CONSTRUCTIVISM IMPLEMENTATION AS A STRATEGY FOR INNOVATING SENIOR SECONDARY PHYSICS EDUCATION: IMPLICATION FOR THE 7TH-POINT AGENDA OF THE FEDERAL REPUBLIC OF NIGERIA.

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Abstract

The study investigated the extent of teacher's acceptability and implementation of the constructivist methods of teaching, x-raying possible implications on the 7th-point agenda of the Federal Republic of Nigeria. Simple random sampling technique was used to obtain a sample size of 50 physics teachers from 25 purposively selected secondary schools in Uyo Senatorial District of Akwa Ibom State to participate in the study. Professional Teachers Identification Questionnaire (PPTIQ), Traditional and Constructivist Teaching Methods Acceptability Questionnaire (TCTMAQ) and Teaching Method Implementation Check List (TMICL) were used for data collection. Percentage analysis of data revealed a colossal 76% acceptability in favour of the constructivist methods and a paradoxical 18% implementation of the constructivist methods of teaching. It was concluded that the extent of constructivism implementation in senior secondary physics is minimal and thus lacking in innovation. As a fallout, there is little or no prospect of realizing the 7th-point agenda of the Federal Republic of Nigeria by the year 2020. It was recommended that government should provide incentives to teachers who make genuine and committed efforts to implement constructivist methods of teaching to serve as extrinsic motivation.

Recent socio-economic and economic changes in the world and within nations have brought about rapid changes in educational goals. The ability of the existing educational practices to adequately target pupil's needs and interest appropriately to the rapid changing society like ours has been questioned. The schools are called not only to equip the learners with fundamental knowledge but also with higher cognitive skills that allow for self-development. Senior secondary physics is not left out of this change.

The pressures for educational innovation are building fast. These include (Nair, 2008):

1. Demand by parents that education work for all children;
2. The increased push for accountability from education officials;
3. The information and communication revolution;
4. New research and greater understanding of the way we learn as children and adults;
5. Changing employment patterns in a global economy.

As education has come under criticism from many quarters, educators have looked for ways to revamp the curricula and innovate teaching and learning. Accordingly, educational curricula and teaching methods are changing. One component of the current development in physics curriculum is the change in focus of instruction from the transmission to the constructivist approach.

Lecture Method

The lecture method involves verbal presentation of ideas, concepts, generalizations and facts by the teachers (Aina, 2006). The teacher talks (transmits) while the students listen (absorbs) and jot down points. The teacher, generally does not entertain questions from students. If he does, it is either to emphasize some points or to make some points clearer (Onwuka, 2000).

The Constructivist Method

Social constructivism encourages the learners to arrive at his or her version of truth, influenced by his or her background, culture or embedded world view. Social constructivists view knowledge as being constructed by learners through an active, mental process of development. "It is the process of new knowledge construction that the old ones refined, reformed or dropped (Ubah, 2009).

But what exactly is constructivism? Constructivism is an umbrella term that encompasses a range of instructional methods, including inquiry method, discovery method, problem-based method and project-based method (Prince & Felder, 2006).

Inquiry Method

Inquiry teaching represents an open-ended approach to science teaching where the learners are given the opportunity to search for meaning in a more meaningful way about events, phenomena, scientific ideas, etcetera. It involves the development of a questioning attitude, and a reflective and critical thinking. The nature of inquiry therefore include: observation, identifying problems, exploration, hypothesizing, predicting, describing and conducting experiments, collecting data, organizing and analyzing data, reporting, making generalization, etcetera. It entails the practicing of attitudinal skills such as objectivity, curiosity, open-mindedness and perseverance (Otuka, 2000).

Discovery Method

Discovery method offers the learners the opportunity to discover scientific facts, concepts and principle for themselves. As inquiry-based approach, it involves learners performing certain mental processes such as observation, classifying, measuring, predicting, describing, inferring, and so on, in order to make discoveries. Unlike inquiry which involves high level of mental processes such as asking insightful questions, formulating problems, formulating hypotheses, designing experiments, etc, the discovery method may not involve all these (Otuka, 2000).

Problem-Based Method

Problem-based learning begins when students are confronted with open-ended, ill-structured, authentic (real-world) problem and work in teams to identify learning needs and develop a viable solution, with instructors acting as facilitators rather than primary sources of information (Barrows & Tamblyn, 1980; Dahlgren, 2003; Prince & Felder, 2006). Learners often learn facts and rote procedures with a few ties to the context and application of knowledge. Problem-solving has become the means to rejoin content and application in a learning environment for basic skills as well as their application in various contexts (Kirley, 2003). Problem-based learning is a way to improve motivation, thinking and learning. It relies on the proper use of the science process skills by students to solve problems (Wetzel, 2008).

Project-Based Method

Project-based learning begins with an assignment to carry out one or more tasks that lead to the production of a final product - a design, a model, a device or a computer simulation. The culmination of the project is normally a written and/or oral report summarizing the procedure used to produce the product and presenting the outcome (Prince & Felder, 2006). It is a process of learning or a study carried out by learners in real life situation. This may be carried out individually or in groups or class, under the guidance of the teacher to achieve objectives (Aina, 2006). The project is essentially a learning unit designed and conducted by the learner in true-to-life manner of the environment.

Analysis of the potential benefits of implementing the constructivist methods of teaching - inquiry method, discovery method, etcetera is reminiscent of the physics teacher, and is tied to the 7^{th}-point agenda of the Federal Republic of Nigeria.

The 7^{th} Point Agenda and the Physics Teacher

The 7^{th} of the 7-point agenda of the Federal Republic of Nigeria (popularly known as Yaradua's 7-point agenda, which is still being vigorous pursued by the present administration) stipulates that "the two-fold reforms in the educational sector will ensure firstly the minimum acceptable international standards of education for all. With this achieved, a strategic educational plan will ensure excellent in both the tutoring and learning of skills in science and technology by students who will be seen as the future innovators and industrialists of Nigeria". Pointing to the fundamentality of the physics

teacher, Ituen (2003) alleged that there is no development in science and technology without recourse to physics education. "If history is anything to go by, then technological break through of any nation, Nigeria included, is indeed dependent primarily on physicists (Udegbue, 2001). "Physics is a very crucial subject for technological development and as such, it's teaching and learning must be a matter of national concern" (Ladipo, 2009). In order to achieve the objectives of physics education at the senior secondary school level (which include the acquisition of essential scientific skills and attitudes as a preparation for the technological application of physics), the guided-discovery method of teaching has been recommend. So, physics teachers are strongly encouraged to employ the students activity-based inquiry-oriented mode of teaching (Lapido, 1985 & 2009).

The Problem

Regrettably, it is recognized (Lapido, 1985 & 2009) that there is an increasing low enrolment in physics in schools and tertiary institutions in Nigeria despite the desire for technological development. The persistent decline in physics enrolment (Ezeife, 1996) points to the fact that there are increasing conditions for underachievement and slow learning portraying possible failure of previous efforts of physics educators in improving the learning situation (Nkwo, Akinbola and Edinyang, 2008). The embarrassing problem of underachievement and the attendant slow learning in physics are attributed by Ikwa (1997) to students' and teachers' ineffective grasp of concepts due to difficulty in constructing understanding of these concepts. This indicates a need to change focus of teaching from the transmission to the constructivist mode, if the 7^{th}-point agenda of the Federal Republic of Nigeria is to be realized. Finding implications for the 7^{th}-point agenda, of the implementation, or otherwise, of constructivist method of teaching, is the thrust of this paper.

Alao and Adelabu (2006) warned that it is difficult for human societies to accepts changes and innovations easily. They (Alao and Adelabu) posited three fundamental conditions necessary for introduction of change and innovation. These are:

1. A proper understanding of what should be done;
2. An explicit and implicit acceptance of the plan;
3. A genuine and committed sense of responsibility for putting the programme into operation.

These fundamental conditions provoke two research questions.

Research Questions

If it is assumed that we as teachers have had a proper understanding of how to implement constructivist teaching method, by virtue of our professional training, then two fundamental questions need to be addressed.

1. Is there a broad-based general acceptability of constructivist approach to teaching to address the 7^{th}-point agenda?
2. To what extent is the constructivist teaching approach, on which the realization of the 7^{th} point agenda anchors, has been implemented?

Research Objectives

The objectives of this study; therefore are

1. To determine the level of acceptability of constructivist approach to teaching on which the 7th point agenda hinges.
2. To determine the extent of implementation of the constructivist approach to teaching on which the realization of the 7th point agenda is anchored?

Method

Survey research design was adopted for the study. All the professionally trained, secondary school physics teachers in Uyo Senatorial District of Akwa Ibom State constituted the population of the study. Simple random sampling technique was used to obtain a sample size of fifty (50) physics teacher from twenty five (25) purposively selected secondary schools in the Senatorial District to participate in the study.

The instruments used for the study were: Professional Physics Teachers Identification Questionnaire (PPTIQ), Traditional and Constructivist Teaching Method Acceptability Questionnaire (TCTMAQ) and Teaching Method Implementation Check List (TMICL). The PPTIQ, TCTMAQ and TMICL were constructed by the researcher and validated by two physics education university lecturers. The research instruments were administered on the respondents by the researcher, with the aid of a research assistant.

Data Analysis and Results

For the TCTMAQ, frequency count was taken of physics teacher's responses on a 4-point scale of: Very Acceptable (VA), Acceptable (A), Unacceptable (UN) and Very Unacceptable (VUN). Data analysis was based on VA and A categorized as A while UN and VUN were categorized as UN.

For the TMICL, frequency count was taken, of physics teachers' responses on a 4-point checklist of: Always, Often, Scarcely and Never. Data analysis was based on "Always and Often" representing "Implementation of teaching method" while "Scarcely and Never" represented 'non implementation'.

Results

The results of data analysis are presented in tables below:

Table 1: Acceptability of Constructivist Teaching Approaches. N = 50

S/N	Teaching Approaches	Acceptability			
		VA	A	UN	VUN
1.	Lecture	Nil (Nil)	10.0 (20.0)	14.0 (28.0)	26.0 (52.0)
2.	Inquiry	21.0 (42.0)	19.0 (38.0)	10.0 (20.0	Nil (Nil)

3.	Discovery	22.0 (44.0)	20.0 (40.0)	8.0 (16.0)	Nil (Nil)
4.	Problem-based	12.0 (24.0)	25.0 (50.0)	9.0 (18.0)	4.0 (8.0)
5.	Project-based	16.0 (32.0)	18.0 (36.0)	14.0 (28.0)	2.0 (4.0

Over all	Traditional (lecture)	10.0 (20.0)	40.0 (80.0)
	Constructivist	38.0 (76.0)	12.0 (24.0)

* Values in bracket are percentage values.

Table 1 reveals 76.0% acceptability in favour of the constructivist method of teaching as against a paltry 20.0% in favour of the traditional (lecture) method.

Table 2: Level of Implementation of Traditional and Constructivist Teaching Methods in Physics Curriculum Delivery. N = 50

S/N	Teaching Methods	Frequency			
		Always	Often	Scarcely	Never
1.	Lecture	15.0 (30.0)	25.0 (50.0)	10.0 (20.0)	Nil (Nil)
2.	Inquiry	Nil (Nil)	20.0 (40.0)	26.0 (52.0	4.0 (8.0)
3.	Discovery	4.0 (8.0)	11.0 (22.0)	20.0 (40.0)	15.0 (30.0)
4.	Problem-based	Nil (Nil)	Nil (Nil)	18.0 (36.0)	32.0 (64.0
5.	Project-based	Nil (Nil)	2.0 (4.0)	6.0 (12.0)	42.0 (84.0

Overall	Traditional (lecture)	40.0 (80.0)	10.0 (20.0)
	Constructivist	9.0 (18.0)	41.0 (82.0)

* Values in bracket are percentage values.

Table 2 reveals a meager 18.0% implementation of constructivist method of teaching as against a colossal 80.0% implementation of the lecture method in the physics classroom.

Discussion of Findings

Table 1 reveals a vast majority (80.0%) of physics teachers accepting the potential advantages of constructivist methods of teaching. This revelation is contrary to Alao and Adelabu's (2006) claim that it is naturally difficult for human society to accept change and innovation easily. This broad-based acceptability is probably due to several training workshops show-casing constructivist teaching as authentic instruction representing powerful teaching and learning.

Table 2 shows a disturbing percentage (18.0%) implementation of the constructivist approaches to teaching. Implementation so revealed is exact reversal, and paradoxical, of the broad-based acceptability by the same teachers. This revelation is consistent with Abbott and Fout's (2003) general finding (in American environment) that "strong constructivist teaching was observable in about 17% of the class lessons. The other 83% of the lessons observed may have contained some elements of constructivist teaching but as many as one-half of the lessons observed has very little or no elements of constructivist teaching present".

Implications of Findings on the 7th Point Agenda

Realization of the 7th-point agenda of the Federal Republic of Nigeria calls for school products to develop new skills and competence. Such evolving generic skills and competences include: decision-making skills, problem-solving skills, autonomous thinking skills, diffused-thinking skills, effective communication skills and independent and autonomous learning skills. These skills are embedded in student's activities in constructivist classroom. Since only 18% of these activities are present, using Uyo Senatorial District of Akwa Ibom State as a case study, by the year 2020, Nigeria will still be getting terribly behind the realization of the 7th-point agenda. This extrapolation is of great significance if "Africa is slow in responding to appropriate changes in matters relating to education and technology" (Alao & Adelabu, 2006). The hope for a strategic educational developmental plan "that will ensure excellence in both the tutoring and learning of skills in science and technology by students who will be seen as the future

innovators and industrialists of Nigeria (Yaradu, 2007) would then be a mirage. "Developing countries in Africa may never develop if Africa continues to find and sustain educational system that is slow to respond to appropriate changes" (Alao & Adelabu, 2006).

Conclusion

The extent of constructivism implementation in senior secondary schools in Uyo Senatorial District of Akwa Ibom State is minimal and hence lacking in innovation.

Recommendations

Arising from the findings of the study, the following recommendations are made:

1. Physics curriculum should integrate the principles of the techniques of constructivist approaches;
2. Behavioural objectives should be pursued using constructivist approaches;
3. Physics teachers should be encourage to analyze and explore how to incorporate constructivism in their classroom instruction;
4. Physics teachers should be trained and retrained in constructivist philosophy;
5. Government should provide incentives to teachers who make genuine and committed effort to implement constructivist teaching approaches to motivate them extrinsically.

References

Aina, M. E. (2006). *General Teaching Methods.* Lagos: National Open University of Nigeria.

Alao, K. & Adelabu, M. (2006). *Planning, programming and strategizing for changes and innovations in the educational systems of developing countries*. A Paper Presented at the 3rd Vittachi International Conference on Rethinking Educational Change, Held in Ifrane, Morocco. 1st – 5th July.

Barrows, H. S. & Tamblyn, R. (1980). *Problem-based learning: An approach to medical education.* New York: Springer.

Dahlgren, M. A. (2003). PBL through the Looking Glass: Comparing Applications in Computer Engineering, Psychology and Physiotherapy. *International Journal of Engineering Education, 19 (5).*

Ezeife, A. N. (1996). *Physics methods: The methodology of physics teaching.* Enugu: University Trust Publishers.

Ikwa, E. O. (1997). Areas of Difficulties in JSS Integrated Science Curriculum as Perceived by Serving Teachers in Cross River State. *Akamkpa Journal of Science and Mathematics Education, 1 (1 &2).*

Ituen, E. (2003). Science and Technology Policy with Respect to Physics. In, L. O. Asuquo (ed). *Science and technology in Akwa Ibom state. Vision and perspectives:* Uyo: Ministry of Science and Technology.

Kirley, J. (2003). *Principles for teaching problem-solving.* Indiana: PLATO Learning, Inc.

Lapido, O. A. (1985 & 2009). *National Curriculum for Senior Secondary Schools. Physics.* Lagos: Federal Ministry of Education.

Nair, P. (2008). *30 Strategies for Education Innovation.* Online: http:llwww.fiedingnair.com/Publications/Edinnovation Nairs. Pdf.

Nkwo, N. I; Akinbola, A. O. & Edinyang, S. D. (2008). Effect of Prior Knowledge of Instructional Objectives on Students Achievement in Selected Difficult Concepts in Senior secondary Physics. *Journal of Science Teachers Association of Nigeria, 43 (1&2).*

Onwuka, U. (2000). *NCE/DLS Course Book on Education, Cycle 1, Modules 6, 7, 8.* Kaduna: National Teachers Institute.

Otuka, J. O. E. (2000). *NCE/DLS Course Book on Integrated Science. Cycle 3, Modules 8, 9, 10, 11.* Kaduna: National Teachers Institute.

Prince, M. J. & Felder, R. M. (2006). Inductive Teaching and Learning Methods. Definitions, Comparisons and Research Bases. *Journal of Engineering Education, 95 (2).*

Udegbue, F. (2001). *Physics: The surest solution to technological breakthrough.* A Paper Presented at the Annual Conference of Institute of Physics. NIP, Abuja.

Wetzel, D. R. (2008). *Problem solving and science process skills*. Online: www.g-and-z.com.

Ubah, M. E. (2009). *Social Studies*. Kaduna National Teachers Institute.