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Method of Teaching

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Abstract

The method a teacher employs in the classroom matter a lot. For this can hinder or enhance pupils understanding of any subject .Science is a subject with complex concepts which may mean different things in the child's language. The method a teacher uses in the class to communicate science concept can be a barrier to their understanding. This study therefore seeks to examine method of teaching as a barrier to understanding science concepts among primary six pupils in Cross River State, Nigeria. One hypothesis was raised and tested. Two instruments were used for data collection. They were, Method of teaching science questionnaire (MTSQ) and 50 item primary science achievement tests. One thousand, eight hundred and eighteen pupils out of sixty eight thousand two hundred and one pupils were randomly selected for the study. Data obtained was analyzed using independent t-test analysis at 0.05 level of significance. The result revealed that there is a significant relationship between method of teaching and pupils' understanding of scientific concepts and academic performance. It is therefore recommended that teachers should use appropriate methods of teaching to communicate science concept to pupils.

Keywords: Method of teaching, Science concepts, Primary school pupils, Academic performance

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Introduction and background

In order to maintain high quality education in Nigeria, appropriate strategies must be adopted. In the teaching-learning process, the way and manner science is taught or how concepts are communicated to students matter a lot. When higher order concepts are presented to pupils before lower order concepts, pupils will not only find difficulty in learning the concepts but will also find it difficult to understand the concepts and relate them to other concepts. Enukoha (1995) opines that in presenting mathematical concepts to students, the pre-requisites must be properly identified and the teacher should ensure that students possess them before going into the new lesson.

For the learning of science concepts to be effective and retained longer by the learner, the communication or presentation of these concepts have to be done in a definite order. Using manipulatives to introduce scientific concepts to pupils will aid their understanding and enhance their academic performance in science. This is typically based on the learning theory of Jean Piaget (1964) who suggest that children construct knowledge from their actions in the environment. Such actions require objects to manipulate. The presentation of scientific concepts should be based on an understanding of how concepts are learned as expressed by Beatie (1986)

… it is generally agreed that an optimal learning sequence of mathematical concepts moves from concrete to semi concrete (iconic) to abstract learning experiences. Such a sequence involves object and their manipulation, pictures or models of real objects and finally, the use of abstract symbols (p.4).

This implies that the sequential and logical presentation of lesson and the use of manipulatives, pictures, and models of real objects are most appropriate in presenting scientific concepts to pupils in the primary school to help them understand the concepts and perform well in the subject. In the same vein, Nja (2012) carried out a study on kitchen resources, classroom interaction, reasoning ability and academic performance of SS2 chemistry in thermochemistry in Calabar with a sample of 240 students. The result revealed that the use of kitchen resources enhance the performance and reasoning ability of the students. This shows that in the teaching of science e.g. aspect of chemistry, kitchen resources can help to boast the pupils' understanding since these materials are seen and manipulated. Furthermore, Achumuga (2006) examine the basic concepts for resource materials, arrived at a conclusion that local and easily available resources e.g. kitchen resources can be used effectively to teach and clear misconceptions. Blumenthal (2011) agreed that the use of kitchen resources in teaching chemistry makes it more accessible because it brings together scientific theory and everyday practicability

According to Gagne in Maduabum (1989) learning materials have to be organized and communicated to learners in a hierarchical fashion from simple to complex so that the learners first master the verbal knowledge and skill that are necessary for the new learning to take place. However, Bruner in Maduabum (1989) advocated for discovery learning in which the sequence of learning unlike Gagne is in a reverse manner. That is, the learner starts with the complex and plans to learn the simple component in the context of working with the complex. The implication of Brunner's view is that in communicating science concepts to students, teachers should deliberately create problems for the students with a purpose that they will learn the basics as the struggle with the problem.

Criticizing the above view, Ausubel in Maduabum (1989) maintained that Bruner's view of discovery method is time consuming, the author therefore asserted that for science learning to be effective, science teachers have to tie the new materials to what the learner already knows

(subsumers) and where the subsumers do not exist, teachers should provide learners with what is known as advance organizers or alert the students in advance the next concept to be treated. Corroborating Bruner's view of discovery method of teaching which allows students to discover knowledge on their own, Blosser (1989) emphasizes the importance of allowing pupil to explore their own ideas in a non threatening atmosphere and the need for teachers to device strategies for encouraging the exploration and for creating the necessary classroom climate.

Clough and wood-Robinson (1985) have suggested several things teachers may try during lesson presentation to enhance the learning of science. These include:

a) Start with student's idea and devise teaching strategies to take account of them.
b) Provide more structured opportunities for students to talk through idea at length, both in small group and whole class discussion;
c) Begin with known and familiar examples;
d) Introduce some science topics into the curriculum at earlier grade-levels.

It can be inferred from the above that no one method of teaching is appropriate or enough for a given lesson, teachers therefore need to employ multiple strategic approach to deliver their lessons.

Blosser (1989) maintained that teachers during communication of science concepts to learners need to consider the extent to which misconceptions may be language difficulties. This may make both teachers and students to fail to share the meaning of the terms they use or the questions they ask. In order to deal with misconceptions, Hopps (1985) in discussing cognitive learning theory and classroom complexity provided some suggestions that are relevant to structuring elementary school science lessons. The suggestions are thus;

1. Teachers can assist learners by providing the kinds of information and experiences which will enable them to bridge the gap between sensory input and prior knowledge. Ideas to be taught should always be related to the relevant frameworks held by the learners.
2. Explanations of any links between new information and prior knowledge should be made in a variety of ways so that learners are presented with visual, verbal and/or a diagrammatic format of the principles to be taught.

Several researchers are of the opinion that higher order concepts other than the ones the learners already know cannot be communicated to the learner (Skemp, 1971, Enukoha, 1995). Enukoha (1995) opined that "understanding of the basic first order concepts makes it easy to understand the subsequent higher order concepts" (p.88). The author further stressed that in communicating mathematics concepts for instance, teachers should ensure that the students understand the lower order concepts thoroughly before they are introduced to higher order concepts. Also Cruickshank, Jenkins and Metcalf (2006) affirm that for pupils to understand any concept, the information should be logically and clearly presented as well as connecting new information to what the pupils already know. Pollard, Anderson, Maddock, Swaffiel, Warin and Warwick (2009) affirm that in teaching science or non science concepts, teachers should build on prior knowledge, develop concepts and processes to enable learners to apply new knowledge. Furthermore, Borich (2011) suggests concept-learning strategy in the teaching of science and other subjects. This is done by giving the learners more practice with examples and non-examples which will enable the learner to understand the concept by recognizing the essential attributes of the concept. Seeing the examples and non-examples of an object or event, the learner will learn the essential attributes that separate seemingly like objects or events.

Science educators and teachers have over the years advocated for teaching for conceptual change. Driver (1983) noted that the alternative conceptions that students have constructed to interpret their experiences have been developed over an extended period of time; one or two classroom activities cannot change the ideas held. The author emphasized that students must be provided time individually, in groups, and with the teacher to think and talk through the implications and possible explanation of what they are observing and this may take time. Students must certainly experience conflict with their expectations when teaching for conceptual change is employed. Posner, Strike, Hewson and Gertzog (1982) suggested that if students are going to change the ideas:

1 They must become dissatisfied with their existing conditions.
2 The scientific conception must be intelligible.
3 The scientific conception must appear plausible.
4 The scientific conception must be useful in a variety of new situations.

Teaching for conceptual change according to Okebukola (2002) then demands a teaching strategy where students are given time to identify and articulate their pre-conceptions, investigate the soundness and utility of their own ideas and those of others, including scientists; and reflect on and reconcile differences in those ideas. The author maintained that the generative learning model (GLM) which is a teaching-learning model provides this opportunity. In this model of teaching and learning, the learner is an active participant in the learning context rather than an empty cup to be filled. This teaching and learning model acknowledges a constructivist's approach to the process of learning where students construct meaning from their experiences. This is precisely how Piaget viewed learning or the process. According to Okebukola (2002), Piaget referred to the process of acquisition and in cooperation of new data into the existing structure as 'assimilation' and the resulting modification of that structure as 'accommodation'. The author further said that, in learning science, the new facts, ideas, and concepts that are acquired gain more meaning by being organized (assimilated) into a cognitive structure; at the same time, the existing cognitive structure is given further clarification and support or even changed by incorporating new information (accommodating itself to the new data). The author therefore stated that instructional process to facilitate conceptual change must;

1 Identify and address student's alternative conceptions
2 Provide opportunities for student' ideas to evolve
3 Enable students' new ideas to be applied in a context familiar to them.

Bruner in Okebukola (2002) asserted that instruction should lead to increase the students' ability to "grasp, transform and transfer" what is learned. Okebukola (2002) says that sequencing of instruction generally should move from inactive (hands-on concrete) to iconic (visual), to symbolic (descriptions in words or mathematical symbols).

The teaching practice of two teachers was compared. One employed the constructivist oriented approach while the other use objectivist oriented perspective. At the end of the study, it was found that the students in a constructivist classroom gain more knowledge than the others in the objectivist classroom (Okebukola, 2002). Some research studies also indicated that as teachers made transition from objectivist to constructivist oriented thoughts and behaviours, their classroom practices changed and the academic performance of students improved drastically (Lorsbash, Tobin, Briscoc & Lamaster, Inpress; Tobin, 1990). Accordingly, Okebukola (2002) maintained that learners need time to experience, reflect on their experiences in relation to what they already know, and resolve any problems that arise and also that learners need time to clarify, elaborate, describe, compare, negotiate, and reach consensus on what specific experiences mean to them. This therefore means that teaching for

conceptual change which involves a constructivist approach to teaching and learning is most appropriate in science classrooms to help students derive meaning from what they study in school and construct knowledge by themselves. By so doing, academic performance of students in science will be enhanced and students will find joy in studying science at any level of education.

Methods and Materials
Purpose of the study

1. Method of teaching science relates to pupils academic performance in primary science

Hypothesis

1. There is no significant relationship between method of teaching science and pupils' academic performance in primary science.

Design

The study adopted the Expost-facto research design. The population of the study consisted of all the 2005/2006 academic session of primary six pupils in the three Educational zones of Cross River State. The total was 68,201 pupils with 34396 males and 33805 females. A proportionate stratified sampling technique was used to select 70 schools out of 994 to participate in the study. A simple random sampling technique of hat and draw method was further used to select 1,818 pupils who participated in the study. Two instruments were used for data collection via-Method of teaching science questionnaire(MTSQ) and a 50 item primary science achievement test. The instruments were face validated as well as content wise. The reliability was carried out using Cronbach Coefficient alpha method with estimates ranging from 0.50-0.90 which were considered appropriate. The instruments were administered after which data was coded for analysis.

Results

Hypothesis 1

This hypothesis stated that there is no significant relationship between pupils' perception of the method of teaching science and their academic performance in primary science.
Pearson Product Moment Correlation Coefficient (r) analysis was used to test the hypothesis. The result is presented in Table 18.

TABLE 1
Pearson product moment correlation coefficient (r) analysis of the relationship between method of teaching science and academic performance in primary science

Variable	N	Sx Sy	Sx^2 $S y^2$	Sxy	r-value
Method of teaching (X)	1818	26878	459456	1174521	0.3572*
Academic performance (y)		77011	3425496		

P < .05; df = 1816; critical r-value=0.194

The result in Table 18 showed that the calculated r-value of 0.3572 is greater than the critical r-value of 0.1946 at 0.05 level of significance with 1816 degrees of freedom. From the result, the null hypothesis of a no significant relationship was rejected while the alternate hypothesis is retained. It therefore showed that there is a significant relationship between pupils' perception of the method of teaching science and their academic performance in primary science. This means that if the pupils understand the method of teaching employed by the teacher in the classroom, they will be able to study scientific concepts, understand and internalized them and perform well in science.

Discussion

This hypothesis was rejected on the basis of the finding which revealed that there is a significant relationship between method of teaching science pupils' academic performance in primary science. By implication, this means that the method employed by teachers to teach science can help pupils to understand and learn scientific concepts which will further lead to high academic performance in science by the pupils. The reason for their poor performance could be that the teaching method is still traditionally oriented other than teaching for conceptual change, which involves helping children to construct meaning from their experience and participate fully in the lesson.

This finding is in consonance with the findings of Gagne (1965) as cited by Maduabum (1989), who asserts that learning materials have to be organized and communicated to learners in a hierarchical fashion from simple to complex. So that the learners first master the verbal knowledge and skills that are necessary for the new learning to take place. Also, Enukoha (1995) affirms that teachers should ensure that students understand the lower order concepts thoroughly before they are introduced to higher order concepts. The finding again lend credence to Cruickshank, Jenkins and Metcalf (2006) who agree that for pupils to understand any concept, the information should be logically and clearly presented as well as connecting new information to what the pupils already know.

This finding is further supportive of Okebukola (2002), who maintains that a teaching strategy where students are given time to identify and articulate their pre conceptions, investigate the soundness and utility of their own ideas and those of others is most appropriate. The author affirmed that the generative learning model (GLM), which acknowledge a constructivist approach to the process of learning provide this opportunity. May be teachers in the primary schools are not aware of this constructivist approach to teaching that is why the pupils performance is still at the usual level. This may explain the high level of misconception of science concepts by pupils because the teachers do not use appropriate methods of teaching science to present science concepts to them.

Furthermore, in a study where the teaching practice of two teachers was compared, Okebukola (2002) found that students in a constructionist class room gain more knowledge than those in the objectivist-oriented classroom. The author also asserted that learners need time to experience, reflect on their experiences in relation to what they already know and resolve any problem that may arise. It is likely if pupils are given time to experience science concept, reflect on these experiences and later resolve any problem that may arise, they may not find it difficult to study science even at the higher level. Borich (2011) further suggests concept-learning strategy in the teaching of science and other subjects by which learners are giving more practice with examples and non-examples which will enable the learners to understand the concept by recognizing the essential attributes of the concept.

CONCLUSION

From the foregoing, it was concluded that, for pupils to understand science concepts, teachers should communicate these concepts logically, beginning from simple to complex. This of course should be built on what the learners already know. Apart from this, teachers should make use of the Generative learning model which utilizes the constructivists approach and concept-learning strategy to teach pupils for better understanding of science concepts.

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