

Assessment of Innovative Teaching Strategies for Rebuilding Performance in Senior Schools Physics in Nigeria

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Abstract:

The study employed a descriptive survey to investigate the assessment of innovative teaching strategies in rebuilding performance in senior secondary school Physics. By the use of purposive sampling, 120 out of a population of 394 senior secondary school year two physics students from two co-educational senior secondary schools in Bichi LGA of Kano State was used. The instrument for data collection was the researchers developed structured questionnaire of the Likert type on assessment of innovative teaching strategies in rebuilding performance in senior secondary physics in Nigeria. The instrument was validated and the reliability index of 0.86 was obtained. The research questions were answered using mean while the hypothesis was tested with t- test statistics. Results showed that inquiry method, discovery learning, individualised instruction, role play, simulation, games, team teaching, brainstorming and other similar strategies were agreed to be innovative teaching strategies that can enhance performance in physics. A recommendation that physics teachers should be encouraged to use these innovative teaching strategies in the teaching and learning of physics in order to rebuild performance in students.

Keywords: Innovation, Teaching Strategies, Science, Physics and Performance.

Introduction

Physics is one of the core science subjects taught at the secondary school level in Nigerian educational system. It is a branch of science that deals with energy and matter and their interactions. It is sometimes referred to as the science of measurement and its knowledge has contributed greatly to the production of instruments and devices of tremendous benefits to the human race. The study of Physics can lead to several scientific fields and professions such as engineering, manufacturing, mining and construction industries. Apart from this, the knowledge of Physics plays a very significant role in the development of any nation. The knowledge of Physics is usually required to pursue courses like Astronomy, Geology, Chemistry, Biology, Engineering amongst others. Udoh (2012) established that learning of Physics offers the student an opportunity to think critically, reason analytically and acquire the spirit of enquiry. Udoh (2012) asserted that Physics is crucial for effective living in the modern age of science and technology. Given its application in industry and many other professions, it is necessary that every learner is given an opportunity to acquire some of its concepts, principles, and skills.

Despite the importance and usefulness of physics, secondary school students' performance in the subjects is very discouraging. Researchers have shown that secondary school students exhibit dwindling interest in the subjects (Esiobu, 2005). It is widely recognized that the teaching and learning of Physics has been faced with challenges such as low enrolment both in secondary schools and in tertiary institutions in Nigeria (Daramola,

2009). Notable among the causes for low enrolment of students offering Physics in secondary schools include, continuous use of lecture method i.e talk and chalk method in teaching Physics, poorly equipped Physics laboratories, inadequate motivation of science teachers, poor remuneration, inappropriate teaching strategies employed by Physics teachers and insufficient number of qualified Physics teachers (NERDC, 2009; Jegede and Adedayo, 2013). Poor academic performance in physics could be attributed to many factors among which are the teachers' teaching strategies. This means that physics concepts cannot be well understood if students are not taught with effective teaching strategies. Many researchers have blamed this poor achievement in physics on the use of inappropriate teaching strategies which might lead to lack of interest and retention of physics concepts (Agommuoh, 2004).

Current studies on how students learn science revealed new and innovative instructional approaches in the teaching of science Agommuoh, 2010. Science and especially physics teaching have undergone a paradigm shift from a passive process to an active construction and interpretation of experiences. Screeden and Sudler (2011) explained that learning is a treasure within, and scientific knowledge is being actively built up and constructed by the learners. This is the constructivist view of learning science. The constructivists see learning as an interaction between the learner and his environment. During this interaction between the learner and his environment his prior knowledge becomes the basis for him to interpret and construct new knowledge. The implication is that learning is a process in which the learners invent and develop new ideas. This means that learning physics is a process of conceptual change and knowledge navigation. Learning in this case involves the restructuring of student conceptions. Teachers must learn to appreciate the ideas students bring into the learning situation, understand the processes by which the conceptual change occurs in order to design the learning programmes. Learning is learner centered which makes the learner an active participant in the learning environment. New learning in this case depends on the learners' previous knowledge that may at times interfere with the understanding of the new information.

The teaching and learning of physics must aim at achieving the following science process skill such as;

1. Development of process skills like observation, classification, communication, measurement, estimation and prediction.
2. Acquisition and understanding of knowledge development of the skills for problem solving and investigations.
3. Ability to think logically as well as to draw conclusion on the basis of experiment.
4. Development of the ability to reach generalization and to apply them for solving life problems.
5. Development of understanding of inter-relationship of science and mathematics.
6. Fostering creativity for innovations in science and mathematics.

The minds of the young need to be exposed to critical thinking, analysis and problem solving strategies in a fast-changing world like ours. The teaching and learning of science especially physics requires a unified and comprehensive approach relying on teachers that are professionally trained and equipped with requisite knowledge and skills. The adoption of student-centered instructional strategies which includes the inquiry method, discussion, role play, simulation, games and other similar strategies have been shown to enhance the active participation of students in the teaching and learning of physics. According to Screeden and Sudler (2011) some other approaches for effective teaching of physics includes;

1. Orientation – Here the teacher introduce the topic.

2. Elicitation of ideas which involves opportunities provided for the students to explore and explain their ideas.
3. Classification and Exchange where students are given a chance to realize scientific and mathematical ideas in examining their own ideas.
4. Exposures to conflict situation which involves students being provided with situation which will enable them test their ideas and recognize the limitation of these ideas.
5. Constructions of new ideas- students are provided with opportunities to restructure (extend, modify or replay their ideas).
6. Evaluation involves students being provided with opportunities to test the validity of their newly reinforce ideas.
8. Review change in ideas which involves students being given opportunity to refer upon how and why their ideas have changed.

Effective teaching according to Obi (2003) is a process related to the teachers' consciousness of the individuality of each child, including his needs, strengths, weaknesses, growth patterns and background of experiences. This means that an effective teacher has to create an atmosphere for a wholesome teaching and learning. Stressing further on this Anyachebelu (2005) explained that effective teaching as a situation whereby the teacher is vast in attainment, knowledge and skills as well as possession of certain pre- requisites and acceptable practices within the codes of ethics of teaching profession. Obi (2003) identified five components of effective teaching to include:

1. Knowledge of subject matter
2. Ability to help students with their works
3. Presenting subject matter appropriately
4. Motivating students to excel and
5. Firmness/fairness in preparing marking guides and grades of examination.

For effective and successful physics teaching, teachers must understand how students think and construct scientific and mathematical knowledge. The implication is that physics teachers need to teach these subjects effectively for a successful preparation of today's individuals for tomorrow (Zakaria & Iksan, 2007). The teacher should know how students learn these subjects and how best to teach them. Physics teaching is not for knowledge depositing and information thrusting but should inculcate scientific temper and values. For effective teaching, the learner is provided with opportunities to have an optimal learning experience through constructing his own knowledge (Zakaria & Iksan, 2007). The teacher should provide a democratic climate in the classroom for effective teaching and learning of physics. This democratic climate creates a conducive environment for the students to enable them freely state their point of view. This encourages active participation of the students in the classroom. The focus is for the teacher to use learner centered innovative pedagogical strategies in the teaching and learning of the subjects. Such innovative strategies include peer tutoring, simulation, Individualised instruction, Brainstorming, Team Teaching, Discovery learning, Inquiry and Role play strategies (Zakaria & Iksan, 2007). In educational institution, gender issue assumes a new dimension in academic performance. Gender refers to the personal traits and social positions that members of the society attached to being female or male Macions (2006). Ikide(2010) documented in terms of achievement that male perform better than female in most schools subjects. However, Nsa(2007) and Offiong(2007) observed no statistically significant effect of gender on students performances when taught with different methods of teaching. The secondary school physics curriculum is designed to provide students with knowledge and skills

that will enable them solve problems and make decision in everyday life (Ministry of Education Malaysia, 2002). Students need knowledge, problem-solving skills, creative and critical thinking for proper adjustment into a fast scientifically and technologically developing society like ours. Students must therefore be taught to meet up with the challenges ahead and demand by daily living. This is very imperative since lecture based instruction which is teacher centered has been identified as a major shortcoming in the teaching and learning of physics (Madu, 2004). This is because according to Kurumah (2004), lecture method emphasizes passive acquisition of knowledge by students who do not have conceptual understanding but memorize the learning content. Bearing in mind the nature of physics, there is therefore, the need for the teacher to use innovative teaching strategies in the teaching of the subject so as to enable the students learn and acquire positive attitudes and values, science process skills and problem-solving skills in order to rebuild the interest in the subject. Hence the need for the study.

Purpose of the Study:

The study was design to determine the extent to which innovative teaching strategies colud rebuilding performance in senior secondary schools Physics.

Research Questions

The following research questions guided the study.

1. What is the extent to which innovative teaching strategies rebuild performance of students in physics?
2. What is the mean score difference between male and female students on the extent to which innovative teaching strategies rebuilds performance of senior secondary schools Physics?

Null Hypothesis:

The hypothesis below tested at $P < 0.05$ significant level guided the study.

1. There is no significant difference between male and female mean score on the extent to which innovative teaching strategies rebuild performance of senior secondary schools Physics.

Methodology

The study adopted a descriptive survey. By the use of purposive sampling, 120, 68 males and 52 females out of a population of 394 senior secondary schools year two Physics students, from two (2) senior secondary schools in Bichi LGA of Kano State was sampled. The instrument used for data collection was the researchers developed structured questionnaire of the Likert type on senior secondary school students' assessment of innovative teaching strategies in rebuilding performance in Physics. The responses were Very High Extent (VHE), High Extent (HE), Low Extent (LE) and Very Low Extent (VLE) weighted 4, 3, 2,1 respectively. It is a ten-item questionnaire that is made up of innovative teaching strategies that can be used in rebuilding of performance in physics. The instrument was face validated by three experts in Physics Department, School of Secondary Education (Science) .Federal College of Education (technical) Bichi,Kano State, Nigeria. The reliability index was determined by cronbach alpha and found to be 0.86. Copies of the questionnaires were distributed by the researcher and collected back and so the percentage return was 100%. The research questions were answered using means, while the hypothesis was tested using t -test statistics.

Results

The results in respect of mean scores of students' assessment of the extent to which innovative teaching strategies rebuild performance in Physics used in answering research questions 1 and 2 are shown in tables 1 and 2 below,

Table 1: Mean scores of senior secondary school students' assessment of the extent to which innovative teaching strategies rebuild performance in physics.

s/no	Item	VHE	HE	LE	VLE	X	Remarks
1	Peer Tutoring	60	30	15	15	3.13	High extent
2	Simulation	48	40	17	15	3.01	High extent
3	Individualised Instruction	52	40	12	08	3.20	High extent
4	Brainstorming	50	45	15	10	3.13	High extent
5	Scaffolding	55	43	15	09	3.20	High extent
6	Cooperative Learning	60	38	12	10	3.23	High extent
7	Team Teaching	59	40	10	11	3.23	High extent
8	Discovery Learning	51	45	15	15	3.15.	High extent
9	Inquiring	53	43	10	10	3.13	High extent
10	Role Play	57	40	13	13	3.22	High extent

Table 1 above clearly showed that all the items have mean values greater than 2.5 which is the mean value of the four point scale used in the study meaning that all the students agreed that these items are innovative teaching strategies that can enhance performance in physics.

Table 2: Mean scores of male and female senior secondary school students' assessment of innovative teaching strategies in rebuilding performance in physics.

s/no	Item	Male X	Remarks	Female X	Remark
1	Peer Tutoring	3.30	High extent	2.28	High extent
2	Simulation	3.21	High extent	3.12	High extent
3	Individualised Instruction	3.35	High extent	3.10	High extent
4	Brainstorming	3.30	High extent	3.28	High extent
5	Scaffolding	3.42	High extent	2.88	High extent
6	Cooperative Learning	3.06	High extent	3.26	High extent
7	Team Teaching	3.17	High extent	3.24	High extent
8	Discovery Learning	3.42.	High extent	2.94.	High extent
9	Inquiring	3.26	High extent	3.22	High extent
10	Role Play	3.36	High extent	2.88	High extent

Result in table 2 shows that all the items have mean values greater than 2.5 meaning that all the students both males and females agreed that the ten items listed above are innovative teaching strategies that can rebuild performance in physics.

Table 3: Related t-test analysis of difference between male and female students mean score of the extent to which innovative teaching strategies rebuild performance of students in Physics(N=120).

	Gender	n	X	S.D	df	t _{cal}	t _{cri}	Decision
Male	68	32.85	10.43					
					118	1.28	1.98	NS
Female	52	30.77	9.83					

NS= not significant at .05 alpha level

Table 3 above clearly showed that t- test calculated value of 1.28 is less than the critical t-value of 1.98. The null hypothesis of no significant difference was rejected and the alternative hypothesis accepted. This therefore means that there is no significant difference in the mean scores of male and female secondary school students' assessment of the extent to which innovative teaching strategies rebuild performance in physics.

Discussion of Findings

Base on the finding of the study, it is revealed that innovative teaching strategies have the potential to rebuild performance of students in Physics. In support of the findings of the study Akinbola and Ado (2007) observed that innovative strategies help the learners to acquire appropriate skills, abilities and competence for individual to solve life problems and contribute to the development and growth of the society. Akinbola (2008) confirmed that the new approach of communicating science and mathematics is by involving students to participate fully rather than listening to talks and taking notes.

The findings of the study also indicated that there is no significant difference between male and female student's means score on the extent to which innovative teaching strategies rebuild performance in senior secondary schools Physics. In line with the findings of the study, Nsa(2007) and Offiong (2007) observed no statistically significant effect of gender on students performance when taught with different methods of teaching. The result implies that male and female students offering Physics in senior secondary school do not differ in their performance when taught with innovative teaching strategies.

Conclusion

Base on the findings and discussion of the study, it is concluded that the innovative teaching strategies can enhance the performance of students. Moreso, male and female students do not indicate difference in the extent to which innovative teaching strategies rebuild performance of students in Physics.

Recommendations

- For rebuilding performance in physics through effective teaching and learning, the following recommendations are made. The curriculum planners should ensure that:
1. Innovative teaching strategies such as team teaching, brainstorming, peer tutoring etc should be reflected in Physics teacher education curriculum to enable new graduate teachers to be fully equipped for teaching and learning of the subjects.

2. Conferences, workshops, and seminars should be organized by government for the practicing and serving science teachers to update their knowledge/skills in the application of these strategies which will enhance quality teaching and rebuilding the interest of the learners in Physics and other science subjects.
3. Physics and other science students should be encouraged to be actively involved in the learning environment by engaging in these innovative teaching and learning strategies.

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