
JUNIOR SECONDARY SCHOOL STUDENTS' PERCEPTION OF INNOVATIVE STRATEGIES USED BY TEACHERS IN TEACHING BASIC SCIENCE AND MATHEMATICS

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***Abstract:** The study employed a descriptive survey to investigate Junior Secondary School Students' perception of innovative teaching strategies used by teachers in Basic Science and Mathematics. By the use of purposive sampling technique, two hundred (200) students were used as sample size from four selected junior secondary schools in Owerri Municipal Council Area of Imo State. The instrument for data collection was a check-list for teacher's academic qualification in section A and researcher structured questionnaire in section B with yes/No format. Three (3) research questions and two (2) hypotheses tested at 0.05 level of significance guided the study. The instrument was validated and the reliability index of 0.80 was obtained. The research questions were answered using percentage and proportions while the hypotheses were tested using chi-square statistics. Result showed that teachers of basic science and mathematics do not use innovative strategies during instruction, the proportion of teachers in basic science and mathematics on the use of innovative strategies during instruction is not significant and, gender and academic qualification is not a significant factor in the use of innovative strategies during instruction in basic science and mathematics. Recommendations were – conferences, workshops, and seminars should be organized for the practicing and securing science and mathematics teachers to update their knowledge/skills.*

Keywords: Science, Basic Science, Mathematics, Innovative Strategies

Introduction

Science plays a vital role in the lives of individuals and the development of a nation scientifically and technologically (Alebiosu and Ifamuyiwa, 2008). It is widely and generally acknowledged that the gateway to the survival of a nation scientifically and technologically is scientific literacy which can only be achieved through science education. Science according to Ting-Kueh (2006) plays major roles 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. Science finds its application in all Facets of life such as agriculture, medicine, energy and power supply, biotechnology, space research and nuclear technology. This means that the understanding of science helps man to know about the universe and things around us. Nigeria as a nation appreciates the importance of science in its Quest to transform its economy successfully. National Policy on Science, Technology and Innovation (FRN, 2012), 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 man to live and adjust in a fast scientifically developing world. Science in the basic level comprises of physics, chemistry, biology and mathematics. Basic science which is one of the core subjects in junior secondary schools need utmost understanding. Mathematics being so important subject and occupying a central position in science and technology provides special skills required by an individual to solve his day-to-day problems, communicate effectively, reason appropriately and makes necessary connections. (Harbour – Peters 2000, Obodo; 2000, Kolawole and Oluwatayo 2005, Borasi; 2008).

The National Council of Mathematics Teachers (2006) asserted that mathematics equips students with uniquely powerful tools to understand and change the world. In spite of the importance and usefulness of Basic Science and Mathematics, student's achievement in the subjects is very discouraging. Studies have shown that student's exhibit lack of interest in the subjects (Esiobu, 2005). Also recent studies have also revealed that the performance of mathematics in ordinary level entrance examinations was generally and consistently poor over the years. (Agwagah, 2005). Poor academic achievement in Basic Science and Mathematics has been attributed to many factors like poor infrastructure, over population, wrong or obsolete teacher's teaching strategies. This means that basic science and mathematics concepts cannot be well understood if students are not taught with effective teaching strategies. Studies have blamed this poor achievement in basic science and mathematics on the use of inappropriate and obsolete teaching strategies which might lead to lack of interest and retention of basic science and mathematical concepts. (Agommuoh, 2004, Agwagah, 2005, Harbor-Peters, 2000, Ifeancha, 2012, Iji & Harbour-Peters, 2005, Kurumeh, 2004 & Ogobonna 2007).

The 21st century pedagogy like cooperative learning, stimulation, brainstorming when used in teaching promotes learning, understanding and brings out the best in learners as they are based on learners interaction with both teacher and students. Copeland (1998) described innovation as the action or process of change, revolution, transformation, restructuring and new methods in a system.

Copeland (1992) outlines guidelines for incorporating innovation in teaching.

- For effective transaction of the curriculum and achievement of curricular objectives appropriate method and pedagogic resources should be used in providing learning experiences to the students. New learning depends on the learner's previous knowledge that may at times interfere with the understanding of the new interaction.
- A number of factors need to be considered while making use of a particular method and pedagogic resource; learners' capabilities, availability of resources, entry behavior, school environment and objectives to be achieved.

- Decide on and plan in advance the innovative idea that the teacher would be incorporating to transact a particular concept so that loss of instructional time is prevented.
- Involve the students in the process of learning by taking them beyond the process of listening to that of thinking, reasoning and doing.
- In order to promote self-study skills use of library and resources center need to be encouraged.
- Receiving regular feedback for teaching and learning should be an in built component of teaching-learning process. Continuous and comprehensive evaluation has to be ensured as it plays an important role for the required modification in teaching-learning process.

The teaching and learning of mathematics must aim at achieving the aims and approaches of mathematics education according to Shidu (1995) which as follows:

- To develop the mathematics skills like speed, accuracy, neatness, brevity, estimation etc.
- To develop logical thinking, reasoning power, analytical thinking, and critical thinking.
- To develop power of decision-making.
- To develop the technique of problem-solving.
- To recognize the adequacy or inadequacy of given data in relation to any problem.
- To develop scientific attitude i.e. to estimate, find and verify results.
- To develop ability to analyze, to draw inferences and to generalize from the collected data and evidences.
- To develop heuristic attitude and to discover solutions and proofs with their own independent efforts.
- To develop mathematics perspective and outlook for obscuring the realm of native and society.

Basic Science formerly known as integrated science is the first form of science students encounters at the junior school level, hence Basic Science prepares students at the junior secondary school for the study of core science subjects (Olaewaju, 1994). This implies that for a student to be able to study single science subject at the senior secondary school level successfully, such student had to be well grounded in basic science at the primary/junior school level. In view of this basic science is given a great emphasis in the school curriculum. The principal reasons for Basic Science teaching in school system are as follows:

- It provides students at the primary school level a sound basic for continuing science education either in single science subjects or further integrated science.
- It enhances the scientific literacy of the citizenry.
- It allows students to understand their environment in its totality rather than in fragments.

- It allows the students to have general view of the world of sciences.
- The processes of science serve as unifying factor to the various science subjects. It is necessary for the learner to know these processes through integrated approach of learning science, (Federal Ministry of Education, 1981).

The teaching and learning of science especially Mathematics and Basic Science 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, role play, simulation, games and other similar strategies have been shown to enhance the active participation of students in the teaching and learning of Basic Science and mathematics. Adeyemi and Ajibade (2011) carried out a research on comparative effects of simulation, Games and Brainstorming instructional strategies on junior secondary school students' achievement in social studies in Nigeria. The Research employed quasi experimental design (3 x 2 non-randomized pre-test, post-test control group) the study concludes that students exposed to simulation games instructional strategy and brainstorming instructional strategy performed significantly better in their achievement in social studies than those students exposed to conventional method of instruction. David & Stanelly (2000) conducted a meta-analysis on the effectiveness of co-operative learning strategies. When the impact of cooperative learning lessons were compared to competitive learning, learning together (LT) promoted the greatest effect, followed by Academic Controversy (AC), Student-Team Achievement Divisions (STAD), Tour-Game-Tournaments (TGT), Group Investigation (GI), Jigsaw, Assisted Individualization (TAI), and co-operative Integrated Reading and Composition (CIRC). When they compared the impact of co-operative learning lessons with individualistic learning, LT promotes the greatest effect, followed by AC, GI, TGT, TAI, STAD, jigsaw and CIRC.

Moreso, of the twelve (12) learning together method that Slavin used, five (42%) were significantly positive. Thirteen of the Slavin's studies used the Jigsaw 11 method, (31%) were significantly positive, of the six studies on Group investigation, three (3) showed significantly positive results. Lai (2002) conducted a research with the methods of STAD, Jigsaw and learning together in an EFL junior high classroom. The findings showed that (a) students were motivated to study English harder and participated more in class by asking and responding to Questions and (b) students' communication skills were improved. In the same vein, Effandi (2003) compared students' Mathematics achievement and problem solving skills. The experimental section was instructed using the cooperative learning strategies and the control section was instructed using the traditional lecture method. Result indicated that students in the cooperative group instruction had higher mean scores in mathematics and problem solving skills than their colleagues in the control group.

According to Screeden and Sudhir (2011) some other approaches for effective Basic Science and Mathematics teaching includes:

1. Orientation
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.
6. Evaluation involves students being provided with opportunities to test the validity of their newly constructed ideas.
7. Application of ideas.
8. Review change in ideas which involves students being given opportunity to reflect 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, weakness, growth patterns and background of experiences. This means that an effective teacher has to create an atmosphere for a wholesome teaching and learning. 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 Basic Science and Mathematics teaching, teachers must understand how students think and construct scientific and mathematical knowledge. The importance is that teachers of Basic Science and Mathematics need to teach these subjects effectively for a successful preparation of today's individuals for tomorrow. (Zakaria & Iksan 2007). 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, team-teaching, brainstorming, cognitive apprenticeship, discovery learning, inquiry and role play strategies. Student needs knowledge, problem solving skills, creative and critical thinking to proffer adjustment into a fast scientifically and technologically developing society. 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 shortening in the teaching and learning of Basic Science and Mathematics (Madu, 2004). According to Kurumeh (2004), lecture method emphasizes passive acquisition of

knowledge by students who do not have conceptual understanding but memorize the learning content. Basic science and mathematics need teacher to use innovative teaching strategies in the teaching of the subjects so as to enable the students learn and acquire positive attitudes and values, possess skills and problem-solving skills. The study therefore investigated junior secondary school student's assessment of these innovative teaching strategies used by teachers in teaching Basic science and mathematics.

Purpose of the Study

The main purpose of the study is to determine the innovative teaching strategy used by teachers in teaching basic science and mathematics in junior secondary school. Specifically the study will:

1. Identify the major innovative teaching strategies used by teachers in teaching basic science and mathematics.
2. Ascertain the proportion of teachers who use innovative strategies in teaching basic science and mathematics.
3. Ascertain if the use of the innovative strategies by the teachers depended on gender.
4. Ascertain if the use of the innovative strategies by the teachers depended on academic qualification.

Research Questions

1. What major innovative strategies are used by teachers in teaching basic science?
2. What innovative strategies are used by teachers in teaching mathematics?
3. What proportion of teachers use innovative strategies in teaching basic science and mathematics?

Hypotheses

1. The use of innovative strategies by teachers during instruction of basic science and mathematics does not significantly depend on gender.
2. The use of innovative strategies by teachers during instruction of basic science and mathematics does not significantly depend on their academic qualification.

Methodology

The study adopted a descriptive survey in determining the junior secondary students' perception on Innovative teaching strategy used by teachers. The population of the study consisted of all the students in nine (9) public junior secondary schools in Owerri Municipal Council Area of Imo State. The researchers used purposive sampling technique in selecting four (4) schools. Two (2) male schools and two (2) female schools with a sample size of two hundred (200) students. The instrument for data collection was a check list for teacher's academic qualification in section A and researcher structured questionnaire titled Teachers Utilization of Innovative Strategy in Teaching (TUIST) in section B. The instrument was of the alternative response format. The validity of the instrument was determined by three experts, two from science education and one from

measurement and evaluation. The reliability coefficient of the instrument was calculated to be 0.80 using Cronbach alpha method. Percentage, Proportion, and chi-square statistical tools were used to analyze the data. Chi-square was used in testing the hypotheses at 0.05 level of significance.

Results

Research Question One: What are Innovative Strategies used by Basic Science Teachers during instruction?.

Table 1: Percentage Analysis on Students' Perception of Innovative Strategies used by Teachers of Basic Science during Instruction

S/N	ITEMS	Yes	Yes %	No	No %
1.	The Basic Science Teachers use co-operative learning i.e. during the class into group learning.	189	5.5	11	94.5
2.	The Basic Science teachers use inquiry learning.	79	39.5	121	60.5
3.	The Basic Science teacher use Discovery learning.	152	76.0	48	24.0
4.	Experimental learning	187	93.5	13	6.5
5.	Simulation	45	22.5	155	77.5
6.	Brainstorming	105	47.5	95	52.5
7.	Role Play	75	37.5	125	62.5
8.	Team teaching	5	2.5	195	97.5
9.	Peer collaboration	165	17.5	35	82.5
10	Lecture method	200	100	-	-
11.	Discussion method	198	99.0	2	1.0
12.	Demonstration method	188	94.0	12	6.0
13.	Story telling	200	100	-	-

The result in table 1 show that students percentage response on cooperative learning (Yes 5.5%, No 94.5%) inquiry learning (Yes 39.5%, No 60.5), Discovery learning (Yes 24.0%, No 76.0%), Experimental learning (Yes 93.5%, No 6.5%), Simulation (Yes 22.5%, No 77.5%), Brainstorming (Yes 47.5%, No 52.5%), Role play (37.5%, No 62.5%), Team teaching (Yes 2.5%, No 97.5%) Peer collaboration, (Yes 17.5%, No 82.5%), Lecture method (Yes 100%), Discussion method (Yes 99.0%, No 1.0%), demonstration (Yes 94.0%, No 6.0%) and storytelling (Yes 100%). This result shows practically that innovative strategies are not used by the teachers during instruction in basic science. Only Experimental learning method is used in teaching Basic Science. This learning method is used because of the nature of the subject.

Research Question Two: What are Innovative Strategies used by Mathematics Teachers during Instruction?

Table 2: Percentage Analysis on Students' Perception of Innovative Strategies used by Mathematics Teachers during Instruction.

S/N	ITEMS	Yes	Yes %	No	No %
1.	Our mathematics used co-operative learning.	11	5.5	193	96.5
2.	Inquiry learning	53	26.5	147	73.5
3.	Discovery learning	79	39.5	121	60.5
4.	Experimental learning	5	2.5	195	97.5
5.	Simulation	53	26.5	147	73.5
6.	Brainstorming	13	6.5	187	93.5
7.	Role Play	35	17.5	165	82.5
8.	Team teaching	10	5	190	95.0
9.	Peer collaboration	25	12.5	175	87.5
10.	Lecture method	200	100	-	-
11.	Discussion method	193	96.5	7	3.5
12.	Demonstration method	189	94.5	11	5.5
13.	Story telling	200	100	-	-

The result in table 1 shows that students percentage response on cooperative learning (Yes 5.5%, No 96.5%), inquiry learning (Yes 26.5%, No 73.5%), Discovery learning (Yes 39.5%, No 60.5%), Experimental learning (Yes 2.5%, No 97.5%), Simulation (Yes 26.5%, No 73.5%), Brainstorming (Yes 6.5%, No 93.5%), Role play (Yes 17.5%, No 82.5%), Team teaching (Yes 5%, No 95.0%) Peer collaboration (Yes 12.5%, No 87.5%) Lecture method (Yes 100%) Discussion method (Yes 96.0%, No 3.5%), Demonstration (Yes 94.5%, No 5.5%) and storytelling (Yes 100%). This result shows that innovative strategies are not used by the teachers during mathematics instruction.

Research Question Three: What proportions of teachers use innovative strategies in Teaching Basic Science and Mathematics?

Table 3: Proportion of Teachers in Basic Science & Mathematics

Teachers	Male	Female	No. of teachers that use innovative strategies	Percentage	Proportion
Basic Science	14	31	5	11.11	0.11
Mathematics	12	27	3	7.69	0.07

The result in table 3 shows that the proportion of teachers in Basic Science and Mathematics that uses innovative strategies are at the low level i.e. (not significant).

Hypothesis 1: The use of innovative strategies by teachers during instruction of basic science and mathematics does not significantly depend on gender.

Table 4: Chi-Square Analysis on Gender

(O)	(E)	(O-E)	(O-E) ²	$x^2 = \frac{(O-E)^2}{E}$
14	13.9	0.1	0	0.000719
31	13.1	-0.1	81	0.000321
12	12.1	-0.1	81	0.000826
27	26.9	0.1	1	0.000371
				$x^2=0.00224$

$x^2_{cal} 0.00224$, $x^2_{crit/table} = 3.84$, $df = 1$

Result in table 4 shows that the $x^2_{cal} (0.00224)$ is less than $x^2_{crit/table} (3.84)$ the null hypothesis is accepted. Therefore the use of innovative strategies is not significantly depended on gender.

Hypothesis 2: The use of innovative strategies by teachers during instruction of basic science and mathematics does not significantly depend on their academic qualification.

Table 5: Academic Qualification of Basic and Mathematics Teachers.

Teachers	NCE	B.ED	OTHERS	TOTAL
Basic Science	3	10	1	14
Mathematics	1	6	2	9
Total	4	16	3	24

Table 6: Chi-Square Analysis on Teachers Academic Qualification

(O)	(E)	(O-E)	(O-E) ²	$x^2 = \frac{(O-E)^2}{E}$
3	2	1	1	0.5
10	9	1	1	0.11
1	2	-1	1	0.5
1	2	-1	1	0.5
6	6	0	0	0.16
2	1	1	1	1.0
				$x^2=2.77$

$X^2_{cal} 2.77$, $x^2_{crit/table} = 5.99$, $df = 2$

Result in table 6 shows that the $x^2_{cal} (2.77)$ is less than $x^2_{crit/table} (5.99)$ the null hypothesis is accepted. Therefore academic qualification is not a factor on teacher's use of innovative strategies during instruction

Discussion

Table 1 and 2 showed that Teachers of Basic Science and Mathematics do not use innovative strategies during instruction. This result is in line with Mađu (2004) Opined that lecture based instruction which is teacher centered has been identified as a major hindrance in the teaching and learning. Table 3 shows that the proportions of teachers that use innovative strategies in teaching Basic Science and mathematics is not significant. This is in line with Kurumeh (2004) lecture method which most teachers adopt,

emphasizes passive acquisition of knowledge by students who do not have conceptual understanding but memorize the learning content. The researchers observed in table 4 and 6 that gender and academic qualification of teachers are not factors in the use of innovative strategies during instruction in basic science and mathematics.

Conclusion

This study concludes as follows

1. Teacher of Basic Science and mathematics do not use innovative strategies during instruction.
2. That the proportions of teachers that use innovative strategies in teaching basic science and mathematics are not significant.
3. Gender and academic qualification of teachers is not a significant factor in the use of innovative strategies during instruction in basic science and mathematics.

Recommendations

In the light of conclusions obtained in the study and result reached, the following recommendations were made:

1. Innovative teaching strategies such cooperative learning, experimental learning, role play, team teaching, peer tutoring etc. should be reflected in Basic Science and Mathematics teacher education curriculum to enable new graduate teachers be fully equipped for teaching and learning of the subjects.
2. Conferences, workshops, and seminars should be organized for the practicing and serving science and mathematics teachers to update their knowledge/skills in the application of these strategies which will enhance quality teaching and learning of the subjects.
3. Science and Mathematics 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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Reference to this paper should be made as follows: Unamba Eugene Chukwuemeka; et al. (2016), Junior Secondary School Students' Perception of Innovative Strategies used by Teachers in Teaching Basic Science and Mathematics. *J. of Education and Policy Review*, Vol. 8, No. 1, Pp. 25 - 36.
