REPOSITIONING SCIENCE EDUCATION THROUGH TAXONOMY-BASED INTERACTION PATTERN OF BASIC SCIENCE TEACHERS IN FCT JUNIOR SECONDARY SCHOOLS

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Abstract

The study investigated the taxonomy-based Basic Science Teachers Interaction patterns in junior secondary schools in Federal Capital Territory. The design of the study was descriptive survey. The population of the study was all the Basic Science Teachers in the Federal Capital Territory junior secondary schools. The sample of 384 Basic Science Teachers was drawn from the six area councils of the FCT using random sampling techniques. Three research questions and three hypothesis guided the study. The instrument used for data collection was five point likert-scale with 25 items. The instrument was validated by experts and pilot tested with its reliability index of 0.76. Simple percentages were used to answer the research questions while t-test statistical technique was used in testing the hypothesis. The findings show that there was no significant difference in the interaction pattern of Basic Science Teachers on the bases of location. On the contrary, it was established that there were significant differences in the interaction patterns of Basic Science Teachers on the bases of cognate experience and educational qualifications. It is recommended that government and other stakeholders should periodically organize seminars and workshops for science teachers on how best to carryout classroom interaction; the government is advised to minimized rate of transfer of highly qualified and experienced science teachers so as to maintain effective teaching and learning in our junior secondary schools.

Keywords: Education, Science and Technology, Basic Science Curriculum, Basic Science Teachers Interaction Patterns

Introduction

The essence of science and technology as a basis for the comfort of man and national self-reliance is highly acceptable by modern human standard. The role of science and technology in national development cannot be overemphasized. Many countries today have been classified as developed, developing and under-developing

based on their scientific and technological input in the entire process of national development.

Science has intrinsic values as a body of accumulated knowledge and as a way of find out about the word. As a discipline, science deals with the search for a understanding of nature through systematic observations and experimentations. Scientific knowledge helps to unravel the intricacies or mysteries about nature and then applied same for the purpose of solving man's problems. Thus science produces the knowledge with which development can be achieved. The growing emphasis on science as an indispensable tool to national development has made the federal government to pay more attention to the development of science and technology by establishing the federal ministry of science and technology in 1979; formulating a national policy on science and technology in 1986; and recognizing the importance of science in national development. Learning science is a means of helping individuals to fulfill their own personal potentials, learning from it and benefit from it, (Orji, 2007).

Successful science teaching involves much complex behavior that requires effective use of higher level of thought processes and decision making abilities. Bot (2008) observed that, the major concerns of science teachers and science education in the present education system us effective teaching and meaningful learning of science subjects at all levels of Nigerian education. For a country to achieve a technological breakthrough there must be a good grasp of scientific knowledge and skills through the teaching and study of science. The science teachers in existence and in the making are expected to contribute to the improvement of science teaching and learning with a view to bringing process to the scientific and technological development (Akanbi, 2005).

As a school subject, science is taught in different forms at the secondary school level of education. The secondary education is of six-year duration and given in two stages – Junior Secondary School Stage and Senior Secondary School Stages, each stage being three year duration (6-3-3-4 system of education). At junior secondary school stage, one of the main science Based Subject to be taught is Basic Science and Technology whose major aim is for scientific literacy or/and prepare future science students for the senior secondary school stage where science subjects in the form of Biology, Chemistry and Physics are studied.

Basic Science is understood to be a process of finding out and a system for organizing and reporting discoveries. Rather than being viewed as the memorization of facts, science is seen as a way of thinking and trying to understand the world (Orji, 2007).

With the present scientific and technological changes taking place across the globe, even the child who does not want to be a scientists or technologist, will however need Basic Science Education to cope with this rapid environmental change. Scientific and technological knowledge is cumulative in nature and children need to start learning basic scientific principles early enough both at home and at school so that by the time they grow-up, all the basics would have been concretized in them.

Science and technology are basically all about observation in which conclusions are drawn. Therefore, children of all ages should be encouraged in learning science and technological education because at this age, they can become acclimatized to the learning of science and technological principles due to the fact that they are curious, wanting to know and love to investigate.

For many years, science has been taught in fragmented manner and compartmentalized into Biology, Chemistry, and Physics etc. Integrated science otherwise known as Basic Science in Nigeria tends to emphasize the unity of scientific knowledge which consists of concepts, principles, laws and their applications in Biology, Chemistry and Physics.

UNESCO (1972) defined Basic Science as those approaches in which concepts and principles of science are presented so as to express the fundamental unity of scientific thought and to avoid pre-natures and undue stress on the distinctions among the various scientific fields. The organization further pointed out that Basic Science teaching should be done in such a manner that:

- Concepts and principles of science and presented so as to express the fundamental unity of scientific thoughts;
- Emphasizes the underlying methodology and processes which characterize the scientific methods and
- Embodies a scientific study of the environment and the technological requirement of everyday life.

These and many other benefits derivable from Basic Science teaching cannot be realized except emphasis is placed on effective implementation of the Basic Science and technology curriculum. The effective implementation of the curriculum cannot be achieved without fruitful classroom interaction coupled with adequate use of behavioral objectives in the classroom teaching and learning of Basic Science and Technology.
Behavioral objectives are defined as the expected behavioral change exhibited by the learners at the end of a given teaching and learning process which hinged on the interaction pattern in the classroom.

Concept of Teaching and Learning

Teaching is a specialized discipline with a body of skill, knowledge and orientations that are best-fit for modeling/formation of human characteristics, intellect and capabilities. Such skills, knowledge ad orientations are not available elsewhere but can only be acquired through rigorous and valid preparation in the institutions established by law to do so on behalf of the society. Blum (1996) in Ibrahim (2011) pointed out that teaching is a communication process in which the teacher sends verbal messages which contain some information to the learners who are expected to receive it and integrate it into their existing knowledge. But he stressed that first, the teacher has to encode his thoughts into words or other forms of communication to students to decode. Imam (2007) collaborated thus: communication in the teaching domain, refers to the interaction between the teacher and the learners in which messages are

successfully passed from one person o another. The transmission of the messages could be verbal or non-verbal. However, Fadipe (2000) gave a different perception. She believed that teaching is all about creativity. Creativity teaching is according to her:

- The ability to translate concepts, skills and knowledge in a manner that motivates learners to learn.
- The ability to make learning interesting to the learners;
- The key to developing a high motivation to learn;
- The ability to impact information in a manner that is easily assimilated, enjoyable and concrete to the audience, irrespective of their level of understanding;
- The ability to dissect complex concepts in the tune of little minds

Learning on the other hand, would be looked at from the perspective of the behaviorist, the cognitivist and constructive. The behaviourist defines learning as nothing more than the acquisition of new behaviours. But this does not account for all kinds of knowledge/learning (Purpose Associate, 2011). As a response to behaviourism, people are not programmed animals that merely respond to environmental stimuli, people are rational human beings that require active participation in order to learn and whose actions are consequences of thinking. Cognitivism become the dominant force in psychology in the late 20th century replacing behaviourism as the most popular paradigm for understanding function. Cognitive psychology is not a refutation of behavioirism but rather an expansion that accepts that mental states are appropriate to analyse a subject to examination. In the same vain, Bruner (1966), perceived learning as an active process in which learners construct new ideas or concepts based upon their current or past knowledge or experience. The learners selects and transforms information, constructs hypothesis and make decisions, relying on cognitive structure (Uschema mental modes) which provides meaning and organization to experience and allows the individual to go beyond the information given. Purpose and his associated (2011) asserted that learning is simply the process of adjusting our mental models to accommodate new experiences. Bruner (1999) based constructivist learning on the students active participation in problem-solving and critical thinking regarding a learning activities which they find relevant and encouraging: Experimental learning is another example of constructivist in action. According to Blum (1996), it is not only based on school knowledge and acquired skills but also an experience. He added that, it is the combination of "Finding out and taking action" the process involves feelings, attitudes and values which affects the disposition of the learners.

Communication in Science Teaching

The term communication may be used to mean transfer, transmission or exchange of ideas, knowledge, beliefs, attitudes or emotion from one person to another. Consequently, classroom interaction is a process which is continuous and proceeds in stages, that is, it is not one way direction of transmission/transmitting ideas but it involves organized procedures that requires investigating whether the message has been fully grasped by the learners. The information give rise to further instruction. The

process continues hence, classroom interaction becomes important in science teaching. The process has three basic components: The communicator (science teacher), the message (the science activities) and the receivers (students).

Science classrooms are activities based and as such, there is always an inter-play of teacher-learner interaction in the form of teaching and communication. Teaching is an act of transmitting some facts, ideas, information, skills and even capabilities using some techniques while communication on the other hand is the act of transferring ideas, information or knowledge from one person to another. Therefore, the main purpose of classroom interaction in Basic Science is to influence the behavior of the learners in holistic manner. However, effective classroom interaction can be regarded as that which brings about the development of learners cognitive, affective and psychomotor domains in Basic Science Teaching.

Classroom interaction pattern refers to the chain of classroom events that takes place between teachers, the learners and the teaching-learning milieu. Some of the variable in the classroom interaction have been demonstrated to promote effective teaching-learning while others are known to inhibit the process. It is important to note these and similar variables so as to understand the various types of activities that are occurring in Basic Science classroom and how these activities promote or inhibit effective teaching and learning of the subject, with the understanding of chains of events and their sequence, can provide knowledge into the types of skills (strategies) and attitudes acquired by the teachers which can be included in the course content of teacher education for effective classroom interaction, it is necessary to diagnose the learner especially with regards to the differences that exist in their intellectual functioning, mechanical pattern, pre-conceptions, cultural belonging, problem-solving patterns, expectations and themselves. Other important aspect to be considered is the condition under which teaching-learning occurs hence it is these conditions that can inhibit or enhance teaching-learning. These condition include:

i. Classroom climate
ii. The structure of interpersonal relation
iii. Improved values that control them

Two major approaches have been used by researchers to study science classroom interactions (Wragg et at, 1976 in Momoh, 2015). The direct classroom observation techniques make use of an observer who visibly approaches the classroom with a "mirror", at set of events that are to be observed (Furst and Rosensline, 1973 in Momoh, 2015). The observer codes events as they occur in the classroom and does not attempt to interpret them. The observers may sit down and watch a audio-video play back or listen to a voice recording and keep a record of the flow of events on an observational form (Flander, 1970 in Momoh, 2015).

The observer is trained to use these categories. The decision as to which category best represent each event is his own. In essence, direct classroom observation technique is a system of coding and decoding of events. These most widely use system

for direct observation is that of Flander, often described as Flander's Interaction Analysis Categories (FIAC).

The direct classroom observation studies although widely used have been severally criticized and these criticisms have led to an alternative approach to classroom observational studies. The indirect approach to classroom observational studies emerged. Mahuta. 1989 in Momoh, 2015 carried out indirect studies of science classroom based on the teachers perceptions and imagination of what happens in the classroom. Mahuta's study was a verification study of emergency behavioral objectives of Martins' work Whereas Martins (1984) used pre-service teachers who were in the field. Martins (1984) agreed that the indirect approach has the following advantages:

- The science teachers are in a more reliable position to describe their students' behavior because they are familiar with them. The data supplied by them were presumed to be more reliable and valid;
- These will be less interference from external observers, since the teachers are themselves the observers.

Even the indirect approach risks some objectivity when teachers are asked to identify typical students in the classroom. It is arguable if the imagined students are typical and representative of a class. It is more likely that the selected students are stereotypical of teachers rather than that of the class. Teachers are unlikely to remember all the students in their class equally as to give an unbiased selection.

Results from the indirect observational studies do not agree with those of direct studies of science classrooms. The differences in the results could be due to misinterpretation of the concept of behavior (as a propensity to act in a certain ways rather than a description of events in the classroom). It could be that teachers were describing the ideal classroom situation as against real events taking place in the classrooms. Teachers may also want to impress the researchers, thereby giving biased descriptions of what they perceived as the typical behavior of their students. The shortcomings of the two methods of classroom observation will suggests that neither the direct nor the indirect classroom observation is wholly ideal for measuring classroom interaction. Neither approach has all the answers to classroom interaction studies. The need to evolve a more efficient method or a combination of methods of observing interactions in science classroom is still very important. In this light, it has been observed that interaction in Basic Science classroom has been bereft of behavioural objectives. The teacher gives little or no attention to taxonomy of educational objectives which should act as a guide in teaching-learning process. This could have made the students lack focus and hence their poor performance.

A study carried out by Onyegegbu (2004) to investigate the interaction pattern in Senior Secondary School practical Biology classroom. The study was necessitated by the decline in the performance of students in Biology practical in school certificate examination. In his study, he sees interaction in the Secondary School Biology as a precursor to learning by students in laboratory, as the type of and interaction pattern that goes on in the laboratory could have a major impact on how well students achieve

the goals on instruction. He viewed science as both process and product derived from experimentation. This means that science involves doing experimental work. Invariable biology as a science subject is a practical course being concerned with the study of life. The entire environments which life exists can be as their laboratory while the entire living organisms (biotic) and still non-living (abiotic) components of the environment serve as resources (Nwagbo, 2008). The study identified the length of time of interaction pattern in activity practical biology classroom. The sample of his study comprised of year two senior secondary school biology students in Akwa City, Anambra State, Nigeria. The random sampling techniques was used to select six-hundred and forty five (645) biology students: (299 boys) and (346 girls) in six schools from eighteen (18) intact classrooms.

The instrument used for data collection was modified Flander's Interaction Analysis System (FIAS) for observing and recoding classroom interaction pattern. The items in the modified Flander's Interaction Analysis were converted to an observation sheet called coding chart. The interaction patterns observed by the researcher were Teacher-Student, student-students interaction patterns. Gender on student-Student and gender on teacher-student interaction. The results from the study showed that, student-students interaction was lower than that of teacher-students interaction. In the mixed schools, boys dominated both the teacher-initiated interaction and student-initiated interaction in the practical biology classroom under observation, Male students were observed to be more active and restless in classroom interaction, while female students group themselves together and interacted more within themselves than between the males. The females preferred asking questions to the teachers than to their male counterparts. Interaction between the teacher and the students in biology practical which is expected to equip the students with the necessary practical biology skills and competencies for functional living in the society is relegated to the background (Nwagbo, 2008). From the above studied on the classroom interaction patterns of teaching and learning science, it has therefore become necessary to contrive a study of this nature to verify the taxonomy based classroom interaction pattern of Basic Science teaching in FCT schools.

Statement of the Problem

Over the years, the performance of students in Integrated Science now referred to as Basic Science at Basic Education Certificate (BECE) has been declining. Students may have their share of the blame for the declining nature of their performances but the teaching of Basic Science and Technology in FCT Junior secondary schools has been fraught with problems. Science teachers that teach Basic Science are mostly not specialists in the subject rather specialist in either Physics/Chemistry, Mathematics/Physics, Chemistry/Biology, Mathematics/Chemistry, Biology/Geography or Biology/Agric at NCE level and or Biology, Chemistry, Physics, Geography at their first degree (Orji, 2007). Most of these teachers who accept to teach the subject, select topics that dealth with their area of specialization, (Momoh, 2015).

This pattern of Basic Science Curriculum Implementation ends up graduating half baked students who do not have an all-round Basic Science training.

As an experienced Basic Science researcher in the FCT, it has been observed that most Basic Science teachers are confronted with other problems which range from lack of equipment and laboratories, inadequate allocation of periods, inadequate training of teachers, lip service to teachers' welfare, high student-teacher ratio and students' apathetic attitude towards the subject. While attention has been focused over the years to solve the afore stated problem, the unimpressive performance continue unabated (ERC, 2009), making researchers and stakeholders alike to shift attention towards classroom interaction.

The declining nature of students' performances in Basic Science as a subject could also be attributed to:

1. Frequency transfer of qualified and experienced Basic Science Teachers – some transfer to become school administrators;
2. Brain drain syndrome – some of the most qualified and highly experienced teachers tend to leave the school system for other professions for reason which include: better pay and better working conditions.

It has therefore become important to investigate the use of taxonomy-based classroom interaction pattern of basic science teachers in FCT as a way towards improving students performances in Basic Science.

Research Questions

In the light of the above stated problems of Basic Science teaching in junior secondary schools in the FCT that the following research questions for the study were raised:

1. What are the natures of classroom interaction patterns of Basic Science teachers in FCT schools?
2. How do classroom interaction patterns of Basic Science Teacher differs on the basis of cognate experience?
3. To what extent do classroom interaction patterns of Basic Science Teachers differs on the basis of academic qualification

Hypothesis

HO_1: There is no significant difference in the classroom interaction of Basic Science Teachers in urban and rural area of FCT.

HO_2: There is no significant difference in the classroom interaction pattern of Basic Science Teachers with various years of cognate experiences.

HO_3: There is no significant difference in the classroom interaction pattern of Basic Science Teachers with various qualifications.

Methodology

The study is a descriptive type of survey and the population comprised 9624 basic science teachers in FCT junior secondary schools. A sample of 384 science teachers were randomly selected from the six area council of FCT using Yamane's formular ($n = \frac{N}{1+N(e)^2}$) for the sample size.

The research study was carried in two parts. The first part dealt with the distribution of the questionnaires to the sampled Basic Science Teachers while the second part of the research work dealt with the observation of the classroom interaction of Basic Science Teachers using external observers. In this case, the researcher and the assistant researchers who were properly guided/trained were the external observers.

The questionnaire consists of two section, A and B. A was demographic data which sought information such as name of school and location, Area Council, year of cognate experience, qualification of the teachers. Section B of the questionnaire contained statements concerning the interaction patterns in Basic Science classroom and the teachers were required to indicate as appropriate, their level of agreement using 4 points likert type scale questionnaire. The instrument was scored in line with likert type 4-point scale namely: Strongly Agree, Agree, Disagree and Strongly Disagree. However, preliminary draft of the questionnaire which contains 33 items was given to academic experts in the department of Science and Environmental Education, University of Abuja to access its contents and construct validity. Finally, the preliminary draft of the questionnaire was adjusted and the items reduced to 25 to get a more effective instrument for the research work.

Split half method was used to determine the reliability of the instrument. The results were computed afterwards and obtained reliability index of 0.76, which shows that the items were reliable. Simple percentage, mean score and t-test of independent unpaired groups were used to analyse the data using statistical means for the research questions and t-test to test the null hypothesis (a cutoff point of 2.50 indicates acceptance level while below indicates rejection of the item by the respondent)

Results

The research question was answered using item 1-25 in the questionnaire. The data is presented in table below:

Table 1: Distribution of Respondents by location

Location	No. of Respondents	Percentage
Rural	164	43.0
Urban	220	57.0
Total	384	100

Table 2: Distribution of Respondents by cognate experience

Experience	No. of Respondent	Percentage
0 – 10 years	280	73.0
11 years above	104	27.0
Total	384	100

Table 3: Distribution of Respondents by Qualification

Qualification	No. of Respondent	Percentage
B.Ed	150	39.0
NCE & Below	234	61.0
Total	384	100

Results

The research question was answered using items 1 – 25 in the questionnaire. The data is presented in table 5.

Research Question One

What are the classroom interaction pattern of Basic Science Teachers in FCT schools?

To answer the research question, standard deviations were used to analyse the data based on the items on table 4a, 4b, 5a, 5b, 6a and 6b.

Research Question One

Are there difference in the classroom interaction pattern of Basic Science Teachers in rural and urban schools?

Table 5a: Classroom interaction pattern of Rural Basic Science Teachers.

S/No	Interaction Pattern	Number	Standard Deviation	Mean	Decision
1.	The teacher always describe the concept to the students during Basic Science lesson	164	0.95	3.32	Agree
2.	The teacher always isolates ideas from opinions during lesson	164	1.00	2.50	Agree
3.	The teacher always defines concepts in Basic Science	164	1.20	2.85	Agree

	classroom				
4.	Teachers allows students to discuss concept during the lesson	164	1.00	3.60	Agree
5.	The teacher is fond of listing examples during Basic Science lesson	164	0.92	2.80	Agree
6.	The teacher always outlines issues concerning concepts during Basic Science lesson	164	1.00	3.70	Agree
7.	Most of the times, the teacher explains concepts during Basic Science lesson	164	0.97	2.48	Disagree
8.	The teacher always makes distinctions among the various concepts being taught	164	1.04	3.15	Agree
9.	The teacher manipulates instructional resources in a bid to teach the concept	164	0.96	3.40	Agree
10.	Most of the time, teacher goes out of his way to solve problem relating to the concepts	164	1.02	2.62	Agree
11.	The teacher spends very little time to demonstrate concepts during practical lessons	164	1.20	2.78	Agree
12.	The teacher takes a personal interest in manipulating instructional materials during Basic Science lesson	164	1.02	2.52	Agree
13.	The teacher spends a lot of time in criticizing existing theories relating to concepts in the class	164	1.06	2.83	Agree
14.	The teacher spends a lot of time in building up theories relating to concepts in the class.	164	1.04	2.60	Agree
15.	The teacher always assesses/evaluates the concepts being taught in Basic Science lesson.	164	0.94	2.78	Agree
16.	Most of the time, the teacher appraises/modifies theories relating to the lesson	164	1.00	3.00	Agree
17.	The teacher organizes/combines information relating to concepts being taught	164	0.92	2.80	Agree
18.	The teacher spends a lot of time showing how execute practical lesson relating to concepts in Basic Science classes	164	1.00	3.70	Agree
19.	The teacher always guides the students to assembling and carrying out the practical aspect during basic science lesson	164	0.97	2.48	Agree
20.	During lesson the teacher is always interested in designing and constructing projects relating to the topic	164	1.04	3.15	Agree
21.	The teacher considers students feelings and interest during basic science lesson	164	0.96	3.40	Agree
22.	Most of the time, teacher goes out of his/her way to ascertain effects of his teaching on students' behavior	164	0.96	2.80	Agree
23.	Teaching always explains the meaning of statements, diagram and graph through investigation.	164	0.90	2.99	Agree
24.	The teacher lays emphasis on evaluation during Basic Science lessons	164	1.20	3.00	Agree
25.	Teacher always draws students attention on implication of topic to daily attitude/behavior in the society	164	1.12	1.80	
	Mean/Standard Deviation		1.02	3.02	Agree

Source: Data collected from field.

Table 4a showed that statements on all items (with the exception of few items) regarding the interaction patterns of rural Basic Science teachers were attested to by the observers. On the contrary, the observers disagreed with statements on items 7, 19 and 25. The overall means for the items in respect of the responses was 3.02 which indicated agreement.

Table 4b: Classroom interaction pattern of urban Basic Science Teachers.

S/No	Interaction Pattern	Number	Standard Deviation	Mean	Decision
1.	The teacher always describe the concept to the students during Basic Science lesson	220	1.02	2.52	Agree
2.	The teacher always isolates ideas from opinions during lesson	220	1.06	2.83	Agree
3.	The teacher always defines concepts in Basic Science classroom	220	1.04	2.60	Agree
4.	Teachers allows students to discuss concept during the lesson	220	0.94	2.78	Agree
5.	The teacher is fond of listing examples during Basic Science lesson	220	1.00	3.00	Agree
6.	The teacher always outlines issues concerning concepts during Basic Science lesson	220	1.02	2.00	Agree
7.	Most of the times, the teacher explains concepts during Basic Science lesson	220	1.00	2.60	Disagree
8.	The teacher always makes distinctions among the various concepts being taught	220	0.96	3.80	Agree
9.	The teacher manipulates instructional resources in a bid to teach the concept	220	1.00	2.82	Agree
10.	Most of the time, teacher goes out of his way to solve problem relating to the concepts	220	1.20	2.68	Agree
11.	The teacher spends very little time to demonstrate concepts during practical lessons	220	1.00	2.50	Agree
12.	The teacher takes a personal interest in manipulating instructional materials during Basic Science lesson	220	1.20	2.48	Agree
13.	The teacher spends a lot of time in criticizing existing theories relating to concepts in the class	220	1.40	3.02	Agree
14.	The teacher spends a lot of time in building up theories relating to concepts in the class.	220	1.22	3.00	Agree
15.	The teacher always assesses/evaluates the concepts being taught in Basic Science lesson.	220	1.14	2.76	Agree
16.	Most of the time, the teacher appraises/modifies theories relating to the lesson	220	1.16	2.40	Disagree
17.	The teacher organizes/combines information relating to concepts being taught	220	1.18	2.58	Agree
18.	The teacher spends a lot of time showing how execute practical lesson relating to concepts in Basic Science classes	220	1.14	3.00	Agree

19.	The teacher always guides the students to assembling and carrying out the practical aspect during basic science lesson	220	1.06	3.48	Agree
20.	During lesson the teacher is always interested in designing and constructing projects relating to the topic	220	1.02	2.84	Agree
21.	The teacher considers students feelings and interest during basic science lesson	220	1.04	2.60	Agree
22.	Most of the time, teacher goes out of his/her way to ascertain effects of his teaching on students' behavior	220	0.94	2.78	Agree
23.	Teaching always explains the meaning of statements, diagram and graph through investigation.	220	1.00	3.00	Agree
24.	The teacher lays emphasis on evaluation during Basic Science lessons	220	1.02	2.00	Agree
25.	Teacher always draws students attention on implication of topic to daily attitude/behavior in the society	220	1.00	2.96	Disagree
	Mean/Standard Deviation		1.06	2.96	Agree

Source: Data collected from the field

For this section, results on table 4b showed that observations on teachers from urban areas tallied positively with statement on all the items (with the exception of few items) on the other hand, the observers disagreed with statement on items 6,12 and 24. The overall mean for the items in respect of respondents from the city was 2.96 which indicated agreement.

Research Question Two

Are there differences in the classroom interaction pattern of Basic Science Teachers with different years of cognate experiences?

Table 5a: Classroom interaction pattern of Basic Science Teachers with 0 – 10 years experience

S/ No	Interaction Pattern	Number	Standard Deviation	Mean	Decision
1.	The teacher always describe the concept to the students during Basic Science lesson	280	1.02	2.98	Agree
2.	The teacher always isolates ideas from opinions during lesson	280	1.12	3.00	Agree
3.	The teacher always defines concepts in Basic Science classroom	280	1.04	3.04	Agree
4.	Teachers allows students to discuss concept during the lesson	280	1.16	3.84	Agree
5.	The teacher is fond of listing examples during Basic Science lesson	280	1.46	3.00	Agree
6.	The teacher always outlines issues concerning concepts during Basic Science lesson	280	1.42	3.86	Agree
7.	Most of the times, the teacher explains concepts during Basic Science lesson	280	1.20	3.29	Agree

8.	The teacher always makes distinctions among the various concepts being taught	280	1.12	2.98	Agree
9.	The teacher manipulates instructional resources in a bid to teach the concept	280	1.22	3.00	Agree
10.	Most of the time, teacher goes out of his way to solve problem relating to the concepts	280	1.04	2.41	Disagree
11.	The teacher spends very little time to demonstrate concepts during practical lessons	280	1.16	3.02	Agree
12.	The teacher takes a personal interest in manipulating instructional materials during Basic Science lesson	280	1.14	2.44	Disagree
13.	The teacher spends a lot of time in criticizing existing theories relating to concepts in the class	280	1.26	3.40	Agree
14.	The teacher spends a lot of time in building up theories relating to concepts in the class.	280	1.00	2.96	Agree
15.	The teacher always assesses/evaluates the concepts being taught in Basic Science lesson.	280	1.24	3.40	Agree
16.	Most of the time, the teacher appraises/modifies theories relating to the lesson	280	1.00	2.92	Agree
17.	The teacher organizes/combines information relating to concepts being taught	280	1.20	3.04	Agree
18.	The teacher spends a lot of time showing how execute practical lesson relating to concepts in Basic Science classes	280	1.00	2.42	Disagree
19.	The teacher always guides the students to assembling and carrying out the practical aspect during basic science lesson	280	1.13	2.91	Agree
20.	During lesson the teacher is always interested in designing and constructing projects relating to the topic	280	0.94	3.00	Agree
21.	The teacher considers students feelings and interest during basic science lesson	280	1.00	3.40	Agree
22.	Most of the time, teacher goes out of his/her way to ascertain effects of his teaching on students' behavior	280	0.90	3.00	Agree
23.	Teaching always explains the meaning of statements, diagram and graph through investigation.	280	1.20	3.22	Agree
24.	The teacher lays emphasis on evaluation during Basic Science lessons	280	1.42	3.00	Agree
25.	Teacher always draws students attention on implication of topic to daily attitude/behavior in the society	280	1.00	2.36	Disagree
	Mean/Standard Deviation		1.02	3.02	Agree

Source: Data collected from the field

Table 5a showed that statements on all items (with the exception of few) regarding the interaction patterns of Basic Science Teachers with experiences ranging from 0 – 10 years were attested to by the observers. On the contrary, the observers disagreed with statements on items 10, 12, 18 and 25. The overall mean for the items in respect of the responses was 3.02 which indicated agreement.

Table 5b: Classroom interaction pattern of Basic Science Teachers with 11 years and above cognate experiences

S/ No	Interaction Pattern	Number	Standard Deviation	Mean	Decision
1.	The teacher always describe the concept to the students during Basic Science lesson	104	1.00	2.22	Disagree
Agree	The teacher always isolates ideas from opinions during lesson	104	1.24	3.02	
3.	The teacher always defines concepts in Basic Science classroom	104	1.40	2.42	Disagree
4.	Teachers allows students to discuss concept during the lesson	104	1.20	3.40	Agree
5.	The teacher is fond of listing examples during Basic Science lesson	104	1.46	3.00	Agree
6.	The teacher always outlines issues concerning concepts during Basic Science lesson	104	1.15	2.96	Agree
7.	Most of the times, the teacher explains concepts during Basic Science lesson	104	1.20	2.48	Disagree
8.	The teacher always makes distinctions among the various concepts being taught	104	1.40	3.02	Agree
9.	The teacher manipulates instructional resources in a bid to teach the concept	104	1.22	3.00	Agree
10.	Most of the time, teacher goes out of his way to solve problem relating to the concepts	104	1.14	2.76	Agree
11.	The teacher spends very little time to demonstrate concepts during practical lessons	104	1.81	2.40	Disagree
12.	The teacher takes a personal interest in manipulating instructional materials during Basic Science lesson	104	1.18	2.58	Agree
13.	The teacher spends a lot of time in criticizing existing theories relating to concepts in the class	104	1.76	3.00	Agree
14.	The teacher spends a lot of time in building up theories relating to concepts in the class.	104	1.80	3.48	Agree
15.	The teacher always assesses/evaluates the concepts being taught in Basic Science lesson.	104	1.44	2.84	Agree
16.	Most of the time, the teacher appraises/modifies theories relating to the lesson	104	1.80	3.22	Disagree
17.	The teacher organizes/combines information relating to concepts being taught	104	1.84	3.00	Agree
18.	The teacher spends a lot of time showing how execute practical lesson relating to concepts in Basic Science classes	104	1.82	2.40	Disagree
19.	The teacher always guides the students to assembling and carrying out the practical aspect during basic science lesson	104	1.80	3.40	Agree

20.	During lesson the teacher is always interested in designing and constructing projects relating to the topic	104	1.66	2.46	Disagree
21.	The teacher considers students feelings and interest during basic science lesson	104	1.64	2.86	Agree
22.	Most of the time, teacher goes out of his/her way to ascertain effects of his teaching on students' behavior	104	1.60	3.00	Agree
23.	Teaching always explains the meaning of statements, diagram and graph through investigation.	104	1.06	2.88	Agree
24.	The teacher lays emphasis on evaluation during Basic Science lessons	104	1.65	2.90	Agree
25.	Teacher always draws students attention on implication of topic to daily attitude/behavior in the society	104	1.24	2.68	Agree
	Mean/Standard Deviation		1.03	2.84	Agree

Source: Data collected from the field

Table 5b showed that statements on all items (with exception of few items) regarding the interaction patterns of basic science teachers with cognate experiences ranging from 11 and above were attested to by the observers. On the contrary, the observers disagreed with statements on items 1, 3, 7, 11, 18 and 20. The overall mean for the items in respect of the responses was 2.84 which indicated agreement.

Research Question Three

To what extent do classroom interaction pattern of Basic Science Teachers differs on the bases of academic qualifications?

Table 6a: Classroom in interaction pattern of Basic Science Teachers with NCE and below:

S/No	Interaction Pattern	Number	Standard Deviation	Mean	Decision
1.	The teacher always describe the concept to the students during Basic Science lesson	234	1.18	3.31	Agree
2.	The teacher always isolates ideas from opinions during lesson	234	1.08	2.20	Disagree
3.	The teacher always defines concepts in Basic Science classroom	234	0.98	2.48	Disagree
4.	Teachers allows students to discuss concept during the lesson	234	1.02	3.04	Agree
5.	The teacher is fond of listing examples during Basic Science lesson	234	1.00	2.45	Disagree
6.	The teacher always outlines issues concerning concepts during Basic Science lesson	234	0.96	3.32	Agree
7.	Most of the times, the teacher explains concepts during Basic Science lesson	234	0.98	3.20	Agree
8.	The teacher always makes distinctions among the various	234	1.20	3.4	Agree

	concepts being taught			0	
9.	The teacher manipulates instructional resources in a bid to teach the concept	234	1.42	2.84	Agree
10.	Most of the time, teacher goes out of his way to solve problem relating to the concepts	234	1.09	2.92	Agree
11.	The teacher spends very little time to demonstrate concepts during practical lessons	234	1.20	2.40	Disagree
12.	The teacher takes a personal interest in manipulating instructional materials during Basic Science lesson	234	1.24	2.60	Agree
13.	The teacher spends a lot of time in criticizing existing theories relating to concepts in the class	234	1.00	2.48	Agree
14.	The teacher spends a lot of time in building up theories relating to concepts in the class.	234	1.18	3.00	Agree
15.	The teacher always assesses/evaluates the concepts being taught in Basic Science lesson.	234	1.16	3.04	Agree
16.	Most of the time, the teacher appraises/modifies theories relating to the lesson	234	0.96	3.00	Agree
17.	The teacher organizes/combines information relating to concepts being taught	234	1.01	2.68	Agree
18.	The teacher spends a lot of time showing how execute practical lesson relating to concepts in Basic Science classes	234	1.00	2.66	Agree
19.	The teacher always guides the students to assembling and carrying out the practical aspect during basic science lesson	234	1.06	3.00	Agree
20.	During lesson the teacher is always interested in designing and constructing projects relating to the topic	234	1.10	2.78	Disagree
21.	The teacher considers students feelings and interest during basic science lesson	234	1.02	2.04	Disagree
22.	Most of the time, teacher goes out of his/her way to ascertain effects of his teaching on students' behavior	234	1.12	3.48	Agree
23.	Teaching always explains the meaning of statements, diagram and graph through investigation.	234	1.04	3.02	Agree
24.	The teacher lays emphasis on evaluation during Basic Science lessons	234	1.06	3.10	Agree
25.	Teacher always draws students attention on implication of topic to daily attitude/behavior in the society	234	1.04	2.76	Agree
	Mean/Standard Deviation		1.08	2.80	Agree

Source: Data collected from the field

Table 6a showed that statements on items (with the exception of few items) regarding the interaction patterns of Basic Science teachers with NCE as the highest qualification were attested to by the observers. On the contrary, the observers disagree with statements on items 2,3,5,11,13 and 21. The overall mean for the items in respect of the responses was 2.80 which indicated agreement.

Table 7b: Classroom interaction patterns of Basic Science Teachers with B.Ed and above

S/ No	Interaction Pattern	Number	Standard Deviation	Mean	Decision
1.	The teacher always describe the concept to the students during Basic Science lesson	150	0.91	2.90	Agree
2.	The teacher always isolates ideas from opinions during lesson	150	1.04	3.12	Agree
3.	The teacher always defines concepts in Basic Science classroom	150	0.90	2.92	Agree
4.	Teachers allows students to discuss concept during the lesson	150	0.94	2.86	Agree
5.	The teacher is fond of listing examples during Basic Science lesson	150	0.92	2.84	Agree
6.	The teacher always outlines issues concerning concepts during Basic Science lesson	150	0.97	3.36	Agree
7.	Most of the times, the teacher explains concepts during Basic Science lesson	150	0.95	3.00	Agree
8.	The teacher always makes distinctions among the various concepts being taught	150	1.14	2.84	Agree
9.	The teacher manipulates instructional resources in a bid to teach the concept	150	0.96	2.86	Agree
10.	Most of the time, teacher goes out of his way to solve problem relating to the concepts	150	0.92	2.81	Agree
11.	The teacher spends very little time to demonstrate concepts during practical lessons	150	1.00	2.40	Disagree
12.	The teacher takes a personal interest in manipulating instructional materials during Basic Science lesson	150	1.07	2.42	Disagree
13.	The teacher spends a lot of time in criticizing existing theories relating to concepts in the class	150	1.00	2.78	Agree
14.	The teacher spends a lot of time in building up theories relating to concepts in the class.	150	1.21	2.81	Agree
15.	The teacher always assesses/evaluates the concepts being taught in Basic Science lesson.	150	1.04	2.70	Agree
16.	Most of the time, the teacher appraises/modifies theories relating to the lesson	150	1.05	3.00	Agree
17.	The teacher organizes/combines information relating to concepts being taught	150	1.00	2.66	Agree
18.	The teacher spends a lot of time showing how execute practical lesson relating to concepts in Basic Science classes	150	1.45	2.88	Agree
19.	The teacher always guides the students to assembling and carrying out the practical aspect during basic science lesson	150	0.98	2.82	Agree
20.	During lesson the teacher is always interested in designing and constructing projects relating to the topic	150	1.02	2.90	Disagree
21.	The teacher considers students feelings and interest during basic science lesson	150	1.44	2.83	Disagree
22.	Most of the time, teacher goes out of his/her way to	150	0.96	2.8	Agree

	ascertain effects of his teaching on students' behavior			7	
23.	Teaching always explains the meaning of statements, diagram and graph through investigation.	150	1.12	3.26	Agree
24.	The teacher lays emphasis on evaluation during Basic Science lessons	150	0.90	2.10	Disagree
25.	Teacher always draws students attention on implication of topic to daily attitude/behavior in the society	150	0.96	2.80	Agree
	Mean/Standard Deviation		0.94	2.82	Agree

Source: Data collected from the field

Table 6b showed that statement on the items (with the exception of few items) regarding the interaction patterns of Basic Science Teachers with B.Ed or M.Ed as the highest qualification were attested to by the observers. On the contrary, the observers disagreed with statements on items 11, 12, and 24. The overall mean for the items in respect of the responses was 2.82 which indicated agreement.

Null Hypothesis One (HO_1)

HO_1: There is no significant difference in the interaction pattern fo Basic Science Teachers in urban and rural areas. The above hypothesis was tested using t-test statistical technique. The results were presented in table 7.

Table 7: t-test result in respect of rural and urban interaction pattern

Location	Number (N)	Mean ($\bar{X}$)	Standard Deviation (SD)	Df	T-value	Std Error	Sig. (Two tailed)	Decision
Rural	164	3.02	1.02					
Urban	220	2.96	1.06	382	1.55	1.2714	0.5554	Accepted

*Not significant at $P \leq 0.05$

The result on table 7 showed that there is no significant difference in the interaction pattern of Basic Science Teachers in rural and urban schools. As a result, the first hypothesis was accepted. In other words, the location of Basic Science Teachers did not affect their interaction patterns.

Null Hypothesis Two (HO_2)

HO_2: There is no significant difference in the interaction pattern of Basic Science Teachers with different years of cognate experience. The above hypothesis was tested using t-test statistical techniques. The results were presented in table 8.

Table 8: t-test result in respect of interaction pattern of Basic Science Teachers with different years of cognate experiences.

Experience	Number (N)	Mean ($\bar{x}$)	Standard Deviation (SD)	Df	T-value	Std Error	Sig. (Two tailed)	Decision
0 – 10 yrs	280	3.00	1.02					
11 + yrs	104	2.84	1.03	382	2.55	1.2523	0.0000	Rejected

*Significant at $P \geq 0.05$

The results on table 9 above indicated the alpha value to be 2.55 and the rules says that when alpha value is greater than the critical table value, 2.50 the result is considered to be rejected, therefore, the result on table 8 showed that there was significant difference in the interaction pattern of teachers with different years of cognate experiences.

Null Hypothesis Three (HO_3)

HO_3: There is no significant difference in the classroom interaction pattern of Basic Science Teachers with different qualifications. The hypothesis was tested using t-test statistical technique. Results were presented in Table 9.

Table 9: t-test result in respect of the interaction pattern of Basic Science Teachers with different qualifications.

Qualification	Number (N)	Mean ($\bar{x}$)	Standard Deviation (SD)	Df	T-value	Std Error	Sig. (Two tailed)	Decision
B.Ed/M.Ed	150	2.82	0.94					
NCE & below	234	2.80	1.08	382	2.86	2	0.0000	Rejected

*Significant at $P \geq 0.05$

The result on table 9 above indicated the alpha value to be 2.86 and the rule says that when alpha value is greater than the critical table value, the result should be considered rejected. Therefore, the result on table 10 revealed the alpha value of 2.86 is more than the critical table value of 2.50, hence the hypothesis that state that there was no significant difference in the classroom interaction pattern of Basic Science Teachers with different academic qualification was rejected. It does appear therefore that teachers' qualification did influence their interaction patterns.

Discussion

The main aim of this study was to investigate taxonomy-based classroom interaction pattern of Basic Science Teachers in the Federal Capital Territory. Three hypotheses were raised and t-test statistical method was used to analyse the relevant data and the result in table 7 indicated that there was no significant difference in the classroom interaction pattern on the basis of location. In other words, location had no

effect on interaction pattern. The way a teacher interacts in the classroom is not necessarily linked with where his school is located. This finding is in line with Heck (2009) who observed that increased teachers effectiveness is central to school effort to improve students outcomes. This observation is also in line with Akiri and Ugborugbo (2017) that conducted a study on influence of teachers classroom effectiveness on students academic performance in public secondary schools. Their result showed that effective teacher produce better performing students. This findings is also in agreement with that of Matelo (2005) that interaction pattern depends on individual entity.

On the contrary, the findings on hypothesis two indicated significant differences in the classroom interaction pattern of Basic Science Teachers with different years of cognate experiences. According to the findings, the act of classroom interaction depends on wealth of teaching experience. Fagbaunyi's (2009) study showed that school with experienced and qualified teachers usually do better than those schools with inexperience unstable and unqualified teachers. The finding on hypothesis three recorded significant difference in the interaction pattern of Basic Science Teachers with different qualifications. This finding is supported by Uko (2017) and Oyo (2017) who observed in their studies that teachers' qualification is unique and important variable for students to do well in their studies. This result should not be surprising because the higher the qualification the more articulate the realistic one becomes. This explanation supports the fact that teachers with qualifications of B.Ed and above were found to have entirely different interaction pattern than those with NCE. This could have explained the significant differences found on the present findings.

Conclusion

The following conclusions were drawn from the findings of the study:
The finding showed that there was no significant difference in the interaction pattern of Basic Science Teachers in rural and urban areas. However, second and third hypothesis which were tested and rejected, revealed that cognate experience and academic qualification of Basic Science Teachers did influence the interaction patterns.

Recommendations

In the light of the findings and the discussion of the results of the study, the following recommendations were made for possible implementation:

- Government at all levels should design teacher education programme that would encourage NCE Basic Science Teachers to acquire their higher qualification in education, hence teacher education should be seen as a continuous enterprise.
- Government and other stakeholders in education should motivate science teachers to stay in the service by providing them with attractive condition of service that guarantee their future and comfort.
- Government and other stakeholders should periodically organize seminars and workshops for science teachers on how best to carryout classroom interaction.

- Government and other stakeholders should as a matter of priority provide conducive instructional environment and resources/materials/media that will facilitate the teaching and learning of Basic Science in our schools.
- For effective classroom interaction pattern that would enhance teaching and learning process, basic science teachers should endeavour to plan their lesson towards the development of the three domains of the learners (cognitive, affective and psychomotor).
- At the beginning of every classroom interaction, the behavioural objectives of the lesson should be made known to the learners as to give them sense of direction.
- The government is advised to minimized rate of transfer of highly qualified and experienced science teachers so as to maintain effective teaching and learning in our junior secondary schools.

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