

Enhancing Science Achievement in Secondary Schools: Teachers' Perspectives on Innovative Strategies

Dr. Afolabi Temitope, Dr. Nneoma Blessing Chukwueke

Department of Curriculum Studies, Faculty of Education, University of Ilorin, Ilorin, Nigeria; Department of Science Education, Faculty of Education, University of Port Harcourt, Port Harcourt, Nigeria

Abstract This study was based on teachers' assessment of innovative teaching strategies that could enhance secondary school students' science achievement. It was guided by two research questions and one null hypothesis. The study adopted a descriptive survey research design. Purposive sampling technique was used to obtain a sample of 150 secondary school Science Teachers in Nasarawa State West Senatorial Zone. Innovative Teaching Assessment Questionnaire (ITAQ) was developed by the researchers as an instrument for data collection. The reliability of the instrument was determined using Cronbach Alpha method which yielded a coefficient value of 0.88. Expert opinions were used to validate the instrument for the study. The research questions were answered using means and standard deviations. The null hypothesis was tested at 0.05 level of significance using Chi-Square statistic. Results revealed that simulations, brain-storming, peer-tutoring, collaborative learning, competitive learning and discovery learning were innovative teaching strategies that proved to enhance Science Students' achievement. Based on the findings of this study, it was recommended that Science teachers should be encouraged to employ these innovative strategies in teaching to enhance students' learning and academic achievement in science.

Keywords: Assessment, Enhancing, Innovative, Science and Teaching strategies.

Introduction

Science is the bedrock on which modern-day technological breakdown is built. Indeed, it is a dynamic human activity which is concerned with the working of the world. This is why developing countries like Nigeria are working hard to develop scientifically and technologically since the world is a scientific and technological global village where all proper functioning of lives largely depends on science (Agommuoh & Ifeanacho, 2013). Science according to Osokoya (2013) plays a major role in creating new knowledge, economic development and wealth creation. This assures social wellbeing by eradicating poverty and providing better health care which improves the quality of human living in several ways. Nigeria as a nation appreciates the importance of science in its quest to transform its economy. This can be seen in the mission statement of the new national policy on Science, Technology and Innovation (FRN, 2012), which seeks to evolve a nation that develops and utilizes science, technology and innovation to build a large, strong, diversified sustainable and competitive economy that will guarantee a high standard of living and quality of life for all its citizens. Without the application of science, it will be very difficult for a man to live and adjust in a fast scientifically developing world.

An integral part of the Nigerian Educational system is Science Education, beginning from Basic Science – which is the foundation science subject from the basic levels and other science subjects like, Chemistry, Physics, Biology and Applied science in the Secondary and Post – Secondary School levels (Samuel, 2017). The practice-oriented subjects were infused into the curriculum content of the Nigerian Educational system because of their educational value and relevance to the needs of the individual learners and the society as a whole (Onwukwe, 2010). In spite of the importance and usefulness of Science, students' achievement in the subjects is not encouraging. Researchers have shown that students exhibit dwindling interest in Science subject (Osokoya, 2013 & Ajaja, 2009).

Underachievement in Science could be attributed to many factors among which are the teacher's teaching strategies. This means that Science concepts cannot be well understood if students are not taught with effective teaching strategies (Osokoya, 2013). According to Ayeni (2011), teaching is a continuous process that involves bringing about desirable changes in learners through the use of appropriate methods. Adunola (2011) indicated that in order to bring desirable changes in students, teaching strategies utilized by the instructor should be best for the subject matter. Furthermore, Hightower (2011) sustained that teaching strategies work effectively mainly if they suit learners' needs since every learner interprets and responds to questions in a unique way. As such, alignment of teaching strategies with students' needs and preferred learning influence students' achievement. To facilitate the process of knowledge transmission, teachers should apply appropriate teaching methods that best suit specific objectives and level exit outcomes (Tebabal & Kahssay, 2011).

Studies on how students learn science revealed new and innovative instructional strategies in the teaching process

(Agommuoh & Ifeanacho 2012). Science teaching has undergone a paradigm shift from a passive process to an active construction and interpretation of experiences. Screeden and Sudhir (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. This implies that learning is a process in which the learners invent and develops new ideas (Chang, 2010). This means that learning Science 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 process by which the conceptual change occurs in order to design the learning programmes (Agommuoh & Ifeanacho, 2013).

For effective and successful Science teaching, teachers must understand how students think and construct scientific knowledge. This means that Science teachers need to teach the subject effectively for successful preparation of today's individuals for tomorrow (Onwukwe, 2010). The teacher must know how students learn the subject and how best to teach it. Science 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 optional learning experience through constructing his own knowledge. The teacher must provide a democratic climate that creates a conducive environment for the student to enable them freely state their point of view. This encourages active participation of the students in the classroom (Oni, 2014).

The focus is for the teachers to use learner-centered innovative pedagogical strategies in the teaching and learning of Science subject (Samuel, 2017). Such innovation strategies include peer tutoring, simulation, team teaching, brainstorming, cognitive apprenticeship, discovery learning, inquiry and role play strategies (Ganyaupfu, 2013). Students need knowledge, problem-solving skills, creative and critical thinking for proper adjustment into 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 Science (Onwukwe, 2010). Bearing in mind the nature of Science, there is, therefore, need Science teachers to use innovative teaching strategies in the teaching of the subject so as to enable the students to learn and acquire positive attitudes and value, process skills and problem-solving skills. Hence the need for the study.

Purpose of the Study

The purpose of this study was to analyze Teachers' Assessment of Innovative Teaching Strategies for Enhancing Secondary School Students' Science Achievement in Nasarawa State, Nigeria. The specific objectives of the study were:

1. To determine the innovative teaching strategies which enhance students' science achievement from their long years of teaching experience in secondary schools in Nasarawa State
2. To determine the influence of gender on teachers' assessment of innovative teaching strategies in enhancing students' achievement in Science from their long years of teaching experience?

Research Questions

The following research questions guided the study.

1. What are the innovative teaching strategies that could enhance students' Science achievement as assessed by the teachers from their long years of teaching experience?
2. What is the influence of gender on teachers' assessment of innovative teaching strategies in enhancing students' achievement in Science from their long years of teaching experience?

Hypothesis

The null hypothesis below was tested at $P < 0.05$ significance level.

1. There is no significant influence of gender on teachers' assessment of innovative teaching strategies in enhancing students' achievement in Science from their long years of teaching experience.

Methodology

The study adopted a descriptive survey design where 150 (85 males, 65 females) Secondary School Science teachers in Nasarawa State West Senatorial Zone, who have taught science using different strategies for not less than 10 years, were sampled using purposive sampling procedure. The instrument used for data collection was the researcher- developed ten-item Innovative Teaching Assessment Questionnaire (ITAQ) of the Likert type on Secondary School teachers' assessment

of innovative teaching strategies in enhancing students' achievement in Science. The responses were indicated as Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) weighted as 4, 3, 2 & 1 respectively, for positively skewed statements and reversed for statements that were otherwise. The instrument was validated by three experts in Science, Technology and Mathematics Education Department, Faculty of Education, Nasarawa State University, Keffi. The reliability coefficient was determined by Cronbach Alpha method and was found to be 0.88. Copies of the questionnaire were distributed by the researchers and collected back immediately after completion. Two (2) research questions were answered using mean scores, and standard deviation and the null hypothesis was tested using Chi-Square statistic at 0.05 level of significance.

Results Research Question One

1. What are the innovative teaching strategies that could enhance students' Science achievement as assessed by the teachers from their long years of teaching experience? **Table 1:**

Means Scores of Secondary School Teachers' Assessment of Innovative Teaching Strategies in Enhancing Students' Science Achievement

S/N	Item	SA	A	D	SD	Mean	Remarks
1	Simulation	60	40	35	15	2.97	Agree
2	Brainstorming	65	50	25	10	3.13	Agree
3	Peer tutoring	70	45	20	10	3.10	Agree
4	Experiential learning	60	50	30	10	3.07	Agree
5	Cooperative learning	75	40	25	10	3.27	Agree
6	Competitive learning	55	60	20	15	3.03	Agree
7	Discovery learning	70	50	20	10	3.20	Agree
8	Collaborative learning	75	45	20	10	3.23	Agree
9	Inquiring learning	65	55	20	10	3.17	Agree
10	Role play	55	50	20	10	3.00	Agree

Table 1 shows that all the items have mean values greater than 2.5 which is the mean value of the four-point scale used in this study. This implies that all the teachers agreed that the items were innovative teaching strategies that could enhance students' achievements in Science. **Research Questions Two**

1. What is the influence of gender on teachers' assessment of innovative teaching strategies in enhancing students' achievement in Science from their long years of teaching experience?

Table 2:

Mean Scores of Male and Female Secondary School Teachers' Assessment of Innovative Teaching Strategies in Enhancing Science Achievement

Female Remarks	S/N Item	(Mean \bar{X})		Male Remarks
		Female	Male	
1	Simulation	3.10	2.98	Agree
2	Brainstorming	3.17	3.21	Agree
3	Peer tutoring	3.06	3.16	Agree
4	Experiential learning	3.26	3.11	Agree
5	Cooperative learning	3.31	3.42	Agree
6	Competitive learning	3.22	2.94	Agree
7	Discovery learning	3.12	2.88	Agree
8	Collaborative learning	3.40	3.20	Agree
9	Inquiring learning	3.42	3.39	Agree
10	Role play	3.19	3.33	Agree

Results in Table 2 show that all the items have mean values greater than 2.5. This implies that both male and female teachers agreed that the ten items listed were innovative teaching strategies that could enhance students’ achievement in Science.

Hypothesis One

Ho₁ There is no significant influence of gender on teachers’ assessment of innovative teaching strategies in enhancing students’ achievement in Science from their long years of teaching experience. **Table 3:**

Male and Female Teachers’ Assessment of Innovative Teaching Strategies that could Enhance Students’ Achievement in Science.

	SA	A	D	SD	TOTAL
Male 85	438	380	86	24	928
	(426.13)	(347.73)	(107.73)	(46.40)	
	361	272	116	63	812
	(372.87)	(304.27)	(94.27)	(40.60)	
	799	652	202	87	1740

cal = 39.25, crit/tab = 7.815, df = 3.

Table 3 shows that the calculated value of 39.25 is greater than the critical value of 7.815. The null

Female 65

χ^2 Total

hypothesis was therefore rejected. This therefore implies that there is a significant difference in the mean scores of male and female teachers’ assessment of innovative teaching strategies that could enhance students’ achievement in Science.

Discussion

The results revealed that all the male and female Science teachers agreed that; simulation, brainstorming, peer tutoring, experiential learning, cooperative learning, competitive learning, discovery leaning, collaborative learning, inquiring learning and role play are innovative teaching strategies that can enhance secondary school students’ science achievement. This result is in agreement with (Osokoya, 2013; Agommuoh & Ifeanacho, 2013), They opine that; new approaches of communicating science are by involving students and making sure that they participate fully rather than listening to talks and taking notes. Science teaching has been shifted from the teacher-centered approaches to studentcentered approaches. So as to enhance learning.

The result also agrees with Ganyaupfu (2013) who explained that innovative teaching strategies when employed help the learner to acquire appropriate skills, abilities, and competencies as equipment for the individual to solve life probe and contribute to the development and growth of the society. According to Screeden and Sudler (2011) and Tebabal and Kahssay (2011), the major goal of teaching is to prepare students to be able to adapt knowledge to various problem settings and multiple contexts. This can only be achieved by using innovative teaching strategies that will involve students’ full participation in the teaching and learning environment. Effective teaching of Science puts much emphasis on students’ participation in the learning process which means that students must be active rather than being recipients of information from the teacher, textbook or any other source of information. The duty of the teacher in the class is to facilitate learning among the learners. He/she is no longer the sole custodian of the learning information as it was previously believed. Innovative strategies guarantee opportunities to learners to express themselves in what they know under the guidance of the teacher.

Conclusion

The job of the teacher requires that he assist the learner to learn. The teacher can achieve this by effectively making the teaching and learning environment stimulating, challenging and dynamic through utilization of innovative teaching and learning strategies which will help enhance academic achievement, empower students and galvanize the effort to achieve the human development goals for the country.

1.

References

- i. Agommuoh, P.C. & Ifeanacho, A.O (2013). *Secondary school students' assessment of innovative teaching strategies in enhancing achievement in physics and mathematics. IOSR Journal of Research Method in Education (IOSR-JRME). 3(5): 6-11* ii.
- iii. Ajaja, O.P. (2009). *Evaluation of basic science technology teaching in basic schools in Delta State, Nigeria. International Journal of Education Science. 1(2): 119-129.*
- iv. Akhtar, M & Hussain, M. (2013). *Effectiveness of teaching strategies on students' achievement in science: An experimental evidence from Pakistan. Middle-East Journal of Scientific Research. 16(5): 626-632.*
- v. Akinyemi, O.A. & Afolabi, F. (2010). *Constructivist practices through guided discovery approach: The effect on students' cognitive achievement in Nigerian junior secondary schools. Eurasian Journal of Science Education. (2(1): 16-25.*
- vi. Alabi, O.A. (2014). *Effect of teaching strategies on students' achievement of secondary school students in chemistry. Journal of Education and Policy Review. 6(2): 119-130.*
- vii. Al-Rawi, I. (2013). *Teaching methodology and its effects on quality learning. Journal of Education and Practice, 6(4): 100-105.*
- viii. Ayeni, A.J (2011) *Teachers' professional development and quality assurance in Nigerian secondary schools. World Journal of Education. 1(2):143-149.*
- ix. Chang, W. (2010) *Interactive teaching approach: implementation and evaluation. Asian-pacific Journal of Education. 1(2): 231-245.*
- x. *Federal Ministry of Education (2012). Know the challenges, facts, figures and key issues. policy implications (FME/NEMIS) Abuja. federal ministry of education: policy, planning, management and research department.*
- xi. *Federal Republic of Nigeria (2012). Science, technology and innovation policy. Abuja: federal ministry of science and technology.*
- xii. Ganyaupf, E.M. (2013). *Teaching methods and students' academic performance. International Journal of Humanities and Social Science Invention. 2(9): 29-35.*
- xiii. Hightower, A.M. (2011). *Improving students' learning by supporting quality teaching. American Journal of Applied Science, 628-636.*
- xiv. Oni, J.O. (2014). *Teacher method of teaching and student academic achievement in basic science and technology in junior secondary schools in South-West, Nigeria. Journal of Education and Social Research. 4(3): 397-402.*
- xv. Onwukwe, E.O. (2010). *Using the learner-centered methods in teaching basic science a paper presented to the 2010 retraining of Imo State schools basic science teachers organized by Alvan Ikoku federal college of education in collaboration with Federal and State ministries of education, February 8th – 11th 2010.*
- xvi. Osokoya, M.M. (2013). *Teaching methodology in basic science and technology classes in South-West Nigeria. Asian Journal of Education, 1(4): 206-214.*
- xvii. Samuel, I.R. (2017). *Assessment of basic science teachers' pedagogical practice and students' achievement in Keffi Education Zone, Nasarawa State, Nigeria. An Unpublished Masters Dissertation, Faculty of Education Nasarawa State University, Keffi.*

- xviii. *Screeden, P.S. & Sudhir, M.A. (2010). Innovative strategies for science teaching: International Journal of Education Science and Research. 1(1): 1-10.*
- xix. *Tebabal, A. & Kahssay, G. ((2011). The effects of student-centered approach in improving students' skills and conceptual understanding of scientific concepts. Latin America's Journal of Education, 5(2): 374-381.*