

TEACHERS' USE OF ANALOGY AND DRAMATIZATION IN THE TEACHING OF ECOLOGICAL CONCEPTS IN SECONDARY SCHOOL

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ABSTRACT

This study investigated the influence of analogy and dramatization strategies on students' achievement in ecological concepts in biology. Two groups pre-test- post test non- equivalent quasi experimental design was employed. The sample was made up of 2067 senior secondary class 1 students. The instruments were 25-items multiple- choice in biology achievement test on ecological concept (BATEC). There was also a focus group interview. Mean and standard deviation were used to answer the research questions while ANCOVA was used to test the hypotheses at $p < 0.05$. The results showed that the use of analogy and dramatization facilitated students' achievement in ecological concepts taught in the study. Also, a no significant effect between type of school (mixed and girls only), gender and achievement was observed. Based on the findings, recommendations such as adoption of analogy and dramatization in the teaching of biology, and its integration with other methods were offered.

Key words: Analogy, Dramatization, Achievement, Science Teaching Strategies.

Introduction

Science remains an indispensable tool for the development of individuals in the area of economy, technology and social growth. Perhaps, this accounts for the reason why the national policy on education (FGN, 2004) outlines the goals of science education as to cultivate inquiring, knowing and rational mind for the conduct of a good life and democracy, produce scientist for national development, promote science studies in technology and the cause of technological development and provide knowledge and understanding of the complexity of the physical world, the firms and conduct of life (p.29). For such important subject and goals to be achieved demands for the adoption of appropriate instructional strategies. Biology as a science has been providing many important innovations for our lives by studying its basic discipline, genetics, biotechnology, molecular biology, microbiology and biochemistry (Mustafa and Osman 2008)

The teacher at levels of learning should as a matter of profession, be well versed in the arrays of instructional strategies for science teaching, especially biology. Identification of biology concepts that are important but difficult to teach and learn have always been subject of discussion by researchers (Adeniyi, 1983; Abimbola, 1984; Onyejekwe, 1984; Olowookere, 1986; Soyebo, 1987; Abimbola, 1998; Mustafa & Osman, 2008). In 2011 Lagos Eko Project identified four (ecology, genetics, adaption and variation) as concepts important but difficult to teach and learn. This year 2012 the concept of evolution was added to the existing four as also an important but difficult concept to teach and learn.

Several reasons have been given in the past for poor performance of students in these concepts. Soyebo (1987); Abimbola (1998) identified factors responsible for students poor performance in these concepts as shallow content knowledge of biology teachers; poor knowledge drives partly from the existence of misleading terms in biology texts and syllabuses and that the teacher seem to have replicated the same knowledge of the concept which they had acquired during their secondary school days. Areola (1983), Abimbola (1998) evaluated students' problem and weakness and found them to be inability to follow

instruction, wrong spellings, inability to observe details, inability to draw inference from experimental results, inability to make good drawing and inability to draw to scale.

Analogy and dramatization are learning strategies that involve the students in active learning. Their uses are based on the construction study theory. To the science that scientist do because they are inquiry-based and often the science benefit to actualize the constructionist promise of improved teaching and learning (Hausfather,2001, Lorschach and Tosin, 1998, Tam, 1999) in Ogunmade (2005). Hausfather(2001) noted that constructionist epistemology encourages teachers to make sense of what they see, think, and do in facilitating students' learning.

Wikipedia(2010)describes analogy from Greek word Analogia “ proportion” a cognitive process of transferring information or meaning from a particular subject to another particular subject. It plays a significant role in problem solving, decision making. Hofstadter (2001) argues that analogy is the lifeblood of human thinking. Glynn(2007) in his own view describes analogy as comparison of the similarities of two concepts, the familiar concept, called analogue and the unfamiliar called the target.Duit& Glynn (1992,1995) argued that effective use of analogy foster understanding and avoids misconception. Conversely, James and Scharmann (2007) argue that analogies are double-edged swords that can foster understanding, but can also lead to misconception.

Also, explained, Duit, Roth, Komorek, and Wilbers (2001), a growing body of research shows that analogies may be powerful tools for guiding students from their pre-instructional conception toward science concepts.

According to Glynn (2007) the purpose of analogy in science is that it serves as a guide for teacher to explain key concepts in science. Analogy also guides textbook authors, and website designers in their use of analogies. Research has shown that using analogy increases student's learning and interest.

Glynn et al (1997) outline advantages of analogy as help students to make connection with new knowledge, allows students to form an initial mental model of concepts to be learnt based firstly on what they are already familiar with and then relating to new knowledge and fosters understanding and avoid misconceptions.

Wikipedia, (2010) traces the meaning of drama from the word “drao”-to mean action. It goes further to say that drama is the specific mode of fiction represented in performance. www.nursingplanter.com/dramatization-in-teaching-andlearning-process gives the function of drama to include: enabling functioning, if accompanied by a high amount of cognitive process, facilitating function for specific cognitive process made easier through action and students' knowledge on the character is increase in situation or concept and as well gives purpose it serves as: to increase knowledge of character or situation, improve the use of imagination and skills to solve problem. Glynn (2007) posits that drama has two characteristics of study and live-ness.. Live-ness of science drama is similar to experiment or offer large room to students to talk, express, adapt and evaluate their science knowledge and thought by its live-ness and this result in un-authoritative learning environment (Glynn, 2007). Despite the existing array of instructional strategies that meet the aspiration of constructivist, biology teachers in secondary school remain adherence to didactic way of teaching. Therefore, trying the efficacy of analogy and dramatization on learning outcome of students becomes the motive of the study.

Objective of the study

The study sought to establish

- i. Influence of analogy and dramatization on students' achievement in ecology
- ii. Achievement of male and female students exposed to analogy and dramatization instruction
- iii. Influence of school type on students' performance in analogy and dramatization ecological instruction

Theoretical framework

The study builds on the construction theory. The theory advocates inquiry-based learning where the learner construct meaning from prior experience encountered, especially within the wall of classroom. This has been found to aligned with improved teaching and learning (Hausfather,2001, Lorsbach and Tosin, 1998, Tam, 1999) in Ogunmade (2005). Hausfather(2001) noted that constructionist epistemology encourages teachers to make sense of what they see, think, and do in facilitating students' learning. Hence, the theory was considered appropriate to anchor the study.

The research questions are:

1. Is there a significant difference in the achievement mean score of students in the experimental group and control group?
2. Is there a significant difference in the mean score of male and female students in the experimental group?
3. Does school type have influence on students' performance?

Hypotheses are:

H₀₁: There is no statistically significant difference in the academic achievement of students in the experimental group and control group.

H₀₂: There is no statistically significant difference in the mean score of male and female students in the experimental group.

H₃: School type has no statistically significant influence on students' performance.

Methodology

The study was conducted in two of the existing six education districts of Lagos State, Western part of Nigeria. Two groups pre-test-post-test quasi-experimental design was adopted. All senior secondary class 1 biology students in districts 1 and 5 formed the study population. Four schools were randomly selected using stratified sampling technique. A random sampling technique was used to select two intact classes each from the four selected schools. Two intact classes were assigned to experimental group (N=98) and another two intact classes to the control group (N=109). A total of 207 SS1 biology students took part in the study. The experimental group consisted of 36 boys and 62 girls while the control group consisted of 58 boys and 51 girls. Three research questions and three research hypotheses guided the study. The ages of participants range between 13- 14 years.

Data collection and Procedure

Biology achievement test in ecology concepts (BATEC) drawn from West African Senior Secondary Examination past questions was used to collect data for quantitative analysis. The BAT is a 25-item multiple choice based on the topic taught along the classroom interaction.

The contents include food chain and food web. Focus group interview was used to collect data for qualitative analysis. The focus group interview instrument consisted of open-ended questions used to elicit discussion and gather information on subjects' level of interest in biology, parent occupation, and understanding of the concepts taught. Content and construct validity for BATEC was ascertained thorough analysis of the multiple choice items by two biology experts in the department of science and technology education at the Ojo campus of the Lagos State University, Nigeria. The instrument (BATEC) was modified based on their suggestions. The BATEC was pilot tested to fifty (50) senior secondary (SS1) biology students in other schools. Data generated were subjected to split half with a reliability coefficient of .78. Quantitative data generated were coded and subjected to descriptive and analysis of covariance with the use of SPSS 17.0 version. Data resulting from the focus group discussion were transcribed.

Results

Table I: Mean and Standard Deviation of Gender, Group, School Type and Academic Achievement.

Source		N	Mean	Standard Deviation
Gender	Male	94	13.62	4.16
		113	13.59	4.21
	Female	109	15.59	2.93
Experimental Group		98	11.82	4.33
		180	13.43	4.28
	Control			
School Type	Mixed	27	15.20	15.20
	Girls			
only				

Table 1 above, shows that experimental group has mean score (15.59) and standard deviation 2.94 against mean score (11.82) and standard deviation 4.33. This implies that students in the experimental group had a better performance than their counterpart in the control group.

The male has achievement mean score 13.62 and standard deviation 4.16 against their female counterparts that pulled post achievement mean score of 13.59 and standard deviation 4.21. This revealed a slight difference in their posttest achievement means in favour of the male.

Girls only school recorded post test achievement score of 15.2 and standard deviation of 2.75 against mixed school with means score of 13.43 and standard deviation 4.28.

Test of Hypotheses

Hypothesis One

H₀₁: There is no statistically significant difference in the academic achievement of students in mental group and control group.

Table 2: Summary of Analysis of Covariance of Students' Performance in the Experimental and Control Groups.

SOURCE SIG	TYPE III SUM OF SQUARE	DF	MEAN SQUARE	F
Correct model	1095.8119	2	547.906	44.786
Intercept	.000			
Pre-test	1950.210	1	1950.210	159.411
Group	.000			
Error 1	360.298	1	360.298	29.451
Total	.000			
Corrected Total	484.420	1	484.420	39.597
	.000			
	2220.709	204	12.234	
	41564.000	207		
	3560.097	206		

a. R squared=.305 (Adjusted R squared) = .298

Table 2 shows the summary of the analysis of covariance of the performance of students in the experimental group and the control group. The result reveals that group has a significant effect on the post test achievement scores of the students $F(1,206) = 39.60$; $P < .05$). This

shows that the use of Analogy and Dramatization strategies were found to be effective. It therefore implies that the hypothesis of no significant difference in the performance of students in the experimental and control groups is not accepted (i.e. rejected).

The result also shows an adjusted square value of .298. This value indicates that use of analogy and dramatization strategies account for 30% of the variance in the post-test achievement scores of the students in the study.

Hypothesis 2

Ho₂: There is no statistically significant difference in the gender academic achievement of the experimental group

Table 3: Summary of Analysis of Covariance of Gender performance in the Experimental group and

Dependant variable post test

SOURCE SIG	TYPE III SUM OF SQUARE	DF	MEAN SQUARE	F
Correct model	937.750a	2	468.875	36.296
Intercept	.000			
Pre-test	1157.366	1	1154.360	89.594
Gender	.000			
Error 1	934.348	1	934.348	72.329
Total	.000			
Corrected Total	7.866	1	7.866	.0609
	2622.347	204	12.918	
	41564.000	207		
	3560.097	206		

a. R squared = .263 (Adjusted R square .256)

Table 3 reveals $F(1, 206) = .0609$; $P > .05$. This shows that gender has no significant effect on the academic achievement of students exposed to analogy and dramatization strategies. Therefore, the hypothesis of no significance in the performance of male and female students is not rejected. This result infers that both male and female students gained academically from the use of analogy and dramatization strategies. Again adjusted R squared value of .256 indicates that gender contributed 26% variance in performance of students in the study.

Hypothesis 3: School type has no statistically significant influence on students' performance

Table 4: Summary of analysis of covariance of students' performance based on type of school

SOURCE	TYPE III SUM OF SQUARE	DF	F	SIG
Intercept Hypothesis	1001.493	1	79.825	.000
Error	378.197	1	30.144	
Pre-test Hypothesis	890.840	1	68.901	.000
Error	2611.710	202		
School Type Hypothesis	10.986	1	.850	.358

Not significant $p > .05$

Result in table 4 shows that type of school (mixed and girls only) has no significant effect on the academic achievement of students ($F(1, 202) = 850, P > .05$). The implication of this result is that mixed or coeducation and girls only school has no significant effect on the academic achievement of students, but that the right choice and use of instructional strategies constitute influencing factor.

Q1: what can you say about the just concluded lesson?

R1: I find the lesson interesting and this will make me pay more attention to biology lesson

Q2: what would you like to study in the future?

R2: I would like to study medicine; I would like to study medicine.

Majority of the students had in mind to undertake science related courses as career in the university. However few were undecided.

Q3: What is the occupation of your father?

R3: My father is a mechanic. Another student, My father is a medical Doctor.

I stay with my Aunt, she is a teacher and I would like to study medicine.

My father is a computer scientist and I would like to study zoology

Most of the fathers are educated which gives a foundation to the choice of future career of the respondents. This shows that the education of the parent may be said to influence students' choice of career

Q4: What do you consider as problem for the learning of biology?

R4: What I consider as problem for the learning of biology on the part of students are poor reading habit, laziness and refusal to do assignment.

Well teachers need to use appropriate examples adequately and the classrooms are not conducive for learning particularly during the hot season of the year. The classrooms are overpopulated.

Insufficient equipment, lack of electricity supply and some of us had to Support our parents through learning a trade outside school.

Problems considered by students include poor reading habit, laziness, lack of laboratory equipment facilities and the need to involve in money making trade after school to support their parents.

Discussion of Findings

The study investigated the influence of the use of analogy and dramatization on students' understanding of ecological concepts at the senior secondary school. It also established students' perception of the two strategies and inquired of what the students considered as problems for learning biology. Quantitative and qualitative data were collected and analyzed and results are shown in tables 1-4 and in italics.

The result on table 1 showed that the experimental group had a higher score than their counterparts in the control group. Gender wise, the male mean score (13.62) was slightly higher than those of girls.

Girls only school had a mean score (15.20) against mixed school 13.43. This shows that potentially, analogy and dramatization had a change in the means of students in the experimental group.

Results of hypothesis one revealed a significant difference occurred in the mean score of students exposed to analogy and dramatization and their counterparts in the control group. This lends credence support to the observation of Okigbo and Okeke (2011), who observed that the use of game and analogy improved students' academic attainment. It indicates that when teachers use appropriate strategies instruction becomes easy and learning becomes meaningful.

The study also found that gender has no significant influence on the academic achievement of students. This observation corroborate that of Danmole and Adebayo (2005) who found that there was no difference in the performance of male and female students exposed to concept mapping. In this study, boys and girls taught food chain and food web gained meaningfully from being exposed to analogy and dramatization. It implies that these strategies are gender

friendly as they bridged gap in the performance of male and female students in ecological concepts.

Result of hypothesis 3 showed there was no significant difference between the means score of students in mixed and girls only schools taught with analogy and dramatization. This result differs from the observation of WAEC (2000) that reported of girls in federal colleges outshined those in mixed school. However qualitative data generated from the focus group interview indicated that the students found the topic taught interesting and majority of them would like to pursue science related career in the future.

The qualitative result further showed that students are faced with some problems ranging from poor reading habit, lack of facilities such as water supply electricity and some have to support their parents economically.

Conclusion

The findings from this study may suggest that school type and being a boy or girl may not necessary have significant effect on the academic achievement of students, rather the right choice and adequate implementation of instructional strategies constitute influencing factors in the study. To further buttress the efficacy of the study, quantitative data were generated from focus group discussion. And the data elucidated an indication that the students found the topics taught interesting and promised readiness to pay more attention to biology lessons; and majority of the students would like to pursue science related career in the future. Emanating from the qualitative result was that most fathers of the subjects in the focus group discussion are elucidated and this gives a foundation to the choice of future career of the subjects. This shows the education of the parent may be said to influence students' choice of career. Finally, the qualitative result further showed that students are faced with problems ranging from poor reading habit, lack of equipment, overcrowded classroom, lack of facilities such as water supply, electricity and some have to support their parents economically.

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