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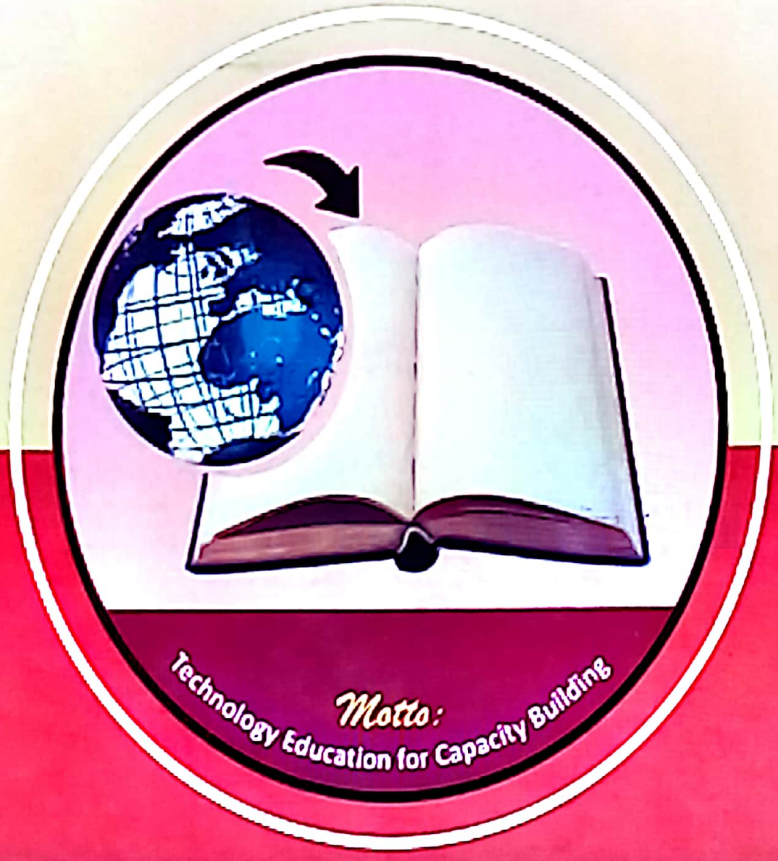

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EFFECTS OF METAPHOR INSTRUCTIONAL STRATEGY ON SECONDARY SCHOOL BIOLOGY STUDENTS' ACHIEVEMENT ON THE CONCEPTS OF SYMBIOSIS AND PARASITISM IN MINNA METROPOLIS.

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Abstract
The study examined Effects of Metaphor Instructional Strategy on Secondary School Biology Students' Achievement on the Concepts of Symbiosis and Parasitism in Minna Metropolis. Increase in students' inability to comprehend and cope with the basic scientific concepts necessitated the search for a more effective classroom instructional strategy to improve their achievement. The design adopted for the study was a Pretest-Posttest Experimental-Control Group. A total of 120 students in Senior Secondary class two (SS II) randomly selected from four secondary schools in Minna metropolis made up the sample for the study. SS (II) students from two schools were randomly assigned to experimental group and the remaining two schools to control group. The experimental group was taught the concepts of symbiosis and parasitism using Metaphor Instructional Strategy while the control group on the other hand was taught the same concepts using traditional teaching method. The instrument for data collection was a 30-item multiple choice test on the concepts of symbiosis and parasitism. The instrument was validated by biology experts and its reliability determined as 0.91 using the Pearson Product Moment Correlation (r). t-test statistics was used to analyze the data. Analysis of data revealed that metaphor instructional strategy was a more effective instructional strategy than the traditional teaching method ($t = 15.71$, $df = 59$, $P < 0.05$) in enhancing students' achievement on the concepts of symbiosis and parasitism in biology. It also revealed that there was no gender difference ($t = 0.95$, $df 29$, $P < 0.05$) among the students in the experimental group. Based on these findings, recommendations were made among which include the adoption of metaphor as an instructional strategy in our educational system and that, government should sponsor teachers to attend training courses on the use of metaphor as an instructional strategy.

Keyword Achievement, biology, concept, effects, metaphor, symbiosis, and parasitism.

Introduction

The importance of science to nation building cannot be over emphasised. It is therefore disheartening to discover that performance of secondary school students in science subjects especially biology has been below expectation (WAEC, 2000, 2002, 2003, 2004, 2006, 2009, 2010 & 2011). Many studies revealed that instructions are ineffective and as a result, students find many topics difficult to understand (Oguniyi, 1988; Oyedokun, 1993; Jegede, 1996; Ajewole, 1997; Akinyemi, 1997; Okebukola, 1998; Ikobi, 1999; Nkadi, 2000, Esiobu, 2000; Glynn, 2000; Onwukwe, 2005; Koroka & Ezenwa, 2009; and Okereke, 2009). To this end, science educators continue to seek more meaningful ways of improving teaching and learning. In biology, students' performance in some concepts like osmosis, ecology, evolution, cell division, genetics and taxonomy is always below average. These concepts are always not properly explained by students especially at the secondary school level (WAEC, 2004, 2006, 2009, 2010 & 2011; Ndu, Asun, & Aina, 1999; Ibole, 2000 & Abu, 2000; Aremu & Sokan, 2003; Adesemowo, 2005; Adeyemo, 2005; Yildirim, Acar, Bull & Sevne, 2008; Onwukwe & Onwukwe, 2010 and Ijioma & Onwukwe, 2011). A seven year WAEC result (2004-2008) can be seen in table 1 below showing poor performance of Niger State biology students at Senior School Certificate Examination level.

Table1: A 7-Year Performance of Niger State Biology Students at SSCE, (2004 - 2010).

Subject	Year	Total No. of Students	Total Credit pass (A1-C6) in %	Total Pass (P7-P8) in %	Total Fail (F9) in %
Biology	2004	6252	1075 (17.19)	1274 (20.38)	3903 (62.43)
	2005	6000	856 (14.27)	1793 (29.88)	3351 (55.85)
	2006	6640	1190 (17.92)	1563 (23.54)	3887 (58.54)
	2007	3395	289 (8.51)	453 (13.34)	2653 (78.14)
	2008	6385	698 (10.93)	1092 (17.10)	4595 (71.97)
	2009	6526	1134 (17.38)	1301 (19.94)	4091 (62.69)
	2010	6845	1308 (19.11)	1580 (23.08)	3957 (57.81)

Source: Niger State Ministry of Education (2011)

From table 1 above, the maximum percentage pass of the students is 19.11 (2010) which is too poor. In search for a better way to improve biology learning, Fafunwa 1990; Glynn, 1991; Abu, 1998; Lagoke, 1992; Okebukola, 1998, Onwukwe & Onwukwe, 2010 and Ijioma & Onwukwe, 2011 among others listed various methods which seemed to bring about meaningful learning to include vee-mapping, concept mapping, metaphor, analogy, co-operative learning and problem solving to mention just a few. Metaphor if effectively used as an instructional strategy could bring redress to students' problem of learning, misconception and poor understanding of some biological concepts. (Berk, 1996; Duit & Kommorek, 1997; Berk, 1998; Lagoke 2000; Susan, 2001; Abimbola, 2001; Allan, 1992; & Garner, 2003 Adesemowo, 2005, Adeyemo, 2005; Yildirim, Acar, Bull & Sevne, 2008).

Metaphor is a word or phrase used to describe something else in order to show that two things have similar qualities and also to make the description more meaningful (Simpson & Weiner, 2001). Longknife & Sullivan (2002) see metaphor as a process of comparing one thing to the other without using the word "like" or "as" to make the comparison. Metaphor is simply an agreement or correspondence between things otherwise different from each other therefore, it involves mapping mechanism which helps learners construct new knowledge on the basis of their prior knowledge (Parida & Goswami, 2002). In classroom situation, metaphor enables teachers to use ideas, words, phrases or objects in place of another ideas, words, phrases or objects to suggest a likeness between them (Graham, 1999; Simpson & Weiner, 2001; Glenn, 2002; Longknife & Sullivan, 2002; Parida & Goswami, 2002 & Garner, 2003). Metaphor is mainly used in classroom instruction to transform a new or foreign concepts to one that may be more recognised and familiar to the learners (Abu, 2000; Lagoke, 2000; Glenn, 2002 & Vosniadou, 2002; Adesemowo, 2005; Adeyemo, 2005; Yildirim, Acar, Bull & Sevne, 2008).

Garner (2003) reported that students who were exposed to series of lecture courses containing specific metaphors demonstrated retention of the course-content information better, when compared to those who received the same material without the infusion of metaphor. Glenn (2002) used metaphors from socio-cultural environment of the learners to determine the potency of metaphor in enhancing the learning of certain science concepts and reported that, metaphors helped learners to create vivid images of the science concepts which led to a better understanding of the concepts. This research study therefore focused attention on the Effects of Metaphor Instructional Strategy on Secondary School Biology Students' Achievement on the Concepts of Symbiosis and Parasitism in Minna Metropolis.

Objectives of the study

The objectives of this study are:

(i) to investigate the effect of Metaphor Instructional Strategy on the achievement on the concepts of symbiosis and parasitism among secondary school biology students in Minna metropolis of Niger State.

(ii) to determine whether Metaphor Instructional Strategy is gender friendly

Research questions

This study was specifically designed to address the following research questions:

Will the use of Metaphor Instructional Strategy in teaching the concepts of symbiosis and parasitism in biology result in:

(I) higher achievement on the concepts of symbiosis and parasitism among secondary school students than when traditional method is used?

(ii) differential achievement between male and female students taught with Metaphor Instructional Strategy?

Research hypotheses

The following null hypotheses were formulated and tested at the 0.05 significant level.

H_{o1}. There is no significant difference in the achievement mean scores of students taught the concepts of symbiosis and parasitism with Metaphor Instructional strategy and those taught with traditional methods.

H_{o2}. There is no significant difference in the achievement mean scores of male and female students taught the concepts of symbiosis and parasitism with Metaphor Instructional Strategy.

Research methodology

Design: The design for the study was the Pretest-Posttest Experimental – Control Group design. The

experimental stimulus (Metaphor) was withheld from the control group and used on the experimental group. Both groups were first pre-tested, thereafter, the experimental group was taught the concepts of symbiosis and parasitism using Metaphor Instructional Strategy while the control group was taught the same concepts using traditional teaching method. After the treatment, a posttest same as pretest consisting of thirty item achievement test on symbiosis and parasitism was administered to both groups.

Sample and sampling techniques:
The subjects comprised of one hundred and twenty (120) students (60 boys and 60 girls) from four secondary schools randomly selected by simple balloting in Minna metropolis. Niger State Government owned co-educational schools were used for the study. This is because the same state government controls both the schools and teachers of the sampled schools, fund and supplies science equipment to the schools and admits students into the schools using the same set of admission criteria. Co-educational schools were used to enable the researcher determine the gender differences in students' achievement of the concepts of symbiosis and parasitism. Students of two schools were randomly assigned (by simple balloting) to experimental group and the remaining two to control group.

Instrumentation:
The instruments used for this study were (i) Treatment instrument and (ii) Test instrument. Treatment instrument was the Metaphor Instructional Strategy produced by the researcher for the purpose of this study and used on the experimental group only.
The test instrument on the other hand was a 30-Multiple Choice Test Items on symbiosis and parasitism drawn from past question papers of Senior Secondary Certificate Examination (SSCE) O' Level conducted by West African Examinations Council (WAEC) and National Examinations Council (NECO). The instruments were further validated by biology experts to determine their appropriateness and relevance to SSII syllabus. A pilot test was conducted in a different school to determine the consistency of the test instrument using the test-retest method and its reliability coefficient determined as 0.91 using the Pearson Product Moment Correlation ®.

Data Collection:
Before the commencement of the teaching, a pretest was administered to both groups to determine whether they were equivalent with respect to their previous knowledge of the concepts of symbiosis and parasitism. The researcher personally handled the teaching in all the classes for three weeks. The experimental group was taught the concepts using metaphor instructional strategy while the control group was taught the same concepts using traditional teaching method. Thereafter, a posttest same as pretest was administered on both groups to determine whether there were differences in their achievement mean scores. The scores from the test formed data for testing the study hypotheses, t-test statistics was used to analyze the data collected.

Result and discussion
Table 2: Pretest Comparison of Experimental and Control Groups.

Groups	N	df	X	SD	t- cal	t- crit	P
Experimental	60		41.90	5.38			
Control	60	59	41.60	3.58	0.105^{ns}	2.00	0.490

ns = Not significant at the 0.05 level.
Table 2 presents the t-test result of the pretest for the experimental and control groups. From the table, the calculated t-value (0.105) is less than the t-value critical (2.00). This indicates that there is no significant difference between the mean score of the experiment group (41.90) and that of the control group (41.60) at the 0.05 significant level ($t = 0.105$, $df = 59$, $P>0.05$). This therefore, meant that the students in both groups were found to be equivalent with respect to their prior knowledge of the concepts of symbiosis and parasitism in biology before the teaching.

Posttest Performance of Experimental and Control Groups
H_{o1}: There is no significant difference between the mean scores of students taught with Metaphor Instructional Strategy and the Traditional teaching methods.

Table3: Posttest Comparison of Experimental and Control Groups

Groups	N	df	$\bar{X}$	SD	t-cal	t-crit	P
Experimental	60		66.11	6.06			
Control	60	59	42.63	6.01	15.71*	1.67	0.001

* = Significant at the 0.05 level.

From table 3, the mean score for the experimental group was 66.11 and that of control group, 42.63. The calculated t-value of 15.71 is greater than the t-value critical (1.67). This indicates that there is statistical significant difference between the mean scores of the experimental group (66.11) and control group (42.63) at the 0.05 level (t = 15.71, df = 59, P<0.05). The experimental group exposed to metaphor instructional strategy performed significantly better than the control group that was taught with traditional teaching method. This result is in consonance with the findings of Solomon (1987) and Glynn (1989) that students taught with metaphor instructional strategy performed better than those taught with the traditional teaching method. Therefore, the research hypothesis that there is no significant difference between the mean scores of students taught with metaphor instructional strategy and the traditional teaching method was rejected.

Performance according to gender

H_{02}: There is no significant difference between the mean scores of male and female students taught with metaphor instructional strategy and the traditional teaching methods.

Table 4: Posttest Comparison of Experimental Group According to Gender

Groups	N	df	$\bar{X}$	SD	t-cal	t-crit	P
Male	30		65.09	6.93			
Female	30	29	63.94	4.82	0.95^{ns}	1.66	0.240

ns = Not significant at the 0.05 level.

Table4: revealed that the calculated t-value of 0.95 is less than the t-value critical of 1.66. This indicates that there is no statistical significant difference between the mean scores of the male students (65.09) and that of the female students (63.94) at the 0.05 level (t = 0.95, df = 29, P > 0.05). Therefore, the research hypothesis that there is no significant difference between the mean scores of male and female students taught with metaphor instructional strategy and the traditional teaching method was not rejected. This result is not in consonance with the findings of Jegede, et al., (1989) and Lagoke (1992) who found differences in the performance of boys and girls. This is an indication that, the teaching method used (Metaphor Instructional Strategy) did not affect boys and girls differently.

Discussion of Result

From the posttest result in table 2 above, the experimental group performed better than the control as the calculated t-value of 15.71 is significant at the 0.05 level (P<0.05), favouring the experimental group taught with metaphor instructional strategy. Consequently, it could be deduced from the result that the use of metaphor instructional strategy had improved the students' achievement on the concepts of symbiosis and parasitism in biology as indicated by their mean scores. This result is in consonance with the findings of Solomon (1987) and Glynn (1988) which revealed that, students taught with metaphor instructional strategy performed better than those taught without metaphor instructional strategy. Therefore, the research hypothesis that there is no significant difference between the mean score of students taught with metaphor instructional strategy and the traditional teaching method was rejected. There is significant difference between the mean score of students taught with metaphor and the traditional teaching method. This remarkable difference in the groups' achievement is an indication that the instructional treatment (metaphor instructional strategy) applied to the experimental group seemed to have broadened the students' knowledge about the concepts of symbiosis and parasitism. This result is in line with the findings of Treagust (1985), Solomon (1987), Glynn (1988), Lagoke (1999) & Abimbola et al. (2001) that students taught with metaphor performed better than those taught with traditional teaching method.

There was no statistically significant difference between the mean scores of male and female students in the experimental group as indicated in table 3 above. This means that, the use of metaphor as an instructional strategy improved the achievement of both boys and girls equally. Therefore, the research hypothesis that there is no significant difference between the mean scores of male and female students taught with metaphor instructional strategy was upheld. This result of gender performance seemed not to be in line with the findings of Erickson & Erickson (1984), Welch (1985), Tobin (1988), Jegede et al (1989) & Lagoke (1991) who found differences in the performance of boys and girls. The reason for this difference on gender performance could be the nature of schools as the schools (Western schools) are more standardized and well organised in terms of infrastructure and quality of staff and equipment than the local schools here in Nigeria.

Major findings of the study

(i) Exposure of secondary school students to teaching with metaphor instructional strategy significantly improved their achievement on the concepts of symbiosis and parasitism in biology as the mean score of the experimental group on posttest scores (66.11) was more than that of the control group (42.63).

(ii) There was no significant difference on achievement of boys and girls exposed to the teaching with metaphor instructional strategy.

In summary, this study revealed that the use of metaphor instructional strategy improved the students' achievements as well as their performance generally. There would have been no improvement on students' achievement if the instructional strategy used was not effective (Okebukola, 1998). Metaphor instructional strategy as indicated by the findings of this study seemed to be an effective method of classroom instruction that could lead to meaningful learning hence, improvement in students' performance. In the light of the above major findings, if the exposure of the students used for this study to metaphor instructional strategy in such a limited period of time could result in such a striking achievement, it stands to reason that under normal classroom setting, metaphor as an instructional teaching method would prove to be very efficient and effective in improving students' achievement and performance generally.

Recommendations

The use of metaphors instructional strategy in teaching has neither been frequent nor used in optimal way. This is because either science teachers are not aware of metaphor as a teaching strategy or they have no formal training about metaphor and analogy use in teaching science (Abimbola et al., 2001). To ensure effective and optimal use of metaphor instructional strategy therefore, it is recommended that:

(i) The use of metaphor as a teaching strategy be adopted by teachers at secondary school level of educational system.

(ii) Government should organize and sponsor teachers to attend training courses on the use of metaphor as an instructional strategy.

(iii) Teachers should harness appropriate and familiar metaphors during teaching to enhance better achievement and performance of the students.

(iv) Teachers should be conversant with previous knowledge of students and make efforts to build on them.

(v) Teachers should evolve an effective procedure of evaluating students' understanding of their teaching in order to find out the effectiveness of the metaphors used in classroom instruction.

(vi) Government should motivate teachers by raising their status and increasing their monthly emolument. This will encourage them to stay in the teaching profession and discharge their duties effectively.

(vii) Authors should use relevant and familiar metaphors for presenting specific concepts and principles in textbooks. This will make students' learning more meaningful and they will be encouraged to read on their own.

(viii) More research should be carried out on the use of metaphor as an instructional strategy to further confirm the findings of this research study. A large population of students and larger number of schools could be used to strengthen the authenticity of the findings.

(ix) More research study on teachers' awareness and use of metaphor as an effective instructional strategy should be conducted.

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