Assessment of level of awareness and extent of utilization of innovative instructional strategies for teaching science in secondary schools in Kebbi State, Nigeria

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ABSTRACT

The study examined level of awareness and extent of utilization of innovative instructional strategies by science teachers for teaching science in senior secondary schools in Kebbi State, Nigeria. The research is quantitative in nature, descriptive survey research design was adopted. A sample of 252 science teachers was drawn from all science teachers in public secondary schools in Kebbi State, Nigeria. The sample for schools was drawn using stratified sampling, while simple random sampling was used in the selection of science teachers. Questionnaire validated by experts was used as an instrument for data gathering. The reliability of the instrument was determined using test-retest method and an index of 0.76 was arrived at. Findings from the study revealed that 19 (67.86%) out of 28 innovative instructional strategies were not known by science teachers, while 5 (17.86%) were known but not utilized by the teachers. Similarly science teachers do not frequent libraries or browse the internet for current books, journals and other resources to update their knowledge on recent practices on teaching and learning science. The study recommends that Government should organize seminars, workshops and provide adequate sensitization to science teachers on awareness and utilization of innovative instructional strategies for effective teaching and learning science. Science teachers should be encouraged to visit libraries and also search the internet for current information and ideas on current practices on teaching and learning science.

Keywords: Awareness, utilization, innovative instructional strategies, teaching and learning science.

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INTRODUCTION

Modern civilization is a scientific civilization and modern society has comprehensively turned into a scientific environment. Likewise, science has become an integral part of our life and living. Science education, that is, the development and explanations of process procedures required to help others acquire scientific and technological knowledge for application in everyday living is paramount. The basic function of science education is, to train individuals for a career in science and the other is to broaden the horizon of non-technical citizens by giving

them some formality with the content, products and discipline of science (Wasagu, 2009). As human endeavors have advanced further into technology, the need for both function of science education has increased. Science teaching should contribute to the all-round development of the children so that they become socially useful and effective citizens of the modern scientific world (Das, 2006). The increasing importance of science education has made it expedite for teachers/lecturers of science to have sound knowledge

on effective innovative instructional strategies for science teaching and learning.

Science teaching in Nigerian Senior Secondary Schools requires a science teacher with a sound background in both the theory and practical aspect of science as well as knowledge about the process of teaching/learning. A science teacher with effective innovative instructional strategies of teaching science is one who is worthy, efficient, excellent, conforming and relevant with a quantifiable ability to produce growth in student achievement. Science teaching requires the use of various innovative strategies of instruction such as. Think-pair-share, compare and contrast chart, O-W-L chart, active learning, collaborative-cooperative learning strategy, peer instruction strategy, animated media instruction strategy, jigsaw strategy, innovative strategy, just in time teaching and many others. However, in a country wide survey, Japan International Cooperation Agency (JICA) (2005) in collaboration with the Federal Ministry of Education Nigeria found poor teacher - pupil strategies in operation, monotonous use of lecture method of teaching and inadequate and poor utilization of available teaching materials by science teachers.

Similarly, Wasagu (2009) postulated that science teaching in Nigerian schools was not and is not producing the desired results as a result of some problems stemming from classroom practices. There is also a rising public discontent over the poor standard of science students' performance in their Senior Secondary School Certificate Examination. In order to ensure accountability in education therefore, we must find an effective means to assess the innovative instructional strategies used by science teachers.

The role of innovative instructional strategies in effective teaching and learning of functional science education cannot be over emphasized; the increasing importance of science education is pertinent for nation building in contemporary world. Researchers have been calling for reforms on the way science, technology, engineering and mathematics are being taught in Nigerian schools (Travis and Lord, 2004; Okebukola, 2005). But a lamentable feature of science teaching and learning in Nigerian schools is poor standard of performance and unproductive science students and graduates. The socio-cultural dimension of the problem has become a might to the extent that science students has consciously or unconsciously accepted science education as a mirage and the practice of science as little as routine accumulation of memos.

Effective utilization of innovative instructional strategies and its penetrating power in the system of teaching and learning will go a long way in advancing the quality of science teaching and learning at all levels of education. The current quandary is as a result of lack of awareness of innovative instructional strategies by science teachers and inadequate knowledge of utilizing the strategies.

Nilza et al. (2010) in their studies on science teachers' awareness of findings from education research indicated that, science teachers' knowledge of education research findings is generally very limited. Teachers regard sound pedagogical knowledge as usually derived from personal experience and common sense. Their study provides evidence of the existence of serious gap between research and the practice of science education teaching and learning.

Similarly, studies indicated that most science teachers are unwilling to adapt to utilization of innovative instructional strategies even when they are aware of them. Fatokun et al. (2019) state that, many innovative teaching and learning strategies are already in existence but many science teachers do not utilize them when teaching, either because they are not well vexed on how to use them or as a result of their unwillingness to make effort and try these new approaches. They further state that, many of those few of the science teachers that have access and are aware of the innovative instructional strategies were not willing to give up their old practices and adopt the new strategies. Likewise, Oyelekan et al. (2017) revealed that science teachers' experience and qualifications did not influence their utilization of the innovative teaching strategies and the result of their study showed that out of thirty six (36) selected innovative teaching strategies, only two (2) were utilized by most of the science teachers the remaining thirty four (34) were rarely utilized. This is despite that, many scholarly works have emphasized the importance of innovative instructional strategies in science teaching and learning, (Anderson, 1998; Race, 2001; Serah, 2011). Meanwhile, Regina et al. (2010) recommended that, Government should provide adequate workshop, seminars and sensitization on awareness and utilization of innovative instructional strategy for in-service science teachers. But not much has been done in the area of assessing the awareness and utilization of science instructional strategies by science teachers in Kebbi State, Nigeria. To properly address the issue, the following research questions are set to be achieved.

Theoretical framework

This paper was hinged on the theory of constructivism, constructivism is a learning theory developed by constructivists, and they believed that the learner has prior knowledge and experiences which are often determined by their social and cultural environment. Learning is therefore done by students' "constructing" knowledge out of experiences.

Constructivists argued that students learn by giving them the training and opportunity to take initiatives for their own learning experiences. The notion of various innovative instructional strategies is based on

constructivists learning theory, most of the innovative instructional strategies involves a form of guided discovery in which the instructor avoid direct instruction where the learner played a passive, receptive role, in guided discovery the learner is actively involved in the learning process through questions and activities to discover, appreciate, visualize and discuss, verbalize the new knowledge. Constructivists encourage activities such as visualization, experimentation, class discussion, research project, films etc. Constructivist views of learning are in agreement with empirical findings concerning the inadequacy of traditional teaching methods in developing and changing students' fundamental science comprehension (Tyler et al., 2014). Tyler et al. (2004) further argued that conceptual change approaches to teaching took their form by realizing that the learning of major science concepts involves the transformation of often well-developed informal conceptions rather than the simple implantation of ready-made science knowledge. The constructivists believed that strategies are many and involve bringing students' prior conceptions into the open and also challenging them to use structured activities and classroom discussion within the frameworks of science ideas. Such teaching schemes, generated on the basis of students' conceptions, are characterized as constructivist or conceptual change approaches. Given the diversity of students and the views expressed in many classrooms, the science teachers' role needs to be more about managing the construction of science concepts among students (Barbosa et al., 2004). The issue of effective utilization of various innovative instructional strategies is what makes a difference between one science teacher and another. Some innovative teaching strategies involve the learners more than others and sometimes add more meaning to everyday life. Appropriate choice and utilization of innovative instructional strategies could help to bring positive changes in the conceptual comprehension of science content among learners.

Objectives of the study

The following objectives were set to be achieved for the study:

1. To examine the level of awareness of innovative instructional strategies among science teachers.
2. To investigate the extent of utilization of innovative instructional strategies among science teachers.
3. To determine science teachers effort to update their knowledge on current trends on instructional processes for effective teaching and learning of science.
4. To investigate the possible factors for non-awareness and utilization of innovative instructional strategies by science teachers.

5. To proffer solutions for the likely gap of awareness and utilization of innovative instructional strategies if it exist among science teachers.

Research questions

The following research questions guided the study:

1. Are science teachers aware of innovative instructional strategies for teaching and learning of science?
2. Do science teachers utilize innovative instructional strategies in teaching and learning of science?
3. Do science teachers make effort to update their knowledge on current trends on instructional processes for effective teaching and learning of science?
4. What are the possible factors for non-awareness and utilization of innovative instructional strategies by science teachers?
5. How can the likely gap of awareness and utilization of innovative instructional strategies can be bridged among science teachers for better teaching and learning of science?

METHODOLOGY

Research design

The study is quantitative in nature, descriptive research of the survey type, using questionnaire for data collection was adopted. Koul (2009) stated that descriptive research of the survey type are conducted to collect detail descriptions of existing situations with the aim of employing data to justify current conditions and practices or to make plans for improving them, or to determine the adequacy of status by comparing it with established standards. Fajemidagba (1995) added that descriptive studies such as case study, surveys, correlational studies and others, may not require technical design because they may not involve the manipulation of any variables or treatment or intervention of some sort, the researcher may only need to plan a sequence of strategies which will be used to complete the study. The researchers adopted this approach, because the study employ data to justify current conditions and practices, and the research make plans for improving them, similarly the study do not involve the manipulation of any variables or treatment, the researchers only plan a sequence of strategies to complete the study.

Population

The population for the study comprised of all the Biology, Chemistry and Physics teachers in all the public

secondary schools in Kebbi State, North-West, Nigeria. However, since it was not possible to engage all of them in the study, only a few were sampled to take part.

Sample and sampling technique

Stratified random sampling technique was used to select sample of Biology, Chemistry and Physics teachers from public secondary schools in Kebbi State. This is because Daramola (1995) stated that stratification in educational research is a process of classifying variables into groups according to desired characteristics such as age group, sex, location, academic ability, socio-economic groups, religion and others, he identified stratified random sampling technique as a two stage sampling process, which involves, (i) classifying a target population into two or more strata according to the desired characteristics of the population, (ii) thereafter, a process of simple random, sampling or a systematic random sampling technique is employed to draw the required sample from each stratum. Therefore, 6 Educational Zones in Kebbi States form the strata, 7 schools were selected using systematic random sampling from each zone, while 6 science teachers (2 each from Biology, Chemistry and Physics) were selected using simple random sampling technique from each school selected in the Educational Zone, making the sum of 42 teachers from each zones, a total of 252 science teachers participated in the study.

Administration

A questionnaire tagged assessment of awareness and utilization of innovative instructional strategies for teaching and learning science was designed. The questionnaire was segmented into four sections. Section A was aimed at investigating the level of science teachers' awareness and utilization of innovative instructional strategies for teaching and learning science. Section B was to assess the level of science teachers' effort to update their knowledge on current trends on instructional processes for effective teaching and learning of science. Section C focused on the possible factors that may lead to non-awareness and utilization of innovative instructional strategies among science teachers. Section D was on possible means of bridging the likely gap of awareness and utilization of innovative instructional strategies if it exists among science teachers. The instrument was validated by experts, their comments and recommendations were reflected in the final copy of the instrument with 28 items. Reliability index of 0.76 was obtained using test re-test method. The researcher visited the sampled schools in each of the educational zones, thereafter, with the help of Vice-principal Academic, the researcher randomly selected two Biology,

Chemistry and Physics teachers each, the instrument was distributed to the sampled teachers, they were collected immediately with 100% returned, collated and all the information gathered was used to answer the research questions.

RESULTS

The data were analyzed using descriptive statistical analysis; the results were presented in tables according to the research questions using frequency count, percentages and mean rating. The following were assigned for easy computation of results; Strongly Agreed (SA) - 4, Agreed (A) - 3, Disagreed (DA) - 2 and Strongly Disagreed (SD) -1. Aware and utilized – 3, Aware but not Utilized – 2, and Not Aware – 1. Any item with a mean equal to or greater than 2.50 was accepted as agreed while the one with a mean less than 2.50 was regarded as disagreed. Similarly any item in Table 1 with percentages of fifty (50%) and above is considered as Aware and Utilized, Aware but not Utilized and Not Aware respectively.

RQS 1 and 2: What is the level of awareness and extent of utilization of innovative instructional strategies among science teachers?

Close inspection of Table 1 revealed that 19 (67.86%) of the innovative instructional strategies were not known by the science teachers while 5 (17.86%) of the innovative strategies were known but not utilized by science teachers. This implies that science teachers were not aware of innovative instructional strategies and there was no adequate attempt to utilize the few known innovative instructional strategies by the teachers.

RQ 3: Do science teachers make effort to update their knowledge on current trends on instructional for effective teaching and learning science?

Table 2 provides answer to research question 3; the respondents disagreed on all the items. This revealed that, science teachers in the study area do not access the internet and do not frequent library or attend conferences, workshops, seminars to update their knowledge on current practices on teaching and learning of science, likewise the libraries were not always updated with current books, journals, internet services and other resources that will aid effective update of their knowledge on current trends on instructional processes for effective teaching and learning of science.

RQ 4: What are the possible factors for non-awareness and utilization of innovative instructional strategies by science teachers?

Table 1. Some innovative instructional strategies for teaching and learning of science, level of awareness and attempt by science teachers on utilization.

S/N	Items on some instructional strategies for teaching and learning science	Aware and utilized FRQ. (%)	Aware but not utilized FRQ. (%)	Not aware FRQ. (%)
1	Think-pair-share	60 (23.81)	130 (51.59)	62 (24.60)
2	Compare and Contrast Chart	NIL (0)	21 (8.33)	231 (91.66)
3	Context Based Learning	NIL (0)	NIL (0)	252 (100)
4	O-W-L Chart	NIL (0)	NIL (0)	252 (100)
5	Peer Instruction Strategy	25 (9.92)	61 (24.21)	166 (65.87)
6	Animated Media Instruction Strategy	NIL (0)	56 (22.22)	196 (77.78)
7	Jigsaw Strategy	33 (13.10)	107 (42.46)	112 (44.44)
8	Jigsaw 1V Cooperative Learning Strategy	29 (11.51)	123 (48.81)	100 (39.68)
9	Crossover Learning	NIL (0)	NIL (0)	252 (100)
10	Mind Mapping	39 (15.48)	112 (44.44)	101 (40.08)
11	Just in Time Teaching Strategy	NIL (0)	NIL (0)	252 (100)
12	Active Learning Strategy	98 (38.89)	104 (41.27)	50 (19.84)
13	Authentic Learning	NIL (0)	NIL (0)	252 (100)
14	Simulation Teaching Strategy	20 (7.94)	167 (66.27)	65 (25.79)
15	Problem Based Instruction Strategy	NIL (0)	59 (23.41)	193 (76.59)
16	Differentiated Instructional Approach	NIL (0)	27 (10.71)	225 (89.29)
17	Activating Strategy	NIL (0)	NIL (0)	252 (100)
18	Virtual Science Laboratories and Remote Lab.	NIL (0)	NIL (0)	252 (100)
19	Metacognitive Teaching Strategy	12 (4.76)	60 (23.81)	180 (71.83)
20	Scenario Analysis Based Teaching	NIL (0)	NIL (0)	252 (100)
21	Programmed Instruction Strategy	NIL (0)	NIL (0)	252 (100)
22	Concept Mapping Instruction Strategy	62 (24.60)	144 (57.14)	46 (18.25)
23	Multiple Intelligent Approach	NIL (0)	57 (26.62)	195 (77.38)
24	Science Text Cards	NIL (0)	NIL (0)	252 (100)
25	Instructional Conversations	31 (12.30)	132 (52.39)	109 (43.25)
26	Computer Game Instruction Strategy	NIL (0)	252 (100)	NIL (0)
27	'Real-world' Learning	NIL (0)	NIL (0)	252 (100)
28	A to Z Approach	NIL (0)	NIL (0)	252 (100)
	Total	**NIL (0)**	**5 (17.86)**	**19 (67.86)**

Source: Field work (2019).

Table 3 provides answer to research question 4. All the respondents agreed to all the items on table 3 on problems that militate against science teachers' non-awareness and utilization of innovative instructional strategies.

RQ 5: Science teachers should be encouraged to visit libraries and also search the internet for current information and ideas on current practices on teaching and learning of science.

Table 4 provides answer to research question 5. All the respondents agreed to all the items on table 4 on possible ways for bridging the gap of awareness and utilization of instructional strategies for effective teaching and learning of science.

DISCUSSION

The results presented in Table 1 revealed that 19(67.86%) of the innovative instructional strategies were not known by the science teachers while 5 (17.86%) of the innovative strategies were known but not utilized by science teachers. This implies that science teachers were not aware of innovative instructional strategies and there was no adequate attempt to utilize the few known innovative instructional strategies by the teachers. These findings is in agreement with Fatokun et al. (2019) who state that many innovative teaching and learning strategies are already in existence but many science teachers are not aware of them nor do they adapt them, either because of limited access to adequate information or their unwillingness to make effort to try them out.

Table 2. Assessment of science teachers' effort to update their knowledge on current trends on instructional processes for effective teaching and learning science.

S/N	Items	Mean	Decision
1	I do visit library for current information on science teaching and learning	2.42	Disagreed
2	I am aware of innovative instructional strategies for science teaching and learning	2.25	Disagreed
3	Our school library is often updated with current books, journals and other resources for teaching and learning science	2.30	Disagreed
4	I often attend conferences, workshops, seminars to update my knowledge on instructional processes for teaching and learning science	2.27	Disagreed
5	I always access internet for educational books, journals and researches to boost my professional expertise	2.29	Disagreed

Source: Field work (2019).

Table 3. Possible problems militating against science teachers' non-awareness and utilization of innovative instructional strategies for teaching and learning of science.

S/N	Items	Mean	Decision
1	There is lack of access to current research findings on innovative instructional strategies for teaching and learning science	3.84	Agreed
2	We lack equipped library with books, journals and other resources on innovative instructional strategies for teaching and learning science	3.21	Agreed
3	Problem of large class size and non-conducive environment	3.00	Agreed
4	Lack of step by step guide by researchers on how to practically utilize innovative instructional strategies for teaching and learning science	2.90	Agreed
5	Lack of motivation, support and encouragements by school administrators	3.42	Agreed
6	Utilization of most innovative instructional strategy is time consuming and very difficult in teaching and learning science	2.57	Agreed

Source: Field work (2019).

Table 4. Possible proposal for effective bridging the gap of awareness and utilization of innovative instructional strategies for teaching and learning of science.

S/N	Items	Mean	Decision
1	Science curriculum could be revised to state explicitly the use of some innovative instructional strategies for teaching and learning science	2.8	Agreed
2	Researchers should provide basic guide on how to utilize innovative instructional strategies for teaching and learning science	3.2	Agreed
3	Supply of necessary ICT facilities/equipment's, books and journals in school libraries to enable science teacher gain firsthand knowledge on innovative instructional strategies	3.81	Agreed
4	Science teachers should be developed professionally through seminars, workshop, conferences and in-service training to make them become aware of current innovative strategies for teaching and learning science	3.1	Agreed
5	There should be proper monitoring of science teachers and adequate motivation by school administrators	2.9	Agreed
6	Researches should be conducted on how to assist science teachers during utilization of innovative instructional strategies in the class	3.2	Agreed

Source: Field work (2019).

Likewise, Rothrauff (2011) affirmed that science teachers do not utilize the numerous technological teaching strategies through research information on improvement of teaching and learning process.

The findings in Table 2 indicated that, science teachers in the study area, do not search the internet for information and do not frequent library or attend conferences, workshop, seminars to update their knowledge on current practices on science teaching and learning, likewise the school libraries were not always

updated with current books, journals, internet services and other resources that will aid effective instruction in science. This collaborate with the findings of Olatomide (2012) who stated that, Agricultural Science teachers in Lagos state lamented that they experience difficulties accessing the internet, lack the time to use the internet, low level of connectivity, and cannot afford high cost of computers and Internet facilities, these issues, to some extent, have hindered the teachers' use and practices of Internet. Olojo et al. (2012) also found out that some of the impediments faced by science teachers in the teaching and learning of science are lack of funds, lack of sponsorship to attend conferences, workshops and seminars. On the issue of updating school libraries with books, journals and other resources that will aid effective instruction in science, the findings is in agreement with Bouazza and Al-Mufaraji (2005) who in their survey revealed minimal use of school libraries by teachers. School libraries possess poor collections, especially of audiovisual materials, journals and electronic resources, and access to the Internet. Teachers expressed their discontent with library services which appeared poorly updated. In addition, Ternenge and Agipu (2019) found that library resources are grossly inadequate especially electronic gadgets that aid information and learning in schools in this modern age of technology. On the same issue, Maram and Ogun (2002) confirm that high unavailability of library resources in most school libraries have a negative effect on the use of library resources in schools.

The findings in Table 3 showed that all the respondents agreed with the Problems Militating against Science Teachers Non-Awareness and Utilization of Instructional Strategies for Teaching and Learning Science, the problems are, lack of access to current research findings on instructional strategies for teaching and learning science, lack of equipped libraries with books, journals and other resources on instructional strategies for teaching and learning science, Problem of large class size and non-conducive environment, Lack of step by step guide by researchers on how to practically utilize instructional strategies for teaching and learning, Lack of motivation, support and encouragements by school administrators. The findings are similar to the findings of Fatokun et al. (2019) whose quantitative findings indicated some of the problems science teachers are confronted with in their bid to utilize research findings and try out some of the new instructional strategies, which include, lack of access to research findings on current innovative teaching strategy are, problem of large class size and unappealing learning environment, bulky syllabus which must be covered within specific time, lack of blue print or step by step implementation guide on how to practically adopt the new teaching approach and lack of necessary encouragement, motivation, support, and monitoring by school administrators. Similarly Solomon,

Kabang and Edward (2019) in their study on Teachers Perceived Knowledge and Challenges of Research Studies in Basic Science and Technology in Plateau State found that, there are no available resources for carrying out research studies and teachers are faced with many challenges such as large class size, lack of funds, lack of sponsorship to attend conferences, workshops, seminars, and in-service training.

The findings in Table 4 highlighted on the possible solutions to the problems earlier stated on non-awareness and utilization of innovative instructional strategies for teaching and learning science. These findings are consistent with the recommendations made independently by Oyelekan et al. (2017) and Regina et al. (2010) that, the state Government and school proprietors should organize workshops, seminars and conferences on innovative instructional strategies as an in-service training for science teachers irrespective of their experience or qualifications. Regina et al. (2010) emphasized that authors of science methods books should illustrate carefully in their books how to make use of all strategies effectively especially the non-adequately utilized ones. On the issue of proper monitoring and adequate motivation by school administrator, Mupa and Chinooneka (2015) stated that, School heads do not supervise teachers. There are some teachers who have never been supervised for the past ten years; such lack of supervision is likely to lead to complacency, some kind of supervision is necessary to boost teachers' morale. Effective leadership styles should be employed in schools for the sake of promoting teaching and learning.

CONCLUSION AND RECOMMENDATIONS

The findings and discussions validate the gap of awareness and utilization of innovative instructional strategies, access to internet and research finding, attendance to conferences, workshops and seminars among science teachers, inadequate supply of current books, journals, and other library resources in schools within Kebbi State, Nigeria. The implication of the findings is that, science teaching may not produce the desired learning achievement in science; likewise science teachers were not adequately fit with necessary skills of innovative instructional strategies which may help to produce changes in the conceptual knowledge of science content to the students. This may lead to the production of science students and graduates who could be unproductive and may not champion the course of new innovations in the area of science and technology. Therefore, it is recommended that:

- State Government should organize workshops, seminars, and conferences to science teachers on awareness and utilization of innovative instructional

strategies and other new innovations on effective teaching and learning of science.
- Science teachers should be encouraged to visit libraries and also search the internet for current information and ideas on current practices on teaching and learning of science.
- Researchers should provide basic steps with clear guidelines on how to utilize the various innovative instructional strategies during teaching and learning interaction.
- Adequate provision of funds and supply of necessary library facilities such as books, journals, internet services etc. should be maintained within Government secondary schools.
- School administrators should supervise teachers frequently and also provide adequate motivation and encouragement to boost the morale of teachers for effective discharge of their responsibilities.

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