Effect of Demonstration, Strategy on Senior Secondary School Students' Achievement in Biology in Obio/Akpor Local Government Area, Rivers State

By

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Abstract

This study investigated the effect of demonstration method of teaching on students' achievement in biology. The quasi experimental design was adopted. A sample size of 100 Secondary School (SSH) students participated in the study. Random sampling technique was used to select the one hundred SSS II biology students from two schools. A validated 25 item instrument known as Biology Achievement Test (BAT) was used to collect data on the students' achievement in biology. The reliability index of BAT was 0.67. Two research questions and hypotheses respectively were raised. The data was analyzed using mean and t test analysis. The result was that demonstration method of teaching was found to be potent in raising students' achievement and retention in biology. The study also found no significant difference between students taught using demonstration and lecture approaches over solving mathematics-related problems in biology (t_{238}, = .723, p>.05). Also, there was a significant difference in the retentive abilities of students taught using demonstration and lecture approaches over ability to understand and apply concept (t_{238}, = 2.59, p<05). Thus, in-service training in form of workshops, seminars and symposia should be organized for teachers from time to time to update their knowledge on how to adopt appropriate **teaching strategies.**

Keywords: Demonstration, teaching biology, achievement test, demonstration method, separation technique is added to the water.

The demonstration method is a process used to introduce some specific skills in the course of instruction. The teacher here is able to do some activities while the

learners are watching. It could involve setting up some apparatus/equipment or showing how a reaction should be performed. As a teacher performs these activities, the students are supposed to be involved except dangerous reactions and manipulations are involved. Usually the students are able to carefully observe, infer, predict and classify. It is teacher-centred and so it is economical as regards the resource used when the school only has limited set of equipment or apparatus or when the activity involved is of high risk.

According to Busari (2004) to make demonstration effective in either teacher demonstration or teacher/student demonstration, the following criteria are essential:

1. Organize the demonstration to make it visible to all students.
2. Attempt to carry out the demonstration before the lesson begins.
3. Avoid having too much demonstration in a lesson not to confuse the students.
4. Be systematic, that is performing the demonstration in a scientific manner.
5. Attempt to time each demonstration and space it to enable the students grasp the message be available for everyone in the class

According to Achounye (2002), demonstration approach is a practical method of teaching. It involves showing, doing and telling something. Hence, the teacher needs to display the steps in the process and explain them accurately and clearly, while students are expected to practice by repeating the things the teacher has done

Advantages of demonstration method

- It bridges the gap between theory and practice.
- It controls the rate of breakages and accidents as students watch the teacher do it before attempting to do the same.
- It is learning by doing method and so enables the teacher to teach manipulative and operational skills.
- It could be a time and material saving device because many students can observe one demonstration at the same time.

In teaching there are many approaches and techniques. It is necessary to state emphatically that no one method can be seen to be the best rather what determines the method to adopt including among others, the age of the learner, his ability, time and circumstance. The teacher is expected to make use of suitable approaches ip different concepts.

Demonstration strategy has been shown to be effective with both large and small groups. The greater .the degree of participation and sensory involvement by the learner, the more effective learning will be. Newby, Stepich, Lehman, and Russel (1996) identified ways teacher can improve the use of demonstration method in the classroom. They suggest that teacher should allow students to use several_ senses by allowing them to see, hear and possibly experience. Also, ideas should be presented to stimulate interest. If these precautionary -measures are not taken, demonstration can limit student participation.

Uhumuavbi and Mamudu (2009) found that demonstration strategy of teaching is sensitive to gender. They reported that exposing students to demonstration strategy yielded a better performance for male students than their female counterparts. It is therefore necessary to verify such claim. In this study gender is one of the moderating variables because it is important to find out if the treatments are truly sensitive to gender.

Instructional strategies are tools for reaching the set goals and objectives. The effective teacher has many teaching methods at his or her disposal and can select the ones that will be most effective for leading the learner to desired behavior. The level of students' performance in the internal and external examinations cannot improve until teachers are able to employ appropriate strategies to impact desired knowledge and skills on the learners.

Research has found that diverse students benefit immensely when they have the opportunity to interact with materials, participate in activities, and manipulate objects and equipment (Carrier, 2005; Prpric and Hadgraft, 2009). Through laboratories, demonstrations, educational games, simulations, field trips, and other interesting activities, students in secondary school classes have many

opportunities to be engaged actively in the learning process (Blair, Schwartz, Biswas, and Leelawong, 2007).

Demonstration strategy has emerged to become an instructional approach that is gaining growing interest within the engineering education community (Hadim and Esche, 2002). Duch (2002) described demonstration strategy as an instructional strategy that challenges students to "learn how to learn," working cooperatively in groups to seek solutions to real world problems. Prpic and Hadgraft (2009) addressed the key ingredients of demonstration strategy and postulated that it should not be confused with design projects or case studies where the focus is predominantly on the application of existing knowledge and integration of what is already known. Demonstration strategy goes beyond this, students will encounter some concepts for the first time and therefore they need strategies for acquiring this new knowledge (Prpic and Hadgraft, 2009). Schools are becoming diverse in terms of student backgrounds and abilities, and teachers are being ever more challenged to find effective ways to meet diverse needs of their students. Educators confront classrooms in which students' exhibit assorted academic and behavioral characteristics and they are increasingly looking for successful instructional and classroom management techniques (Toumaki and Criscitiello, 2003). As educators face more demands and more diverse student needs, research is showing that schools may benefit by using peer-mediated interventions which are consistently producing academic gains (Ryan, Reid, and Epstein, 2004).

Demonstration method has been used extensively in the sciences (Tretter, 2003) and to lesser extent in engineering. For instance, Lee (2004) carried out a study on students' performance in sciences using a demonstration method. In his study, be reported that students were able to identify some difficulties they faced in learning science when they were given problem to solve. Wilson (2004) investigated the effect of two teaching methods on students cognitive achievement and problem solving skills in biology. He showed that the treatment groups performed significantly better than the control group. Demonstration method have no substitute for laboratory exercise or for learning proper techniques of handling laboratory equipment, but are effective means of supplementing and clarifying the material being taught.

Gender has remained a burning issue and has also remained relevant in education because it has been linked to achievement and participation in certain professions (Sotonade, 2004). Certain cultures restrict particular gender to certain professions like farming, engineering and trading (Erinosho, 1997; Olatoye and Afuwape, 2004). Therefore, using gender as a moderating variable in an experimental study can yield useful practical information. However, there have been conflicting findings on how gender influences academic achievement. It seems the influence of gender varies according to school subjects. For example, Olatoye (2008) reported no significant difference between male and female achievement in science. Tamir (1990) also reported no significant difference between male and female achievement in biology and biology but reported a significant gender difference in physics (boys scoring higher).

Kumar and Morris (2005) advocated for consideration of gender in studies involving achievement and scientific understanding in the biological and physical sciences. Lee (1998) observed that educators perhaps unknowingly had for many decades considered reading and literature as female domains and mathematics and science as male domains. While understanding the need to address gender difference represents a vital step, making education gender-responsive will require a genuine commitment to provide teaching-learning experiences that reflect female and male difference. Lee further noted that males tended to do much better in the physical sciences (like physics), while females held a modest advantage in the life science (like biology and agricultural science). Though, teachers have begun to take a closer look at demonstration strategy of teaching as a tool in their array of teaching techniques, yet there has not been much research report of their effectiveness. It is against this backdrop that experimental investigation into effect of demonstration strategy of teaching on senior secondary school students' achievement in separation techniques become imperative.

Statement of problem

The poor academic achievement in the sciences in secondary school students raises doubts, among others, on the efficacy of the teaching approaches utilized by teachers in school. The nature of science as dynamic and objective activity has great implication for its teaching and learning. Science involves a mode of inquiry through which knowledge is generated and expanded. There is, therefore, the

need to carry out studies using an innovative teaching strategy of guided-inquiry whereby students are helped to become active rather than passive learners as seen when the conventional approaches (demonstration, lecture, drill, etc) are used by the teachers in teaching the sciences in our schools today.

Purpose of the study

The purpose of this study was to determine the effect of demonstration strategy on students' performance of biology concepts. The study sought to investigate how demonstration method affected students' achievement, to ascertain whether the cognitive achievement of students taught through demonstration was statistically different from that of students taught through lecture method.

Research questions

The study was guided by the following research questions:-

1. Is there any difference between students taught using demonstration and lecture approaches in biology?
2. Does any difference exist in the retentive abilities of students taught using demonstration and lecture approaches with respect to ability to understand and apply concepts?

The following hypothesis guided the study:-

Research Hypotheses

HO_1 There is no significant difference between students' taught using demonstration and lecture approaches in biology.

HO_2 There is no significant difference in the retentive abilities of students' taught using demonstration and lecture approaches with respect to understand and apply concepts.

Methodology

This study adopted quasi - experimental pretest posttest control group design. The experiment was conducted in Obio/Akpor local Government Area of Rivers State. The target population consisted of all students in Obio/Akpor Local Government Area. Simple random sampling technique was used to select two co-educational public secondary schools from the' 12 Senior Secondary Schools in Obio/Akpor

Local Government Area of Rivers State. A total of 100 SS2 students in intact classes were used. Two intact classes of 52 students in experimental and 48 students for control were used. One group was designated the experimental group was taught using lecture method the other group was taught using demonstration method. The instrument used was the Biology Achievement Test (BAT). Items were adopted from. The test items consisted of 25 multiple choice questions having two sections A and B. The BAT was validated (face and content) by resource persons in science education, who found some items to be too difficult, others not to measure what they are supposed to measure and discarded them. The reliability of the instrument was established using the test re-test method to obtain a reliability coefficient of 0.67.

Treatment Procedure

The researchers visited the two schools, all located in Obio-Akpor Local Government Area of Rivers State, Nigeria to obtain permission from the principals for the use of their schools and students for the study. The class teachers were also contacted for agreement to be reached and adequate preparation to be made for the actual use of the students so that normal class lessons would not be disrupted. The biology teachers and students were trained for one week on the use of demonstration approach in teaching-learning for the experimental treatment. The training involved preparation of the entire required lesson notes together, micro teaching/ demonstration by the researcher. Thereafter, the demonstration approach was employed to teach the students for six weeks. At the end of the instructional implementation, the-posttest was administered. The students in the control group were not trained as in the experimental group. Rather, they were taught using the conventional method of chalk and talk. Students were pre-tested before instruction was given and at the end of the six weeks of instructional implementation, the posttest was administered.

Research question 1: What difference exists between students taught using demonstration and lecture approaches in biology?

Table 1 Gain score in biology by the students taught biology concept using demonstration and lecture approaches

Approaches	N	Pretest Mean	SD	Post test Mean	SD	Mean Gain	% Gain
DEA	52	42.77	4.97	62.71	14.08	19.94	47.2
CTA	48	42.55	7.19	63.96	12.68	21,41	50.3

DEA: Demonstration approach
CTA: Lecture approach

Table 1 Shows that mean pretest score of the students in the lecture group, 42.55 was slightly lower than that of their counterpart in demonstration group, 42 77 However, the mean post test score of the students in the lecture was found higher than of Demonstration group by 0.22, given a gain % of the two groups to be 47.2% for DEA and 50.3%for CTA.

Hypothesis 1: There is no significant difference between students taught using demonstration and lecture approaches in biology

Table 2 t-*test* analysis of difference between students' taught using demonstration and lecture approaches in biology

Approaches	**N**	***X***	SD	**Df**	**, t-cal.**	**t-crit.**	**Decision at p>0.05**
DEA	52	62.71	14.08				Not ,
CTA	48	63.96	12.68	238	- 0.72	1.96	Significant

DEA: Demonstration approach
CTA: Conventional teaching approach

Table 2 shows that there is no significant difference (t_{238}, = .723, p>.05) between students taught using demonstration and lecture approaches with respect to solving mathematics related problems in biology. This implies that the two approaches are not significantly different in facilitating in enhancing students' solving mathematics-related problems in biology

Research question 2: Does any difference exist in the retentive abilities of students taught using demonstration and lecture approaches with respect to ability to understand and apply concept?

Table 3 Gain score on retentive abilities of students taught using demonstration and lecture approaches with respect to ability to understand and apply concept?

		Pretest		Post test		Mean	%
Approaches	N	Mean	SD	Mean	SD	Gain	Gain
DEA	52	43.46	4.79	63.25	12.56	19.79	45.53
CTA	48	43.82	5.17	59.46	9,96	15.64	35.69

DEA: Demonstration approach
CTA: Conventional teaching approach

Table 3 Shows that mean pretest score of the students in the demonstration group, 43.46 was slightly lower than that of their counterpart in the lecture group 43.82. However, the mean post test score of the students in the demonstration group was found higher than of lecture group by 3.79, given a gain % of the two groups to be 45.53% for DEA and 35.69% for CTA.

Hypothesis 2: There is no significant difference in the retentive abilities of students taught using demonstration and lecture approaches with respect to ability to understand and apply concept

Table 4 T-est analysis of difference in the retentive abilities of students taught using demonstration and lecture approaches with respect to ability to understand and apply concept

Approaches		$\bar{X}$			t-	Decision
	N		SD	df	cal. t-crit.	atp<0.05
DEA	52	63.25	12.56			
CTA	48	59.46	9.96	238	2.59 1.96	Significant

DEA: Demonstration approach
CTA: Conventional teaching approach

Table 4 Shows that there is a significant difference (t**23**s, = 2.59, p<.05) in the retentive abilities of students taught using demonstration and lecture approaches with respect to ability to understand and apply concept. This difference is seen to be in favour of the demonstration group. It implied therefore that demonstration approach was found more facilitating in enhancing students' understanding and application of the biology concept taught than the lecture approach.

Discussion of findings

There is a significant difference between academic achievements of students taught with the demonstration method (DEM) and those taught using the Conventional Teaching Method (CTM) in biology (FI,97=31.10^=0.00). The null hypothesis of non-significant difference was rejected: It indicates that the mean difference m academic achievements between the two teaching approaches was in favour of the experimental group (demonstration approach).The finding synchronizes with the earlier work of Broaler (1998) who conducted an extensive longitudinal study of two schools in Britain tracking students from ages **12** to 16 and concluded that phoenix students performed better than students in amber hill when exposed to demonstration method.

There is a significant difference between retention scores of students taught with the demonstration approach (DEA) and those taught using the Conventional Teaching Approach (CTA) in biology (FI,97=75.19,p=0.00). The null hypothesis of non-significant difference was rejected. It indicates that the mean difference in academic achievements between the two teaching approaches was in favour of the experimental group (demonstration approach).The finding is consistent with the findings of Wilson (2004)

Recommendations

Based on the findings, the following are recommended:

- School administrators should encourage teachers to adopt the demonstration learning approach based on the result of the experimental and control groups which show that the experimental group (demonstration approach) performed significantly better than the control group (conventional teaching method).

- Government should motivate teachers by ensuring good conditions of service.
- Considering that demonstration learning approach demands absolute dedication on the part of teachers, the schools should allow more flexibility in the *time* assigned to teach a unit of subject in order to attain mastery.
- That government should organize workshops, seminars, in- service training for all categories of teachers to enable them to be conversant with the various modem ways of teaching.
- Also schools should be equipped with modem learning facilities such as audio-visual materials, information and communication technology centers, library, and counseling centers.
- Finally, government and school administrators should make policies that will make demonstration learning approach compulsory for school teachers.

Conclusion

The results of the study have shown that there is no significant difference between academic achievement of students taught with the demonstration learning approach and those taught using the Conventional Teaching Method in biology. The result also reveals that there is a significant difference in the retentive abilities of students taught using demonstration and lecture approaches with respect to understand and apply concepts in chernistry

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