Science Teachers' Utilisation of Innovative Strategies for Teaching Senior School Science in Ilorin, Nigeria

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ABSTRACT

Efforts have been made to improve science teaching in secondary schools in Nigeria, yet, students continue to perform poorly in science subjects. Many innovative teaching strategies have been developed by educators and found to impact significantly on students' academic performance when utilised. Hence, this study was aimed at examining science teachers' utilisation of innovative teaching strategies in teaching senior school science subjects in Ilorin, Nigeria. A sample of two hundred and fifty six (256) science teachers were selected from secondary schools in Ilorin East, South and West Local Government Areas using stratified random sampling technique. Data was obtained using a researcher-designed questionnaire known as the Innovative Teaching Strategies Questionnaire (ITSQ) which has a reliability index of 0.91 Cronbach alpha. Results showed that out of the thirty six (36) selected innovative teaching strategies, most science teachers frequently used only two (2), while the rest were rarely used. The results also showed no significant difference in science teachers' level of utilisation of the innovative teaching strategies based on experience and qualifications. It was recommended among others that science teachers avail themselves of the opportunities provided by these innovative strategies in improving the performance of their students.

Keywords: *science, teachers, utilisation, innovative strategies, senior school.*

INTRODUCTION

Science as a field of study has made it possible for man to know more about the universe. The effective teaching of science subjects can lead to the attainment of scientific and technological greatness (Adesoji & Olatunbosun, 2008). Science teachers are very crucial in the translation of science educational objectives into practice. Science education provides a more effective preparation for citizenship and in order to achieve this, qualified and experienced science teachers who are well aware of global demands of science teaching with a view to engendering scientific and technological values in learners are required. There has been much concern about the apparent fall in the standard of science education at the secondary school level in Nigeria. For instance, Madu (2004) and Okebukola (2005) working separately, have lamented on the decline in the standard of science teaching in Nigeria. Nwagbo (2001) identified a number of factors obstructing students' understanding and achievement in the science subjects and among these factors was the use of inappropriate, non-effective teaching methodology. Abimbola (2013) stated that the performance level for individual science subjects did not show any significant rise for a twenty-year period between 1991 and 2011, except occasionally for chemistry and physics.

The persistent poor performance in science subjects at School Certificate level has given rise to an assumption that most science teachers in secondary schools in Nigeria probably do not make use of varied forms of teaching strategies to be able to cope with some specific difficulties associated with the teaching and learning of science by both the teachers and the students respectively (Achor, 2003; Umoren & Ogong, 2007). Nwosu (2004) submitted that most science teachers do not possess the prerequisite knowledge needed for activity based learning and as a result, the most prevalent method of teaching has been the 'talk and chalk' (lecture) method. Ajaja (2013) identified the 'method adopted for teaching and learning science'(p.1) as one of the factors contributing to this low interest in science and hence expressed the need for a search for alternative instructional strategies that could stimulate students' interest and enhance their achievement. The use of various innovative teaching strategies is borne out of the fact that there are different topics to be taught and skills intended to be developed. Many innovative strategies have been developed by educators with a view to involving learners more in the teaching learning process. This is considered very important and there is the need get these strategies into the classrooms (Slavin, 2005; Leikin & Zaslavsky, 1997). For this to be done successfully, there is need for teachers not only to be aware of these strategies, but also to learn how to use these strategies appropriately in the classroom. A teacher who is not aware of a variety of such strategies can neither attempt to use them in the first place nor use them appropriately.

Recent empirical studies have indicated that some of these innovative strategies produced better result in terms of students' learning. For instance, Lamidi, Oyelekan and Olorundare (2015) conducted a study to determine the effects of mastery learning instructional strategy on secondary school students' achievement in mole concept, a topic that has been empirically identified as difficult to understand by students. It was found out that students taught using the mastery learning instructional strategy performed significantly better than their counterparts in the control group. Similarly, Gambari, Yusuf and Thomas (2015) examined the effectiveness of computer-assisted instruction on Student Team Achievement Division (STAD) and Learning Together Model (LTM) cooperative learning strategies on Nigerian secondary students' achievement and motivation in physics. They found out that the students taught with STAD and LTM performed significantly better than their counterparts taught using individualised computer instruction (ICI). It was further indicated that the cooperative learning strategies were found to be gender friendly.

In another recent study, Abdulwahab, Oyelekan and Olorundare (2016) investigated the effects of cooperative instructional strategy on senior secondary school students' achievement in electrochemistry using gender and scoring levels as moderating variables. The findings of this study also revealed that students taught using cooperative instructional strategy performed better than their counterparts in the control group and that the low scorers benefitting most from the strategy. Hence, as a way of proffering solution to students' dismal performance in the sciences, it is important to find out whether some of these innovative strategies are being utilised by the teachers or not.

The prescribed method for implementing the senior secondary school curriculum for biology placed emphasis on field study, guided discovery, laboratory techniques and skills and conceptual thinking. Other methods include models, demonstration, field trip, discussion, group work, project work and resource persons. The methods were prescribed in pursuance of the stated objectives, the contents and context of the curriculum (Nigerian Educational Research and Development Council (NERDC, 2009a). Chemistry curriculum content focuses on practical activity with emphasis on locally available materials. The prescribed methods include guided discovery, class discussion, field trip, laboratory and demonstration (NERDC, 2009b). Physics content organization uses the spiral approach while guided discovery method of teaching has been recommended to achieve the stated objectives of the curriculum. The prescribed methods for implementing the senior secondary school curriculum for physics place emphasis on experimentation, questioning, discussion and problem solving (NERDC, 2009c). The curriculum if effectively implemented will enable the learner achieve his/her maximum potential and perform better in various subject areas.

As often specified by the current curriculum in use, science teachers are expected to deliver a particular content in a specific term, week and time of the year to the learners. However, how to put the required knowledge across to learners might often be a problem to the teachers. This problem could arise from having to teach much within a short time, not having the required materials or not knowing the strategies to teach with. Further, it was found that some teaching strategies could be more facilitative than others when used in teaching which often depends on the subject or topic/concept being taught (Barbosa, Jofili & Watta, 2004; Longjohn, 2009; Umoren & Ogong, 2007). Hence, the effective use of one or more innovative strategies suitable for a particular science topic or content is necessary.

The teachers' educational qualification is one of the factors for good delivery of lessons in the classroom. Professional development can no longer be viewed as an event that occurs in a particular day of the year rather it must become part of the daily work of life of educators. Okunloye (2009) identifies teaching as a profession that requires the acquisition of knowledge in a specialised teacher training educational institution such as colleges of education and universities for effective and successful practice. It must be recognised that classroom teachers are core of institutional education, they must recognise that they have to grow being teachers to educators through a lot of in-service training and continuous practice (Majasan, 1996).

Omosewo (1998) contributed that teacher academic qualification was a necessity for students' performance in physics. Khurshid and Zahur (2013) reported that teachers with more professional qualifications were more aware of the innovative teaching methodologies than teachers with less professional qualifications. The search for highly qualified teachers has resulted in ever increasing demands for certification in both subject matter and pedagogy but equating teacher quality with teacher qualifications has not had the predicted results. Teachers have a great influence on students during the process of transferring knowledge and enhancing students' cognitive growth that is why it becomes necessary for a teacher to try to comport himself well at all times since there is a strong chance of his student trying to emulate his behaviour, speech and attitude to life.

Fullan (1995) contributed that teachers' professional development in a climate of educational reform must address the total challenge of implementing educational standards, working with diverse population and changing forms of student assessment. Professional development cannot be over-emphasized because it plays an essential role in successful educational reform. It serves as a bridge between where prospective and experienced educators are now and where they will need to be to meet new challenge of guiding all students in achieving higher standards of learning and development. Teachers should have a solid foundation in their subject area and training in learning theories and effective practices.

Teaching experience is vital in a teaching and learning situation. Experience can be said to be those attitudes, skills or knowledge acquired by the teacher through his participation in instructional programmes. The experience of the teacher may help him to cope and adapt to changes in educational programmes. Teacher's years of experience is a measure of their quality and thus becomes imperative in the achievement of student's academic performance (Akinsolu, 2010). Teachers are said to gain extensive experience of successful and unsuccessful performances throughout their years of teaching, this assumption generated an in-depth research into how teachers who have been involved in teaching for different period of time perceive their teaching (Fives, 2010; Fives & Lisa, 2008).

The importance of experienced teachers in schools has been highlighted by some researchers (Akinleye, 2001; Ijaiya, 2000; Ogundare, 2001). These researchers gave similar opinions about teaching experience and students' learning outcomes in schools. Their opinion was centered on the fact that experience improves teaching skills while pupils learn better at the hands of teachers who have taught them continuous. Richards (1991) commented that teachers entering the profession may find their teaching effort stressful, but with experience they acquire a repertoire of teaching strategies that they draw on throughout their teaching. Teachers' theories about teaching are being guided by their previous experience as learners and as teachers (Mok, 1994).

Adeyemo (2008) examining teachers' teaching experience and students' learning outcomes in the secondary schools in Ondo State, Nigeria revealed that teachers' teaching experience was significant with students' learning outcomes as measured by their performance in the SSC examinations. Schools having more teachers with five years and above teaching experience achieved better results than schools having more teachers with less than five years teaching experience.

Sodaak and Podell (1997) observed that experienced teachers are more resistant to change in their beliefs of self-efficacy and the use of different types of activities than teachers with less experience. Onanuga (2006) was of the opinion that more years spent on the teaching job renders most teachers ill-productive in all aspects, makes them to become lazy and uncommitted to their teaching profession Gorrell and

Dharmadasa (1994) indicated that, although less experienced teachers preferred implementing new methods of instruction, experienced teachers are more concerned about classroom management and organisation of instruction and their impact on the students.

Anchor et al. (2010) discovered that more experienced science teachers had higher mean utilisation scores of the innovative teaching strategies than the less experienced ones. Khurshid and Zahur (2013) revealed that experienced teachers were more aware and utilised the innovative strategies than the less experienced ones.

Hence, this study sought to find out the utilisation of selected innovative strategies for teaching senior school science by science teachers within a locality in Nigeria with a view to making appropriate recommendations that could lead to improvement in the performance of students in science subjects.

THEORETICAL FRAMEWORK

The Constructivist developed a learning theory known as the Constructivist Learning Theory. These theorists believe that learning is based on prior knowledge and that students learn best when they are allowed to create a personal understanding based on experiencing things for themselves and reflecting on them. They believe that students learn to learn by giving them the training to take initiatives for their own learning experience. The concept of innovative teaching is actually based on the constructivist learning theory. A number of teaching strategies are principled on the constructivist learning theory which mostly involves a form of guided discovery in which the teacher avoids direct instruction and attempts to lead students through questions and activities to discover, discuss, appreciate and verbalize the new knowledge. Activities encouraged by constructivist include experimentation, visualisation, research project, field trip, films and class discussion.

Constructivist views of learning are in consonance with empirical findings concerning the inadequacy of traditional teaching approaches in developing and changing students' fundamental science understanding (Tyler, Waldrip & Griffiths, 2004). Tyler et al., (2004) further stressed that conceptual change approaches to teaching took their cue from the realisation that the learning of major science ideas involves the transformation of often well-developed informal conceptions rather than the simple implantation of ready-made science insights. The constructivists agree that the approaches 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 characterised as constructivist or conceptual change approaches.

Given the diversity of learners and the views expressed in many classrooms, the science teachers' role needs to be more about managing the construction of knowledge between participants (Barbosa, Jofil & Watta, 2004). The issue of effective management is what makes a difference between one science teacher and another. Some teaching strategies involve the learners more than others and sometimes add more meaning to everyday life. This was stressed by Barbosa, Jofil and Watta (2004) in pointing out that very little of what science teachers teach will be directly used in their students' lives. It is on this basis that they advocated for teachers' need to look beyond the 'utility argument' of the subject so as to see what aspects of science are needed to enrich lives with an understanding of people and the universe. Appropriate choice of teaching strategies could help to bring this to realization.

PURPOSE OF THE STUDY

The main purpose of this study was to find out science teachers' utilisation of innovative teaching strategies in implementing senior school science curricula. Specifically, the study sought to find out:

1. The level to which science teachers utilise innovative teaching strategies in their teaching.
2. If science teachers' number of years of teaching experience influenced their level of utilisation of innovative teaching strategies
3. If science teachers' qualifications influenced their level of utilisation of innovative teaching strategies.

RESEARCH QUESTIONS

Answers were sought to the following research questions:

1. To what level do science teachers utilise innovative teaching strategies in their teaching?
2. To what level does the utilisation of innovative teaching strategies by experienced science teachers differs from that of the less experienced science teachers?
3. To what level does the utilisation of innovative teaching strategies by qualified science teachers differs from that of unqualified science teachers?

RESEARCH HYPOTHESES

The following research hypotheses were put to test:

$HO_{1:}$ There is no significant difference in the level of utilisation of innovative teaching strategies between experienced and less experienced science teachers.

$HO_{2:}$ There is no significant difference in the level of utilisation of innovative teaching strategies between qualified and unqualified science teachers.

METHODOLOGY

The study was a descriptive research of the survey type. The population was all senior secondary school science teachers of biology, chemistry and physics in Ilorin East, South, and West Local Government Areas of Kwara State, Nigeria. Three hundred (300) science teachers were purposively and randomly selected from senior secondary public and private schools. Eventually, two hundred and fifty six (256) science teachers responded properly to the instrument used for the study.

The instrument used for the study was a researcher-designed questionnaire known as the Innovative Teaching Strategies Questionnaire (ITSQ). The questionnaire contained two sections, A and B. Section A requested for the personal information of each respondent like the name of school, schools' location, gender of respondent, teaching qualifications, years of experience and area of specialization. Section B of the questionnaire requested for information on teachers' level of utilisation of the selected innovative teaching strategies. It had a 3-option rating scale of Frequently Used (FU=3), Rarely Used (RU=2) and Not Used (NU=1), which are the levels of utilisation. The level of utilization of each strategy is represented by the mean utilization value which ranges between 1 and 3. For the purpose of this study, the level of utilization of the strategies in terms of the mean utilisation value is rated as follows:

1.0: Not used

1.1- 2.4: Rarely used

2.5- 3.0: Frequently used

The mean utilization value for each of the items is calculated by multiplying the weighted value of the response modes (3 for FU, 2 for RU, and 1 for NU) with the number of teachers that chose them for the item, added together and then divided by the total number of teachers.

The study took into consideration thirty six selected innovative teaching strategies out of one thousand two hundred and seventy one (1271) instructional strategies listed by Kelly (2010) and those listed by the United States' National Center on Educational Outcomes (2002). The strategies were selected based on their innovative nature, student centeredness, relevance to the various science subjects.

The questionnaire was validated by four lecturers in the Department of Science Education, University of Ilorin, Nigeria. The reliability of the questionnaire was determined using Cronbach Alpha reliability procedure in which the questionnaire was administered to twenty science teachers selected from another area not covered in the study. Using the Statistical Program for the Social Sciences, a reliability coefficient of 0.91 was obtained.

After due permission was sought from the selected schools by the researchers, the researchers met with the teachers to seek their consent and explained the aim of the study as well as their level of involvement in the study. The researcher administered the questionnaires alongside a glossary of the selected innovative strategies personally to the teachers, waited for them to be filled and retrieved them that same day before leaving the schools. Data collection was done over a period of one month. The data obtained from the questionnaire were coded and subjected to statistical analysis using the frequency count, percentages, mean and Chi-Square.

RESULTS

The data obtained in respect of each of the research questions and hypotheses are presented and explained as follows:

Research Question 1: To what level do science teachers utilise the innovative teaching strategies?

Table 1 is interpreted on the bases of the percentage of teachers that used the strategies as well as the level of utilisation as represented by the mean utilisation values.

Table 1 Frequency Counts, Percentages and Mean of Science Teachers' Level of Utilisation of the Innovative Teaching Strategies.

S/N	Strategies	Frequently Used (Frequency)	Freq. Used %	Rarely Used (Frequency)	Rarely Used %	Not Used (Frequency)	Not Used %	Mean Utilisation
1	Acronym Memory	56	21.9	159	62.1	41	16.0	2.06
2	Affinity	4	1.6	47	18.4	205	80.1	1.21
3	Analogy	77	30.1	160	62.5	19	7.4	2.23
4	Choral Response	25	9.8	169	66.0	62	24.2	1.86
5	Computer Assisted Ins.	13	5.1	24	9.4	219	85.5	1.20
7	Construction Spiral	17	6.6	39	15.2	200	78.1	1.29
8	Cooperative Learning	85	33.2	126	49.2	45	17.6	2.16
9	Crawford Slip	4	1.6	24	9.4	228	89.1	1.12
10	Demo kits	9	3.5	96	37.5	151	59.0	1.45
11	Discussion Web	4	1.6	69	27.0	183	71.5	1.30
12	Field Trip	59	23.0	126	49.2	71	27.7	1.95
13	Grab Bag	1	0.4	21	8.2	234	91.4	1.09
14	Graphic Organizers	5	2.0	111	43.4	140	54.7	1.47
15	Guided Discovery	32	12.5	145	56.6	79	30.9	1.82

S/N	Strategies	Frequently Used (Frequency)	Freq. Used %	Rarely Used (Frequency)	Rarely Used %	Not Used (Frequency)	Not Used %	Mean Utilisation
16	Idea Spinner	1	0.4	26	10.2	229	89.5	1.11
17	Jigsaw	18	7.0	43	16.8	195	76.2	1.31
18	Laboratory	184	71.9	58	22.7	14	5.5	2.66
19	Listen-Think-Pair-Share	15	5.9	79	30.9	162	63.3	1.43
20	Manipulatives	15	5.9	106	41.4	135	52.7	1.53
21	Mind Maps	14	5.5	56	21.9	186	72.7	1.33
22	Minimalism	22	8.6	86	33.6	148	57.8	1.51
23	Models	122	47.7	106	41.4	28	10.9	2.37
25	Multimedia	7	2.7	48	18.8	201	78.5	1.24
26	Peer Review	36	14.1	175	68.4	45	17.6	1.96
27	Peer Tutoring	44	17.2	185	72.3	27	10.5	2.07
28	Problem Solving	34	13.3	143	55.9	79	30.9	1.82
29	Project Based Learning	20	7.8	185	72.3	51	19.9	1.88
30	Reciprocal Teaching	11	4.3	143	55.9	79	30.9	1.64
31	Role Playing	3	1.2	86	33.6	167	65.2	1.36
32	Socratic Method	6	2.3	110	43.0	140	54.7	1.48
33	Stir the Teams	1	0.4	37	14.5	218	85.2	1.15
34	Study Aids	15	5.9	159	62.1	82	32.0	1.74
35	Twinning	2	0.8	116	45.3	138	53.9	1.47
36	Vee Mapping	_	_	34	13.3	222	86.7	1.13

The table shows that most of the science teachers frequently used laboratory and models, with the highest percentages of 71.9 % and 47.7% respectively, and mean utilisation values of 2.66 and 2.37 respectively. On the basis of the mean utilisation values, laboratory strategy was frequently used while the models strategy was rarely used. Table 1 also shows that most of the science teachers rarely used acronym memory, analogy, choral response, cooperative learning, field trip, guided discovery, models, model-lead-test, peer review, peer tutoring, problem solving, project based learning, reciprocal teaching and study aids with the highest percentages of rare use being 62.1%, 62.5%, 66.0%, 49.2%, 49.2%, 56.6%, 50.0%, 68.4%, 72.3%, 55.9%, 72.3%, 55.9% and 62.1% respectively. All these have their mean utilisation values between 1.1 and 2.4 meaning that they were all rarely used.

The table also shows that affinity, computer assisted instructions, construction spiral, Crawford slip, demo kits, discussion web, grab bag, graphic organizers, idea spinner, jigsaw, listen-think-pair-share, manipulatives, mind maps, minimalism, multimedia, role playing, Socratic method, stir the teams, twinning and vee mapping were being used by science teachers, since their utilisation values were above 1. However, they were not being used by most of the science teachers; because their percentages of non-use are 80.1%, 85.5%, 78.1%, 89.1%, 59.0%, 71.5%, 91.4%, 54.7%, 89.5%, 76.2%, 63.3%, 52.7%, 72.7%, 57.8%, 78.5%, 65.2%, 54.7%, 85.2%, 53.9% and 86.7% respectively.

Research Question 2: To what level does the utilisation of innovative teaching strategies by experienced science teachers differ from that of the less experienced science teachers?

The corresponding hypothesis to this research question is hypothesis 1.

Hypothesis 1: There is no significant difference in the level of utilisation of innovative teaching strategies between experienced and less experienced science teachers.

Table 2 Chi-Square Item-by-Item analysis of Science Teachers' Level of Utilisation of the Innovative Teaching Strategies Based on Experience.

			Frequently Used	Rarely Used	Not Used				
S/N	Strategies	Experience	Observed No. of Teachers (Expected)			Total	P	df	Remark
1	Acronym Memory	Experienced Less Experi.	34(22.3) 22(33.7)	53(63.4) 106(95.6)	15(16.3) 26(24.7	102 154	0.001	2	S
2	Affinity	Experienced Less Experi.	4(1.6) 0(2.4)	18(18.7) 29(28.3)	80(81.7) 125(123.3)	102 154	0.046	2	S
3	Analogy	Experienced Less Experi.	31(30.7) 46(46.3)	62(63.8) 98(96.2)	9(7.6) 10(11.4)	102 154	0.766	2	NS
4	Choral Response	Experienced Less Experi.	13(10.0) 12(15.0)	65(67.3) 104(101.7)	24(24.7) 38(37.3)	102 154	0.425	2	NS
5	Computer Assisted Ins.	Experienced Less Experi.	4(5.2) 9(7.8)	12(9.6) 12(14.4)	86(87.3) 133(131.7)	102 154	0.470	2	NS
6	Constructivism	Experienced Less Experi.	16(12.4) 15(18.6)	58(45.0) 55(68.0)	28(44.6) 84(67.4)	102 154	0.000	2	S
7	Construction Spiral	Experienced Less Experi.	10(6.8) 7(10.2)	20(15.5) 19(23.5)	72(79.7) 128(120.3)	102 154	0.052	2	NS
8	Cooperative Learning	Experienced Less Experi.	43(33.9) 42(51.1)	50(50.2) 76(75.8)	9(17.9) 36(27.1)	102 154	0.003	2	S
9	Crawford Slip	Experienced Less Experi.	3(1.6) 1(2.4)	9(9.6) 15(14.4)	90(90.8) 138(137.2)	102 154	0.345	2	NS
10	Demo kits	Experienced Less Experi.	5(3.6) 4(5.4)	47(38.2) 49(57.8)	50(60.2) 101(90.8)	102 154	0.029	2	S

S/N	Strategies	Experience	Frequently Used	Rarely Used	Not Used	Total	P	df	Remark
			Observed No. of Teachers (Expected)						
11	Discussion Web	Experienced Less Experi.	3(1.6) 1(2.4)	30(27.5) 39(41.5)	69(72.9) 114(110.1)	102 154	0.248	2	NS
12	Field Trip	Experienced Less Experi.	31(23.5) 28(35.5)	46(50.2) 80(75.8)	25(28.3) 46(42.7)	102 154	0.075	2	NS
13	Grab Bag	Experienced Less Experi.	1(0.40) 0(0.6)	9(8.4) 12(12.6)	92(93.2) 142(140.8)	102 154	0.446	2	NS
14	Graphic Organizers	Experienced Less Experi.	4(2.0) 1(3.0)	62(44.2) 49(66.8)	36(55.8) 104(84.2)	102 154	0.000	2	S
15	Guided Discovery	Experienced Less Experi.	18(12.8) 14(19.2)	54(57.8) 91(87.2)	30(31.5) 49(47.5)	102 154	0.128	2	NS
16	Idea Spinner	Experienced Less Experi.	0(0.4) 1(0.6)	12(10.4) 14(15.6)	90(91.2) 139(137.8)	102 154	0.571	2	NS
17	Jigsaw	Experienced Less Experi.	5(7.2) 13(10.8)	14(17.1) 29(25.9)	83(77.7) 112(117.3)	102 154	0.266	2	NS
18	Laboratory	Experienced Less Experi.	80(73.3) 104(110.7)	20(23.1) 38(34.9)	2(5.6) 12(8.4)	102 154	0.063	2	NS
19	Listen-Think-Pair-Share	Experienced Less Experi.	4(6.0) 11(9.0)	37(31.5) 42(47.5)	61(64.5) 101(97.5)	102 154	0.221	2	NS
20	Manipulati ves	Experienced Less Experi.	9(6.0) 6(9.0)	50(42.2) 56(63.8)	43(53.8) 92(81.2)	102 154	0.014	2	S
21	Mind Maps	Experienced Less Experi.	4(5.6) 10(8.4)	25(22.3) 31(33.7)	73(74.1) 113(111.9)	102 154	0.520	2	NS
22	Minimalis m	Experienced Less Experi.	11(8.8) 11(13.2)	32(34.3) 54(51.7)	59(59.0) 89(89.0)	102 154	0.550	2	NS
23	Models	Experienced Less Experi.	59(48.6) 63(73.4)	34(42.2) 72(63.8)	9(11.2) 19(16.8)	102 154	0.029	2	S
24	Model-Lead-Test	Experienced Less Experi.	14(9.2) 9(13.8)	54(51.0) 74(77.0)	34(41.8) 71(63.2)	102 154	0.031	2	S
25	Multimedia	Experienced Less Experi.	2(2.8) 5(4.2)	15(19.1) 33(28.9)	85(80.1) 116(120.9)	102 154	0.309	2	NS
26	Peer Review	Experienced Less Experi.	18(14.3) 18(21.7)	73(69.7) 102(105 .3)	11(17.9) 34(27.1)	102 154	0.044	2	S
27	Peer Tutoring	Experienced Less Experi.	22(17.5) 22(26.5)	73(73.7) 112(111 .3)	7(10.8) 20(16.2)	102 154	0.130	2	NS
28	Problem Solving	Experienced Less Experi.	18(13.5) 16(20.5)	60(57.0) 83(86.0)	24(31.5) 55(47.5)	102 154	0.05 9	2	NS

S/N	Strategies	Experience	Frequently Used	Rarely Used	Not Used	Total	P	df	Remark
			Observed No. of Teachers (Expected)						
29	Project Based Learning	Experienced Less Experi.	12(8.0) 8(12.0)	76(73.7) 109(111.3)	14(20.3) 37(30.7)	102 154	0.034	2	S
30	Reciprocal Teaching	Experienced Less Experi.	5(4.4) 6(6.6)	62(57.0) 81(86.0)	35(40.6) 67(61.4)	102 154	0.330	2	NS
31	Role Playing	Experienced Less Experi.	3(1.2) 0(1.8)	45(34.3) 41(51.7)	54(66.5) 113(100.5)	102 154	0.001	2	S
32	Socratic Method	Experienced Less Experi.	6(2.4) 0(3.6)	47(43.8) 63(66.2)	49(55.8) 91(84.2)	102 154	0.004	2	S
33	Stir the Teams	Experienced Less Experi.	1(0.4) 0(0.6)	13(14.7) 24(22.3)	88(86.9) 130(131.1)	102 154	0.391	2	NS
34	Study Aids	Experienced Less Experi.	9(6.0) 6(9.0)	65(63.4) 94(95.6)	28(32.7) 54(49.3)	102 154	0.155	2	NS
35	Twinning	Experienced Less Experi.	1(0.8) 1(1.2)	49(46.2) 67(69.8)	52(55.0) 86(83.0)	102 154	0.728	2	NS
36	Vee Mapping	Experienced Less Experi.	- -	15(13.5) 19(20.5)	87(88.5) 135(133.5)	102 154	0.585	2	NS

NS= Not Significant, S= Significant

Research question 2 could be answered for each of the strategies by inspecting the observed values for each of them. For example, for strategy number 1 which is acronym memory, the observed values of the number of experienced and less experienced science teachers who frequently used the strategy was 34 and 23 respectively, that of those who rarely used it were 53 and 106 respectively while that of those who did not use it were 15 and 26 respectively. The figures provide answers to research question 2 for each of the strategies.

Table 2 also shows that there was a significant difference between experienced and less experienced science teachers' level of utilisation of strategies 1, 2, 6, 8, 10, 14, 20, 23, 24, 26, 29, 31 and 32. Acronym memory, affinity, constructivism, cooperative learning, demo kits, graphic organizers, manipulatives, models, model-lead-test, peer review, project based learning, role playing and stir the team's p-values were 0.001, 0.046, 0.000, 0.003, 0.029, 0.000, 0.014, 0.029, 0.031, 0.044, 0.034, 0.001, and 0.004, respectively. The p-values of these innovative teaching strategies were less than 0.05 level of significance with 2 degrees of freedom hence, the significant difference.

Table 3 shows that the p-value was 0.396 which was greater than 0.05 level of significance with 2 degrees of freedom. Therefore, the null hypothesis which states that there is no significant difference in the level of utilisation of the innovative teaching strategies between experienced and less experienced science teachers was retained.

Table 3 Chi-Square Analysis of Science Teachers' Level of Utilisation of the Innovative Teaching Strategies Based on Experience.

	Frequently Used	Rarely Used	Not Used				
Experience	Observed No. of Teachers (Expected)			Total	P	df	Remark
Experienced	14(11.2)	40.7(39.2)	47.3(51.6)	102	0.396	2	NS
Less Experienced	14.2(17.0)	57.6(59.1)	82.2(77.9)	154			

Research Question 3: To what level does the utilisation of innovative teaching strategies by qualified science teachers differs from that of unqualified science teachers?

The corresponding hypothesis is hypothesis 2

Hypothesis 2: There is no significant difference in the level of utilisation of the innovative teaching strategies between qualified and unqualified teachers.

The level of difference in the utilisation of each of the innovative strategies by qualified and less qualified science teachers could be seen in the observed figures for both groups presented on table 4. For instance, the observed figures for the frequent use of acronym memory are 32 and 24 for qualified and unqualified teachers respectively, that of rare use are 62 and 97 respectively while that of not used are 16 and 25 respectively. The figures provide answers to research question 3 for each of the strategies.

Table 4 shows the Chi-square item-by-item analysis of science teachers' level of utilisation of the innovative teaching strategies. It shows that there was a significant difference between qualified and unqualified science teachers' level of utilisation of strategies 2, 6, 8, 14, 15, 19, 20, 24, 29, 31 and 32. The p-values of these innovative teaching strategies were 0.004, 0.021, 0.002, 0.008, 0.014, 0.007, 0.018, 0.042, 0.033, 0.000 and 0.016 respectively which were less than 0.05 level of significance with 2 degrees of freedom.

Table 4 Chi-Square Item-by-Item Analysis of Science Teachers' Level of Utilisation of the Innovative Teaching Strategies Based on Qualifications

			Frequently Used	Rarely Used	Not Used				
S/N	Strategies	Qualification	Observed No. of Teachers (Expected)			Total	P	df	Remark
1	Acronym Memory	Qualified Unqualified	32(24.1) 24(31.9)	62(68.3) 97(90.7)	16(17.6) 25(23.4)	110 146	0.053	2	NS
2	Affinity	Qualified Unqualified	4(1.7) 0(2.3)	27(20.2) 20(26.8)	79(88.1) 126(117)	110 146	0.004	2	S
3	Analogy	Qualified Unqualified	38(33.1) 39(43.9)	62(68.8) 98(91.2)	10(8.2) 9(10.8)	110 146	0.205	2	NS
4	Choral Response	Qualified Unqualified	14(10.7) 11(14.3)	72(72.6) 97(96.4)	24(26.6) 38(35.4)	110 146	0.333	2	NS
5	Computer Assisted Ins.	Qualified Unqualified	6(5.6) 7(7.4)	15(10.3) 9(13.7)	89(94.1) 130(125)	110 146	0.118	2	NS

S/N	Strategies	Qualification	Frequently Used	Rarely Used	Not Used	Total	P	df	Remark
			Observed No. of Teachers (Expected)						
6	Constructivism	Qualified Unqualified	19(13.3) 12(17.7)	52(48.6) 61(64.4)	39(48.1) 73(63.9)	110 146	0.021	2	S
7	Construction Spiral	Qualified Unqualified	9(7.3) 8(9.7)	20(16.8) 19(22.2)	81(85.9) 119(114.)	110 146	0.319	2	NS
8	Cooperative Learning	Qualified Unqualified	43(36.5) 42(48.5)	58(54.1) 68(71.9)	9(19.3) 36(25.7)	110 146	0.002	2	S
9	Crawford Slip	Qualified Unqualified	2(1.7) 2(2.3)	13(10.3) 11(13.7)	95(98.0) 133(130)	110 146	0.480	2	NS
10	Demo kits	Qualified Unqualified	3(3.9) 6(5.1)	48(41.2) 48(54.8)	59(64.9) 92(86.1)	110 146	0.201	2	NS
11	Discussion Web	Qualified Unqualified	3(1.7) 1(2.3)	30(29.6) 39(39.4)	77(78.6) 106(104)	110 146	0.419	2	NS
12	Field Trip	Qualified Unqualified	30(25.4) 29(33.6)	50(54.1) 76(71.9)	30(30.5) 41(40.5)	110 146	0.356	2	NS
13	Grab Bag	Qualified Unqualified	1(0.4) 0(0.6)	10(9.0) 11(12.0)	99(100.5) 135(134)	110 146	0.460	2	NS
14	Graphic Organizers	Qualified Unqualified	5(2.1) 0(2.9)	53(47.7) 58(63.3)	52(60.2) 88(79.8)	110 146	0.008	2	S
15	Guided Discovery	Qualified Unqualified	21(13.8) 11(18.2)	61(62.3) 84(82.7)	28(33.9) 51(45.1	110 146	0.014	2	S
16	Idea Spinner	Qualified Unqualified	0(0.4) 1(0.6)	14(11.2) 12(14.8)	96(98.4) 133(131)	110 146	0.348	2	NS
17	Jigsaw	Qualified Unqualified	8(7.7) 10(10.3)	21(18.5) 22(24.5)	81(83.8) 114(111)	110 146	0.676	2	NS
18	Laboratory	Qualified Unqualified	85(79.1) 99(105)	21(24.9) 37(33.1)	4(6.0) 10(8.0)	110 146	0.218	2	NS
19	Listen-Think-Pair-Share	Qualified Unqualified	4(6.4) 11(8.6)	45(33.9) 34(45.1	61(69.6) 101(92.4)	110 146	0.007	2	S
20	Manipulatives	Qualified Unqualified	10(6.4) 5(8.6)	52(45.5) 54(60.5)	48(58.0) 87(77.0)	110 146	0.018	2	S
21	Mind Maps	Qualified Unqualified	5(6.0) 9(8.0)	29(24.1) 27(31.9)	76(79.9) 110(106)	110 146	0.299	2	NS

S/N	Strategies	Qualification	Frequently Used	Rarely Used	Not Used	Total	P	df	Remark
			Observed No. of Teachers (Expected)						
22	Minimalism	Qualified Unqualified	12(9.5) 10(12.5)	42(37.0) 44(49.0)	56(63.6) 92(84.4)	110 146	0.135	2	NS
23	Models	Qualified Unqualified	58(52.4) 64(69.6)	40(45.4) 66(60.5)	12(12.0) 16(16.0)	110 146	0.329	2	NS
24	Model-Lead-Test	Qualified Unqualified	15(9.9) 8(13.1)	48(55.0) 80(73.0)	47(45.1) 58(59.9)	110 146	0.042	2	S
25	Multimedia	Qualified Unqualified	3(3.0) 4(4.0)	22(20.6) 26(27.4)	85(86.4) 116(115)	110 146	0.905	2	NS
26	Peer Review	Qualified Unqualified	19(15.5) 17(20.5)	75(75.2) 100(99.8)	16(19.3) 29(25.7)	110 146	0.298	2	NS
27	Peer Tutoring	Qualified Unqualified	24(18.9) 20(25.1)	76(79.5) 109(106)	10(11.6) 17(15.4)	110 146	0.216	2	NS
28	Problem Solving	Qualified Unqualified	15(14.6) 19(19.4)	67(61.4) 76(81.6)	28(33.9) 51(45.1)	110 146	0.256	2	NS
29	Project Based Learning	Qualified Unqualified	13(8.6) 7(11.4)	81(79.5) 104(106)	16(21.9) 35(29.1)	110 146	0.033	2	S
30	Reciprocal Teaching	Qualified Unqualified	5(4.7) 6(6.3)	63(61.4) 80(81.6)	42(43.8) 60(58.2)	110 146	0.891	2	NS
31	Role Playing	Qualified Unqualified	3(1.3) 0(1.7)	49(37.0) 37(49.0)	58(71.8) 109(95.2)	110 146	0.000	2	S
32	Socratic Method	Qualified Unqualified	6(2.6) 0(3.4)	47(47.3) 63(62.7)	57(60.2) 83(79.8)	110 146	0.016	2	S
33	Stir the Teams	Qualified Unqualified	1(0.4) 0(0.6)	19(15.9) 18(21.1)	90(93.7) 128(124)	110 146	0.267	2	NS
34	Study Aids	Qualified Unqualified	8(6.4) 7(8.6)	68(68.3) 91(90.7)	34(35.2) 48(46.8)	110 146	0.692	2	NS
35	Twinning	Qualified Unqualified	0(0.9) 2(1.1)	55(49.8) 61(66.2)	55(59.3) 83(78.7)	110 146	0.224	2	NS
36	Vee Mapping	Qualified Unqualified	- -	16(14.6) 18(19.4)	94(95.4) 128(127)	110 146	0.605	2	NS

NS= Not Significant, S= Significant

Hence, there was a significant difference between science teachers' utilisation of these strategies based on their qualifications.

Table 5 Chi-Square Analysis of Science Teachers' Level of Utilisation of the Innovative Teaching Strategies Based on Qualifications

	Frequently Used	Rarely Used	Not Used				
Qualification	**Observed No. of Teachers (Expected)**			**Total**	**P**	**df**	**Remark**
Qualified	14.6(12.1)	44.0(42.2)	51.4(55.6)	110	0.451	2	NS
Unqualified	13.6(16.1)	54.3(56.1)	78.1(73.9)	146			

NS= Not Significant

Table 5 shows that the p-value was 0.451 which was greater than 0.05 levels of significance with 2 degrees of freedom. Therefore, the null hypothesis which states that there is no significant difference in the level of utilisation of the innovative teaching strategies between qualified and unqualified science teachers was retained.

DISCUSSION

This study revealed that science teachers' experience and qualifications did not influence their utilisation of the innovative teaching strategies, hence, the two null hypotheses put to test in this study were retained. The innovative strategies that were utilised by science teachers have been revealed in this study. The results of this study revealed that out of the thirty six selected innovative teaching strategies, only two (2) were utilised by most of the science teachers. The remaining thirty four (34) strategies were rarely utilised as the mean utilisation for each of the strategies was below 2.5. This agrees with the submission of Achor, Samba and Ogbeba (2010) who stated that various teaching strategies exist yet poor teaching and learning of science seems to continue unabated.

The prescribed methods for implementing the senior school science curricula such as field trip, guided discovery, problem solving, and project based learning were rarely used. This study confirms the finding of Achor, Samba and Ogbeba (2010) which concluded that science teachers do not utilise most of the strategies they are aware of which is an indicator that certain concepts in science have probably not been taught using the appropriate teaching strategies.

The findings also revealed that there was no significant difference in the level of utilisation of the innovative teaching strategies between experienced and less experienced science teachers. The finding did not agree with that of Achor, Samba and Ogbeba (2010) that experienced teachers effectively used these strategies than less experienced teachers. This variation in results could probably be as a result of the number of innovative strategies considered in this study. Thirty six innovative strategies were considered in this study while nineteen innovative strategies were considered by Achor (2010). Also, Khurshid and Zahur (2013) revealed that more experienced teachers utilised innovative teaching strategies than the less experienced ones. The differences existed probably because this study considered 5 years upward as the experience level while the previous study considered 7-10 years as the experience level. The findings also revealed that there was no significant difference in the level of utilisation of the innovative teaching strategies between qualified and unqualified teachers, hence hypothesis 2 was also retained.

CONCLUSION

Findings of this study indicate that all the innovative strategies were used by the teachers, however, only two (2) of these thirty six (36) strategies were frequently used by most of the science teachers. The teachers rarely used the rest of them. This implies that science teachers barely utilised innovative teaching strategies in their lessons. The item by item analysis showed that significant differences existed between experienced and less experienced science teachers, qualified and unqualified science teachers with respect to some specific innovative teaching strategies. The two null hypotheses were retained as there was no significant difference in the level utilisation of the innovative teaching strategies between experienced and less experienced science teachers and qualified and unqualified science teachers. Hence, teachers' qualification and their number of years of teaching experience had no influence on their utilisation of innovative teaching strategies.

RECOMMENDATIONS

Based on the results of the findings in this study, the following recommendations were made:

1. Science teachers should avail themselves of the opportunities provided by these innovative strategies in improving the performance of their students.
2. The State Government and school proprietors should organize workshops, seminars and conferences on innovative instructional strategies as in-service training for science teachers irrespective of their experience or qualifications.
3. Teacher training institutions in the state should ensure that teachers in training are taught on how to use various innovative teaching strategies.
4. The Kwara State Ministry of Education and Kwara State Teaching Service Commission should ensure that science teachers adhere to the prescriptions made in the senior secondary education curriculum in respect of the teaching strategies to be used for teaching their respective subjects. They should ensure that the prescribed methods for teaching biology, chemistry and physics that are stated in the Senior Secondary Education Curriculum are frequently used by the teachers in addition to other viable instructional strategies.
5. The Nigerian Educational Research and Development Council (NERDC) should consider including more innovative teaching strategies to be part of the prescribed strategies of teaching in the Senior Secondary Education Curriculum during the review of the present senior secondary school curriculum.
6. Schools should encourage teachers on the use of innovative teaching strategies by providing adequate funds, materials and good learning environment that can facilitate the use of these innovative strategies.

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