Assessment of Instructional Strategies Employed by Physics Teachers and Students Academic Achievement in Secondary Schools in Rivers State

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Abstract

The study assessed instructional strategies employed by Physics teachers and students academic achievement in Secondary schools in Rivers State. The study in specific terms, assessed the instructional strategies employed by physics teachers, determine the level of use of instructional strategies in the teaching of Physics and determine the difference in the academic achievement of those taught with frequently used instructional strategies in Rivers State. The population of the study consisted of all practicing Physics teachers and students in Rivers State. The sample size of the study was 28 Physics teaachers selected from 18 science teaching schools in Rivers State and 140 science students from 4 schools whose teachers indicated usage of any of the frequently used instructional strategies. A structured questionnaire and Physic Achievement Test (PAT) was used to collect data from Physics teachers and students respectively. Frequency, Mean and standard deviation was used to analyze the gathered data, while z-test was used to test hypotheses at 0.05 level of significance. In the study, among the traditional instructional strategies, it was found that lecture method, demonstration method, laboratory method and problem solving method of teaching are the most frequently used strategies employed by Physics teachers in Rivers State. However, when the students who were taught Physic by these most frequently used strategies were tested, it was found that students who were frequently taught Physics with demonstration method achieved more that those taught with lecture method. Similarly, students taught with problem solving methods achieved more than those who were frequently taught with laboratory strategy. It was recommended that Physics teachers should employ instructional strategies that will actively engage students in the lesson.

Keywords: Instructional, Strategies, Physics, Teachers, Students, Achievement.

Introduction

Over the years, the teaching of Physics, as a science subject had undergone several improvements; all have been geared towards making the subject more impactful. It is well understood that science teaching involves the manipulation, experimentation and observation of specimen that represents the immediate environment to understand natural event, hence practical works becomes the essential component of science teaching. Unfortunately, the most frequently used instructional strategy in science teaching most especially in Nigerian education revolves the traditional mode of teaching.

Physics is one of the science subjects that students experience difficulties as most of the concepts are abstract yet physical notion. According to Karaca (2013) physics is beyond learning or definition of terms rather it deals with quantitative measurement and experimental observation in order to understand natural events. It explains natural events mathematically and relates these events to daily activities (Eren & Gurdal, 2010). Ergul and Cigrtik (2013) however opined that the proving of theories that governs physical nature and numerical expression of these theories makes it difficult for learners to comprehend and make relationship between other science subjects. In other to effectively address students' difficulties in teaching and learning, what they learn is as important as how they learn it (Hoellwarth, Moetter & Knight, 2005). The quest for how students learn effectively, puts flexibility demand on the teacher to employ appropriate instructional strategies in order to convey these concepts to learners in an uncomplicated manner.

According to Ergun (2010), in the development of students' cognitive learning and their performance in solving problems, there is a need to teach physics by using different student-centred teaching methods instead of repeating one strategy over and over. Relating the subject to real life events, getting rid of boring mathematical processes through special teaching methods would protect the students from memorization and also enable the students to participate in the lesson willingly (Baran & Maskean, 2010; Abdulsallam, 2014). The memorization approach leads to difficulty in interpretation of abstract notions and inability to identify relationships among Physics concepts, which creates an obstruction to effective learning of Physics (Cildir, 2012).

Researches on students academic achievement has generally established that instructional strategies employed by teachers has high effect in harmonizing individual differences for improved achievement (Riding and Douglas 1999; Pitchers, 2002). Instructional strategy involves the teaching method used to convey learning to learners. According to Akinbobola (2015) instructional strategies are planned actions adopted in the acquisition of skills, attitudes and knowledge. Instructional strategies are the techniques the

teachers use to help student become independent, strategic learners (Alberta, 2002). They are referred to paradigms of teaching that reveals the nature of knowledge and learning. Excellent teachers modify instructional strategies in order to suite the learning styles of the learners and the nature of the concept to be taught. Langley and Eylon (2006), have it that the use of appropriate instructional strategies foster on deriving optimum achievement, learning enjoyment, and modification of students' behavior.

Amadi and Ekezie (2017) asserted that teaching, over the years does not has a single strategy of impacting knowledge to learners. Thus, teachers are constantly in quest of appropriate teaching method that will effectively communicate the accurate experience to learners. According to Akinbobola (2015), the challenges in teaching is to create experiences that involve the student and support his own thinking, mode of learning, explanation, communication and application of the scientific models needed to make sense of these experiences. However, the use of appropriate instructional strategies in teaching helps in proffering solutions to trending challenges of individual differences in teaching. Instructional strategies are decisions about organizing people, materials and ideas to provide effective learning (Nwachachuku, 2005). Similarly Weston and Carantom in Vincent and Udeme (2014) added that instructional strategies are both teaching method and the materials use for teaching process; it determines the approach the teacher may take to achieve learning objectives. Teaching strategies comprises the principles and methods used for instruction to be implemented by teachers to achieve the desired learning in students (Amadi and Akpomi, 2016).

The use of appropriate instructional strategy in conveying knowledge to learners is of extreme significance to achieving learning objectives. When teaching is effectively handled with appropriate teaching strategy, students are motivated to learn, help them to stimulate their attention and focus. Also instructional strategies help to constructively arrange information in the form that will be easily assimilated by the learner which therefore leads to understanding and retention. Thus, Alberta, (2002) opined that for Physics teachers to achieve his instructional objectives he must understand that student need:

- Step-by-step strategy instruction
- A variety of instructional approaches and learning materials
- Appropriate support that includes modelling, guided practice and independent practice
- Opportunities to transfer skills and ideas from one situation to another
- Meaningful connections between skills and ideas, and real-life situations
- Opportunities to be independent and show what they know
- Encouragement to self-monitor and self-correct
- Tools for reflecting on and assessing own learning.

Gbamaja in Omeodu (2018) pointed that content, methodology, and techniques are some of the basic element of teaching and concluded that good teaching requires sound and deep knowledge of pedagogical principles of conveying that knowledge to the learners. In other words, for effective teaching process to take place, teachers must possess a sound and deep knowledge of presenting information to learners according to their mode of learning and attitudes. However, in the choice of suitable instructional strategies physics teachers must be able to identify;

- Students' age and their previous knowledge on the topic to be taught,
- The time frame of the lesson
- The size of the class
- The available resources for teaching.

These vital factors need to be considered before the teacher could determine the type of instructional strategy to employ in the teaching process.

In recent years, computer assisted instructional strategy is gradually taking the lead of modes of teaching, however many challenges are attached to the use of this trending mode of instruction. Over the years before the emergence of computer in teaching and other recent constructivist learning approach, there are different types of traditional instructional strategy use in the teaching of science. Such are lecture method, discussion method, problem solving method, laboratory method, demonstration method, among others. To describe few;

Good and Merkel in Gurpreet (2011) suggest lecture as a method of teaching by which the instructor gives an oral presentation of facts or principles to learners and the class usually being responsible for note taking, usually implies little or no class participation by such means as questioning or discussion during the class period. It is a teacher-centered method of teaching whereby the teacher expressly makes most of the verbal discourse of the concepts and subjects according to the lesson plan while learners are expected to remain passive for a specific period of time. Kauchak and Eggen in Grupreet (2011) opined that, lecture method remain popular for several reasons as follows:

1. They are efficient, planning time is devoted to organizing the context. Less attention has to be devoted to teaching strategy.
2. They are flexible and can be adapted to a wide range of subjects.
3. Most people can learn to lecture well enough to survive in a classroom. Lectures are easier to learn than most other instructional strategies.
4. They are easier for teacher due to simply "telling" students about the subject

According to Daluba (2013) Demonstration method refers to the type of teaching method in which the teacher displays what is expected from the learner when the lesson ends while the learners observe with the intention to

replicate the actions. The teacher does whatever the learners are expected to do at the end of the lesson by showing them how to do it and explaining the step-by-step process to them (Ameh, Daniel and Akus, 2007).

It is an established fact that science education tends to develop critical thinking abilities, logical responding and problem solving abilities in the learners. Problem solving teaching method according to Rushikesh (2013) is a method where students learn by working on problems. It is an attempt to make students fully participate in the lesson by solving critical problems posed in the lesson. This model enables the student to learn new knowledge by facing the problems to be solved, instead of burdened contents. Studies by Abell & Pizzini (1992) have shown that, in classes where the teacher adopted the problem-solving approach, there was increased use of brainstorming, an increase in time allotted to defining, sharing and presenting the problem, as well as more student-selected research questions and student-designed investigations.

Since the late 19th century, science educators have believed that Laboratory method instruction is an essential approach of impacting scientific knowledge to learners. Laboratory method according to Agbogun in Hamidu, Ibrahim and Mohammed (2014), laboratory method which exposes science students to observe and manipulate materials to demonstrate certain aspects of the subject matter which has been learnt in class through lectures, discussions and textbooks. This study tends to assess the various instructional strategies employed Physics teachers and student achievement in secondary schools in Port Harcourt Local Government of Rivers State.

Purpose of the Study

The main purpose of the study is to determine the assess the effect of instructional strategies employed by physics teachers on Students Achievement in Secondary Schools in Port Harcourt Local Government Area. Specifically, the study sought to

1. Assess the instructional strategies employed by physics teachers in secondary schools in Port Harcourt.
2. Determine the level of use of instructional strategies in the teaching of Physics in Secondary schools
3. To determine the difference in the academic achievement of those taught with frequently used instructional strategies.

Research Questions

1. What are the instructional strategies employed by physics teacher in secondary school in Port Harcourt?
2. To what level do Physic teachers use any of the instructional strategies in the teaching of Physics in Secondary schools?

3. What is the difference in the academic achievement of those taught with frequently used instructional strategies?

Hypotheses

H_{01}; There is no significant difference between the mean scores of students taught lecture method and demonstration method.

H_{02}; There is no significant difference between the mean scores of students taught lecture method and problem solving method.

Methodology

The study was carried out in Rivers State secondary schools. The research design adopted for this study involves both descriptive survey and quasi-experimental research design. Descriptive survey was used to obtain Physics teachers responses on the instructional strategies used in teaching Physics while quasi-experimental design was used to evaluate students' level of achievement in Physics. The population of the study involved all Physics teachers and students in Rivers State. Stratified random sampling technique was used to select six science teaching secondary schools in each of the three senatorial district of Rivers State. Thus, 18 schools were involved in the study. In the selected 18 schools, there were total of 28 Physics teachers and all were involved in the study. However, four (4) schools were purposively sampled from the Eighteen (18) schools on the basis of the most frequently used teaching strategies. All the SS2 students in the selected four schools (140 students) were engaged in the quasi experiment.

The instrument used for the study was a structured questionnaire and a Physics Achievement test (PAT). The responses of the Physics teachers were collected using questionnaire which was structured in 4- point rating scale. The Physics Achievement was constructed by the researcher based on the first term scheme of work excluding the last two topics. This because the study was conducted at the end of first term 2018/2019 academic session. The test involved fifty multiple choice questions which carries two marks each. The both instruments were validated by two experts in the department of Science Education Rivers State University. The reliability of the instruments were conducted using test-retest method. The both instruments were administered to six teachers and 15 students who were not part of the study sample on two different occasions. The results obtained on each occasion were correlated using Pearson Product Moment Correlation Co-efficient (PPMC). The *r* value obtained was 0.72 and 0.612 respectively. The value obtained showed that both instrument were reliable. Frequency, Mean, and standard deviation were used for data analysis whereas z-test was used to test hypotheses at 0.05 level of significance.

Analysis and Discussion

Research Question 1; What are the instructional strategies employed by physics teacher in Secondary School in Rivers State?

Table 1: Frequency table of the instructional strategies employed by physics teachers in secondary schools in Port Harcourt.

S/N	Instructional Strategies	Frequency of teachers who employed each strategies (n=28)
1.	Lecture method	25
2.	Project Method	12
3.	Demonstration Method	24
4.	Questioning Method	18
5.	Problem Solving Method	21
6.	Assignment Method	10
7.	Discovery`/Inquiry Method	13
8.	Discussion Method	19
9.	Field-trip Method	8
10.	Simulation gaming Method	5
11.	Laboratory Method	26
12.	Buzz group method	3
13.	Programmed Method	3
14.	Debate method	4

Multiple Responses***

Table 1 presents Physics teachers responses on the traditional instructional strategies employed in the teaching of Physics. From the total 28 Physic teachers who were engaged in the study on a multiple response; lecture method (25), project method (12), Demonstration Method (24), questioning Method (18), Problem solving method (21), Assignment Method (10), discovery/inquiry method (13), Discussion Method (19), Field-trip method (8), Simulation gaming method (5), Laboratory Method (26), Buzz method (3), programmed method (3), Debate Method (4). In the result, lecture method, demonstration method, problem solving method and laboratory method are the traditional instructional strategies that obtained high frequency.

Research Question 2: To what level do Physic teachers use any of the instructional strategies in the teaching of Physics in Secondary schools in Rivers State?

Table 2: Mean responses of physics teachers on the level to which they use the instructional strategies in the teaching of physics.

S/N	Instructional Strategies	Frequently Used (FU)	Used (U)	Rarely Used (RU)	Not Used (NU)	Mean	Decision
1.	Lecture method	22	5	1	0	3.75	FU
2.	Project Method	7	8	13	0	2.79	U
3.	Demonstration Method	20	5	3	0	3.61	FU
4.	Questioning Method	10	6	7	5	2.96	U
5.	Problem Solving Method	19	5	3	1	3.50	FU
6.	Assignment Method	10	10	5	3	2.96	U
7.	Discovery`/Inquiry Method	9	10	3	6	2.79	U
8.	Discussion Method	8	13	3	4	2.89	U
9.	Field-trip Method	0	3	9	16	1.54	RU
10.	Simulation gaming Method	0	2	7	19	1.57	RU
11	Laboratory method	24	3	1	0	3.79	FU
12	Buzz group Method	0	0	7	21	1.25	NU
13	Programmed Method	0	2	1	25	1.18	NU
14	Debate method	0	0	1	27	1.04	NU

Field Survey, 2018. 0 ≥ 1.50= Not Used, 1.50≥2.50= Rarely Used, 2.50≥3.00= Used, 3.00≥4.00= Frequently Used

Table 2 shows the level at which Physics teachers utilize each of instructional strategies in the teaching of Physics. Based rating scale, Lecture method (3.75), Demonstration Method (3.61), Problem solving method (3.50), Laboratory Method (3.79) were found to be frequently used strategies. Also, Project method (2.79), Questioning Method (2.96), Assignment Method (2.96), discovery/inquiry method (2.79) Discussion Method (2.89) were rated as used strategy but not frequently. More so, Field-trip method (1.54), Simulation gaming method (1.57), were rarely used method. Lastly, Buzz method (1.25), Programmed method (1.18), and Debate Method (1.04) were rated as none used strategy in the teaching of Physics. The result is in collaboration with Grupreet (2011) who asserted that lecture method remain one of the most popularly used method of teaching science because of its flexibility, easier to use, and time efficient.

Research Question 3: What is the difference in the academic achievement of those taught with frequently used instructional strategies?

Table 3A: Mean difference of students taught with lecture method and demonstration Method.

Instructional Strategies	N	Mean scores	S.D	Mean Difference
Lecture Method	31	48.13	17.92	
				9.44
Demonstration method	42	57.57	17.04	

Field Survey, 2018. N- Total number of participants, S.D- Standard Deviation

Table 3A shows the academic achievement of students taught using lecture method and demonstration method. From the table, students in which their teacher uses Lecture method of teaching had a mean score 48.13 while those whose teachers employed demonstration method of teaching had mean score of 57.57. The mean difference obtained was 9.44. This means that those taught with demonstration method performed better than those who were taught with lecture method. A study carried out by Daluba 2013, on the effect of demonstration method on the teaching of agricultural science affirmed that students taught with demonstration method achieved better than those that were taught with conventional methods of teaching.

Table 3B: Mean difference of students taught with Problem solving method and laboratory Method.

Instructional Strategies	N	Mean scores	S.D	Mean Difference
Problem solving method	38	56.03	19.09	
				11.27
Laboratory Method	29	44.76	18.78	

Field Survey, 2018. N- Total number of participants, S.D- Standard Deviation

Table 3B shows the academic achievement of those taught frequently taught Physics with problem solving method and Laboratory method. From the table, students taught Physics with problem solving method has mean scores of 56.03 while those taught with laboratory method had mean scores of 44.76. The mean difference obtained was 11.27. This means that those students frequently taught Physics with problem solving method achieved more than those taught with laboratory methods. Studies by Abell & Pizzini 1992 have shown that, in classes where the teacher adopted the problem-solving approach, there was increased use of brainstorming, an increase in time allotted to defining, sharing and presenting the problem, as well as more student-selected research questions and student-designed investigations which in turn yielded high achievement.

Hypotheses

H_{01}; There is no significant difference between the mean scores of students taught Physics with lecture method and demonstration method.

Table 4: Z- test analysis of means scores of students taught with Lecture method and Demonstration method

Groups	N	Mean	S.D	Level of sig.	z-cal	z-crit	Remark
Lecture method	31	48.13	17.93				
				0.05	2.31	1.96	Rejected
Demonstration method	42	57.57	17.04				

The table presents the z- test analysis of mean scores obtained from students taught with lecture method and demonstration method. The hypothesis was tested to determine whether the difference between the mean scores of both group is actually significant. However, at 0.05 level of significant, the z-calculated value (2.31) is higher than the z-critical value (1.96). therefore the hypothesis is rejected. This means that students that are taught physics using demonstration method of instructional strategies performed significantly better that those who were taught with lecture method.

H_{02}; There is no significant difference between the mean scores of students taught Physics with problem solving method and Laboratory method.

Table 4; Z-test analysis mean scores of students taught problem solving method and laboratory method.

Groups	N	Mean	S.D	Level of sig.	z-cal	z-crit	Remark
Problem solving method	38	56.03	19.09				
				0.05	2.42	1.96	Rejected
Laboratory method	29	44.76	18.78				

The table shows the z-test analysis of the mean scores of students taught Physics with problem solving method and laboratory method. The z-test analysis was conducted to determine whether the difference that existed between the mean scores is significant. The Hypothesis was tested at 95% confidence level. The z-calculated value obtained was 2.42 greater than the z-crit value of 1.96. The hypothesis is thus rejected. This implies that students that are taught Physics using problem solving method performed significantly better than those who were taught with Laboratory method.

Conclusion

The following conclusions were made based on the findings of the study**;**

- The use appropriate instructional strategies as demanded the nature of the lesson enhance the achievement of instructional objectives.

- The study found that the most widely used traditional instructional strategy are lecture method, demonstration method, problem solving method and laboratory method.
- Finding from the study also affirmed that students who were taught physics using performed less compared to those taught with demonstration method.
- It was also found that Problem solving instructional strategy is another effective means of teaching Physics as it forces the learner to brainstorm in other to solve problems for themselves. Findings affirmed those taught Physics with Problem solving technique achieved more academically, compared to those who were taught with laboratory method of teaching.

Recommendation.

Based on the findings of the study, it was recommended that;

- Physics teachers should imbibe instructional strategies that are would get students involved in various classroom activities as regards to the lesson this will enable them to develop more interest in the lesson.
- Physics teachers should consider teaching resources before embarking on employing any kinds of instructional technique.
- Physics teachers should employ appropriate instructional strategies based on the learning attitudes of the students and the lesson to be taught because diverse topics in Physic and other science subjects demands flexibility in instruction due to their various concepts.
- Demonstration method and problem solving method are effective teaching technique that centres its instruction on students' deliberate effort to learning, thus Physic teachers should take advantage of these methods to convey knowledge to learners.

References:

1. Abdulsallam, M.S.., (2014). Teachers and Students Views on the use of augmented Reality Environments in Physics Education. Pegem Journal of Education and Instruction, 4(1),59-74.
2. Abell, S. K., & Pizzini, E. L. (1992), The effect of a problem in-service program on the classroom behaviors and attitudes of middle school science teachers, Journal of Research in Science Teaching, 29 (7), 649-667
3. Akinbobola O.A (2015). Effects of Learning Styles and Instructional Strategies on Students' Achievement in Nigerian Senior Secondary School Physics. Advances in Physics Theories and Applications vol. 41(2) pp 20-29

4. Alberta, (2002). Instructional strategy in Health and Life Skills Guide to Implementation (K-19). Alberta learning, Alberta Canada.
5. *Amadi, N. S., Ekezie, A. I. A. (2017).*Analysis of Strategies Used By Lecturers in Teaching Agricultural Education in Higher Institutions in Rivers State, Nigeria. Journal of Education and Practice 8(31)
6. Ameh, I-Ei, Daniel, B. P., & Akus, Y. (2007). Research and Methods in the Social Sciences. Ankpa: Rowis press.
7. Baran, M. & Maskan, A.K., (2010). The effect of Project Based Learning Pre-service Physics Teachers Electrostatic Achievement. Cypriot Journal of Educational Sciences 5(4) 16-24.
8. Cildir, S. (2012). Visualization of Limits in Computer Environment and the views of Prospective Teachers on this Issue. Hacettepe University Journal of Education 42, 143-153.
9. Daluba, N.E (2013). Effect of Demonstration Method of Teaching on Students' Achievement in Agricultural Science. World Journal of Education vol. 3 (6) pp 1-7
10. Eren, C.D. & Gurdal, A. (2010). The Effet of Teaching Physics with Fragmented Teaching Method on Students' Academic Success; Recalling the attitudes Towards Group Work.Pamukkale Uiniversity Journal of Education 28(1),67-79.
11. Ergil, N.R. & Cigrik, E.2013). The process of Knowledge Construction about the concept of Electrical Power. Hacettepe University Journal of Education 28(1) 153-164.
12. Gurpreet, K. 2011. Study and Analysis of Lecture Model of Teaching. *International Journal of Educational Planning & Administration. Volume 1, Number 1 (2011), pp. 9-13*
13. Hamidu M. Y., Ibrahim A. I., Mohammed, A 2014.The Use of Laboratory Method in Teaching Secondary School Students: a key to Improving the Quality of Education. International Journal of Scientific & Engineering Research, 5 (9),81-86
14. Hoellwarth, C. Moetter, J.M. & Knight, R.D (2005). A Dierect Comparison of Conceptual Learning and Problem Solving Ability in Tradition and Studio Type Classroom. American Journal of Physics, 73(5), 459-462.
15. Karaca, K. (2013). Views of Pre-service Teachers on the Contribution of Visual Materials in Physics Instruction. Gazi University Institute of Education, Ankara.
16. Langley, D. & Eylon, B.S.(2006). Probing High School Physics Teachers' View and Concern about Learning Activities. International Journal of Science and Mathematics Education. 4(2), 215-239.

17. Rushikesh K. 2013. A Problem-Solving Approach for Science Learning. International conference New Perspective in Science Education, 2nd Edition.
18. Vincent, E.O and Udeme T.A. (2014) Instructional Strategies and students'' Acadedmic Performance in Electrical Installation in Technical Colleges in Akwa-Ibom State: Instructional Strategies for structuring Appropriate Learning Experiences for Students. International Journal of Educational Administration and Policy Studies, 6(5) 80-86.