no value in their science [and technology] study for resolving current problems	Students become involved in resolving social issues; they see the resolving social issues; they see the relativity of science study to fulfilling citizenship responsibilities
Students can recite information or concepts studied	Students seek out information to use in dealing with questions
Students cannot relate the science they study to any current technology	Students are engrossed in current technological developments and use them to see the importance and relevance of science concepts

STS approach to science teaching provides learners with essential readiness skills needed for scientific literacy. These skills go beyond learning; they give learners a foundation for making sound decisions, understanding recent scientific advances and their implications. This approach also prepares students to enter the job market, and develop feelings of control in their lives.

Some Challenges of Implementing STS in Nigeria

One of the major challenges of implementing STS in Nigeria is the diffusion of STS content into our present science curriculum. For a start, the composition of the curriculum may start with a ratio of 20 percent STS content and 80 percent science content. The curriculum should be developed in such a way that technology in terms of techniques and products provides the interface between science concepts and skills and the rest of the society. The STS content may be increased as teachers and students get familiar with the reform. Associated with the revision of the curriculum is the writing of new textbooks, workbooks and teacher's guides that will emphasis STS content.

STS teaching demands students to work outside the normal class hours as students need to consult agencies, experts, the internet and other sources of information to gather authentic data in order to draw valid conclusions from their research. However, the secrecy with which some agencies operate in Nigeria may be a major setback to STS teaching in Nigeria.

The teachers are the major implementers of any reform in education. The successful implementation of STS in Nigeria will require the re-training of science teachers not only to incorporate STS in their teaching, but also to be models to their students by engaging in research themselves.

Similarly, the government must be prepared to fund students' research, provide appropriate materials and favourable environments for science teaching.

Conclusion

This paper has addressed the STS approach to science, its benefits and some challenges to its implementation in Nigeria. The traditional approach to science teaching as is being operated in most schools cannot take us to "the promise land." The introduction of STS in Nigeria would enable students to develop skills which will allow them to be active and responsible citizens by responding to issues which impact their lives. STS strategies may create a scientifically literate citizenry, which is needed for Nigeria's technological development and self reliance.

Recommendation

The need to introduce STS approach to science teaching in Nigeria's educational system cannot be overemphasized as articulated in this paper. If we are to breast up to the challenges of science and technology, the following recommendations are made:

1. Government as a matter of urgency should set up a committee to work out the nitty-gritty of implementing STS in our educational system.
2. Science curricula should be reviewed to reflect STS content.
3. Authors should write textbooks, workbooks and teacher's guides with STS content.
4. Teachers need to be re-trained to acquire necessary skills for teaching science using STS.
5. The teachers must be sensitive to societal problems and challenge students to investigate and proffer solutions to them.
6. Equipped science laboratories should be provided to enable students to carryout investigations.
7. Students should be allowed access to information from the internet, experts and relevant documents in the course of carrying out scientific investigations.
8. Government, Non Governmental Organisations (NGOs) corporate organisations should be ready to fund students' research.

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