EFFECT OF ROUNDHOUSE TEACHING STRATEGY ON ACADEMIC PERFORMANCE AND INTEREST OF SENIOR SECONDARY SCHOOL BIOLOGY STUDENTS IN PLATEAU CENTRAL EDUCATIONAL ZONE, PLATEAU STATE, NIGERIA

Lapaam, Titus Musa [1], Abdulkarim Ali Deba[1]*, & Shaibu S. Sara[2],
[1] Department of Science Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria
[2] Department of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria
Corresponding author: bautipatrick@gmail.com

Abstract
The study investigated the effect of the roundhouse teaching strategy on the academic performance and interest of SSII Students in Biology. A quasi-experimental design was used, in which pre-test and post-test control groups were involved. The instruments for data collection were the Ecology Achievement Test (EAT) and the Ecology Interest Inventory scale (EIIs). The internal consistency of the instrument was determined using Cronbach Alpha and a reliability coefficient of 0.87 and 0.75 respectively. Data were analyzed using mean and standard deviation. The study showed that Biology students taught using a roundhouse teaching strategy had the highest pretest and post-test mean difference of 31.71 followed by the lecture method of teaching with the least post-test mean difference of 18.72. The findings of this study showed that the male students taught Biology using a roundhouse teaching strategy had a pre-test and post-test mean difference of 31.00. Likewise, the female counterpart who taught Biology with the same teaching method had the highest pre-test mean difference of 41.00%. Therefore, the female Biology students had the highest mean in roundhouse teaching strategy. Also, this study revealed that when the roundhouse teaching strategy is compared with the lecture method, a mean difference of 13.98 was obtained with a p-value of 0.039, indicating a significant difference in favour of the roundhouse teaching strategy. Furthermore, the findings indicated that there is a significant difference in the performance of students taught Biology using roundhouse teaching strategy and lecture methods, F, (df =2, 50) = 3.500, $p < 0.05$ since the computed p-value0.036 is less than 0.05 level of significance. The null hypothesis is rejected. It was recommended that the school authorities integrate and encourage teachers to use the Round House Teaching strategy in teaching and learning Biology in senior secondary schools.

Keywords: Performance, biology, interest, and roundhouse.

Introduction

The academic performance of students is the center around which the whole education system revolves. The success and failure of any educational institution is measured in terms of academic performance of students. Not only the schools, but parents also have very high expectations from students concerning their academic performance, as they believe that better academic results may lead to better career options and future security (Idowu, 2018). These types of performance are attained or acquired after a period of training or learning by the student to acquire knowledge, useful skills, attitudes, and societal values that will make them useful to themselves and society. Agboghoroma and Oyovwi (2015) discovered that the major areas of problem in teaching biology, that resulted in students_ poor performance are rooted in the difficulty of some concepts in biology like ecology. In addition, Agboghoroma and Oyovwi (2015) also identified teachers_ failure to use effective teaching methods that would make the learning of these concepts easier. Ezegbe, Ikwumelu, and Okeke (2012) opined that suitable teaching methods increase students_ interest, which leads to higher performance. Ward and Wandersee (2014) stated that in learning science-related subjects, an effective teaching method should be used in areas of difficult concepts and this will improve students_ performance. Furthermore, they developed Roundhouse's teaching strategy, which allows the use of principles of constructivist learning and helps students understand any difficult concept and easily remember what they have learned without any need for memorization. Based on

the Chief Examiner Report (2018) there was a general decline in academic performance in Biology, in Senior Secondary School Certificate (SSCE). This indicated that the performance of the students in the 2018 SSCE was poorer than that of 2017 with a raw mean score of 30 and a standard deviation of 9.00. When compared with the raw mean score of 31 and the standard deviation of 11.92 of WASSCE. Furthermore, the Chief Examine Report (2018) on the West African Examination Council (WAEC) highlighted student_s weakness in answering some questions in Biology, which was attributed to ineffective methods of teaching and students_ lack of interest in reading and understanding the biological concepts. It is against this background that the present study was carried out to determine the effect of the Roundhouse Teaching strategy on the academic performance and interest of senior secondary school Biology students in Plateau State Central Educational Zone.

Objectives of the Study

Specifically, the objectives of this study were to:

1. Find out whether students' achievement scores taught Biology using a roundhouse teaching strategy will perform better than those taught using the lecture method.
2. Gender will have a significant influence on the student_s achievement scores in Biology well taught using a roundhouse teaching strategy.
3. Determine the differences in the academic performance of students taught Biology using the roundhouse teaching strategy and those taught using the lecture method.
4. Determine the differences in the academic performance of male and female students taught Biology using a roundhouse teaching strategy.

Research Questions

To carry out the research, the following research questions were formulated in line with the objectives of the study:

1. What are the mean achievement scores of students taught biology using the roundhouse teaching strategy and those taught using the lecture method?
2. What are the mean achievement scores of male and female students taught Biology using a roundhouse teaching strategy?
3. What is the difference in the mean scores of students taught Biology using the roundhouse teaching strategy and those taught using the lecture method?
4. What is the difference in the mean achievement scores between male and female students taught Biology using a roundhouse teaching strategy?

Research Hypotheses

The following research hypothesis was tested at a 0.05 level of significance

Ho1: There is no significant difference in mean achievement scores between students taught Biology using roundhouse teaching strategy and those taught using lecture method

Ho2: There is no significant difference in mean achievement scores between male and female students taught Biology using a roundhouse teaching strategy

Ho3: There is no significant difference in the mean achievement scores between students taught Biology using roundhouse teaching strategy and those taught using lecture method.

Ho4: There is no significant difference in the mean achievement scores between male and female students taught Biology roundhouse teaching strategy.

Methods

The design for the study was a quasi-experimental design, which involves a pretest, post-test, and non-equivalent control group design. During the treatment period, the researcher conducted the pre-test and post-test on both 2 experimental groups and control groups with question items for the selected schools. This design investigates the possible cause and effect as well as relationship between two or more variables by the application of treatment which cannot be resolved by mere observation or description‖. The experimental and control groups were pre-tested to determine the

group equivalence at the start of the experiment. The data collected were analyzed using Statistical Package for Social Science (SPSS) version 16.0. Mean and standard deviation were used to answer the research questions, while ANCOVA was used to test the hypotheses at a 0.05 level of significance. The results obtained were used to determine whether there was a significant difference among students who taught Biology using the Roundhouse teaching strategy while the corresponding control group was taught Biology using Lecture Methods. The decision to test the null hypotheses was based on comparing the computed p-value and level of significance. If the computed p-value is greater than 0.05 level of significance, the null hypothesis will be accepted and concluded there is no significant difference between the variables compared. However, if the computed p-value is less than or equal to 0.05 level of significance the null hypothesis will be rejected, and concluded that there is a significant difference between the variables compared.

Post hoc analysis will also be used if the computed ANCOVA value is found to be significant, to determine the group that brings about the significant effect.

Results

Table 1: Mean achievement scores of Pre-Test and Post –Test of Students taught Biology using Roundhouse Teaching Strategy

Teaching method	Pre-Test		Post-Test		Pre-test / Post-test
	n	Mean	SD	Mean	SD	Mean difference
RHS	60	28.500	6.81	60.21	11.73	31.71

The result presented in Table 1 shows that for the group of 60 students taught using the roundhouse Teaching strategy, they scored a pre-test mean of 28.50. There is substantial improvement in their performance after the treatment, with a mean post-test score of 60.21. The post-test mean scores clearly showed that the roundhouse teaching strategy had over a 60 percent improvement in the student_s performance. It is therefore safe to conclude based on the analysis that the roundhouse teaching strategy highly improves the academic performance of students in the plateau central educational zone.

Table 2: Mean Difference of Male and Female Students Taught Biology using roundhouse Teaching strategy

Teaching Method	Gender	Pre-Test			Post-Test		Mean Gain
		N	Mean	SD	Mean	SD	
RHS	Male	60	28.846	6.903	59.846	12.125	31.00
	Female	60	4.243	24.000	65.000	0.000	41.00
	Mean difference		4.846	2.660	-5.154	12.125	-10.00

The result in Table 2 shows that male students taught Biology using a roundhouse teaching strategy had pre-test mean scores of 28.85, there is to a large extent improvement after the treatment with a post-test mean score of 59.85. The pre-test and post-test mean gain of the group is equal to 31.00. Therefore, based on this result, shows clearly that there is an improvement in Biology students_ academic performance. The counterpart female students who taught, Biology using the roundhouse teaching strategy had pre-test mean scores of 24.00 which is an improvement after the treatment with a post-test mean score of 65.00. The mean gain of 41.00 is observed, which shows the magnitude of the improvement between the pre-test and post-test in Biology students_ academic performance. The post-test mean difference of -5.15 is observed between the male and female Biology students taught using the roundhouse teaching strategy in Plateau state.

Table 3: Mean Difference between roundhouse teaching strategy and lecture Methods on Students' Performance in Biology

Teaching Method	Experimental and Control Group	
	Pre-test Mean	Post-Test Mean
RHS	28.500	60.21
LM	30.27	48.73
Mean Difference	= -1.77	= 11.48

The result in Table 3 presented the mean difference between the experimental and control groups of Biology students taught using roundhouse teaching strategy (experimental groups) and lecture teaching method (control group). The pretest mean difference of -1.77 was obtained between the roundhouse teaching strategy group (experimental group I) and the lecture teaching method (control) which means the lecture method teaching strategy group supersedes the roundhouse teaching strategy group by 1.77. It is, therefore, seen as the groups are equivalent. Based on this, it is concluded that the two groups are equivalent for comparison. Furthermore, the post-test mean difference between the roundhouse teaching strategy (experimental group I) and lecture method (control group) is 11.48 which shows that the roundhouse teaching method group supersedes the lecture method in terms of improving students_ academic performance in biology in Plateau state secondary schools.

Table 4: Summary of one - way Analysis of Covariance (ANCOVA)

Source	Type II Sum of Squares	Df	Mean Square	f	sig	Partial Eta Squared
Corrected Model	1994.787a	6	332.465	2.404	0.037	0.189
Intercept	8028.646	1	8028.646	58.044	0.000	0.484
Pretest	33.916	1	33.916	0.245	0.622	0.004
Teaching. Methods	968.371	2	484.185	3.500	0.036	0.101
Error	8575.850	42	138.320			
Total	227515.000	50				
Corrected Total	10570.638	49				
a. R Squared= .189	(Adjusted R	Squared= no.)				

***Hypothesis 1*:** There is no significant difference in mean achievement scores between students taught Biology using the roundhouse teaching strategy and those taught using the lecture method. The result in Table 4 shows that F, (df = 2, 50) = 3.500, where $p < 0.05$, thus indicating the computed p-value 0.036 is less than 0.05 level of significance with a medium effect size

(partial eta squared = 0.101). Therefore, the null hypothesis is rejected, meaning that there is a significant difference between the performance of students taught using the roundhouse teaching strategy and lecture methods. Hence, Bonferroni multiple comparison analysis was run to compare the teaching methods to determine the teaching method that is responsible for the significant difference.

Table 5: Bonferroni Multiple Comparisons Analysis

(RH) teaching methods	**(L) teaching methods**	**Mean Difference (RH-L)**	**Std. Error**	**Sig.a**
Roundhouse teaching strategy	Lecture teaching method	13.980*	5.459	0.039
Lecture teaching method	Roundhouse teaching strategy	-13.980*	5.459	0.039

The mean difference is significant at the 0.05 level.

Table 5 shows the results of Bonferroni's Multiple Comparisons of treatments. The result indicates that the roundhouse teaching strategy is compared with the lecture teaching method the mean difference of 13.98 is obtained with a p-value of 0.039 indicating there is a significant difference in favour of the roundhouse teaching strategy method.

Hypothesis 2*:* There is no significant difference between the performance of male and female students taught Biology using roundhouse teaching strategy and lecture methods.

Table 6: ANCOVA Test of Significant Difference in the Performance of Male and Female Students taught Biology using roundhouse teaching strategy and lecture method

Table 6: Summary of one - way Analysis of Covariance (ANCOVA)

Source	Type II Sum of Squares	Df	f	Sig	Partial Eta Squared
Corrected Model	1994.787a	6	2.404	0.037	189
Intercept	8028.646	1	58.044	0.000	.484
Pretest	33.916	1	0.245	0.622	.004
Gender	19.678	1	0.1420	0.707	0.002
8575.850	8575.850	42			
Total	227515.000	50			
Corrected Total	10570.638	49			

The result in Table 6 shows that, F (df = 1, 50) =0.1420, p>0.05. Thus, the computed p-value (0.707) is greater than the 0.05 level of significance, therefore, the null hypothesis of no significant difference is not rejected, which means there is no significant difference between male and female

Students taught Biology using a roundhouse teaching strategy and lecture method on the students_ performance in Biology.

Discussion

The findings of this study were discussed and compared with similar studies in the literature. The discussion followed the main research findings of the study. The findings of the study showed that the Biology students taught using the roundhouse teaching strategy had the highest pretest and post-test mean difference of 31.71 followed by the lecture method of teaching with the least post-test mean difference of 18.72. The findings of this study agreed with Ibe et al., (2013) who also found that students who taught biology using a roundhouse teaching strategy had the highest pre-test and post-test mean of 42.67. This was followed by the lecture method of teaching, with the least post-test mean difference of 42.67. 22.60. Another result of this study showed that the male students taught Biology using a roundhouse teaching strategy had a pre-test and post-test mean difference of 31.00. Likewise, the female counterpart who taught Biology with the same teaching method had the highest pre-test mean difference of 41.00%. Therefore, the female Biology students had the highest mean in roundhouse teaching strategy. The findings of this study are also in line with the result of Ali *et al*., (2015). Who reported that the female counterpart who taught Biology using a roundhouse teaching strategy had the highest pre-test mean difference of 51.00% compared with the male counterpart who had 36.00%. Another finding of this study revealed that when the roundhouse teaching strategy is compared with the lecture method a mean difference of 13.98 was obtained with a p-value of 0.039 indicating there is a significant difference in favour of the roundhouse teaching strategy. The findings of this study agreed with Al-Kahllut *et al*., (2012); Al-Mazrou and Haya (2015) who found that there is a significant difference in favour of the roundhouse teaching strategy. The findings of the study also indicated that there is a significant difference in the performance of students taught Biology using roundhouse teaching strategy and lecture methods, F, (df =2, 50) = 3.500, $p < 0.05$ since the computed p-value0.036 is less than 0.05 level of significance. The null hypothesis is rejected.

Conclusion

Based on the findings of this study, it is, therefore, concluded that the use of a roundhouse teaching strategy has highly improved students_ performance in Biology. However, the lecture method also enhanced students' performance in Biology. The gender barriers of the students do not influence their performance in Biology.

Recommendation

1. It is recommended that the school authorities should integrate and encourage teachers to use the Round House Teaching strategy in teaching and learning Biology in senior secondary schools.

Reference

Abu, J., Saleh, M., & Ali. A. (2018). *Educational psychology.* Al-Massira house.

Agboghoroma, P. R., & Oyovwi, T. O. (2015). Evaluating effect of students_ academic achievement on identified difficult concepts in senior secondary school biology in Delta State. *Journal of* Education *and Practice*, **6**(30), Retrieved on 19th March 2017 via www.iiste.org.

Al-Kahllut, A. A. (2012). The effectiveness of using the roundhouse strategy on developing the concepts and visual thinking skills among the female students in the 11th Grade in Gaza in geography. *UnpuIslamic University, Gaz*a.

blished MA thesis, Al-Mazrou, H. (2015). Roundhouse diagram strategy: Effectiveness in the development of metacognitive skills and the achievement in science among female secondary stage students of different mental capacities. *Arabian Gulf Message, **26*** (96), 13-67.

Almazroua, H. (2015) The effectiveness of teaching by the strategy of roundhouse in developing the skills of beyond knowledge for the students of secondary stage with a different mind capacity. *Magazine of the Message of Arabian Gulf Issue 9613-67.*

Al-Zayat, F., & Mustafa, C. (2014). The psychology of learning. *Cognitive Perspective. **2***(4), 207-210

Ezegbe, B. N., Chikwelu, C. H., & Okeke, J. N. (2013). Effect of simulation method on secondary school students_ achievement in Government. *Ikenga International Journal of African* Studies. ***15***(**2**), 76-91

Ezeudu, S. D. & Otor, P. (2016). Relative effectiveness of inquiry and expository methods of teaching social studies on academic performance of secondary students in Akwa Ibom, Nigeria. *British Journal of Arts and Social Sciences, **8*** (1),92-102

Ibe, H. N. (2013). Effects of guided inquiry and expository teaching methods on senior retention scores: A case of problem-based learning method. *International Journal of School Students,* **3 (**4), 12-16.Retrieved on 5th March, 2018 www.epj.com

Jika, H. A. (2019). Effect of guided inquiry teaching strategy on academic achievement and interest of senior secondary school students in biology in Taraba State *(Unpublished Masters in Technology Education Thesis).*

Musa, O.D. (2018) *Concise text in educational research* (Revised Edition)

Nwafor, C. E. & Oka, O. O. (2018). Effects of computer assisted instruction on junior secondary school students_ achievement in basic science. *International Journal of Scientific & Engineering Research, 7*(**1**0), 29-55. Retrieved from www.ijser.org.

Nwajiubu, A. S. (2018). Students_ ability level and their competence in problem-solving tasks in physics. *International Journal of Educational Research and Technology*, **1**(2), 35-47. Retrieved June 12th, 2014 from http://www.soeagra.com

Oghenevwede, A. E. (2014). Effects of discovery and inquiry approaches in teaching and learning of biology on secondary schools students_ performance in Delta State,Nigeria. *Journal of Research in Education and Society* ***1***(1), 30-39 Retrieved on 12th July, 2019 http://www.icidr.org/jres

Okeke, R. (2018). Some definitions of science. American Scientist, 87-462. From www.ddceutkal.org/syllabusRetrieved on 1st August,, 2018 on Secondary School Students_ Learning Outcomes in Biology. *Unpublished Doctor of Philosophy Thesis*. Ekiti State University, Ado-Ekiti. Ekiti State, Nigeria.

Onyenechere, E. C. (2014). Gender and geography: A preliminary survey of gender balance of academies in Nigerian university Geography Departments. *Nigerian Geographical Journal, (NGJ)* **10**(1), 81-96. Retrieved June 12th, 2018 http://www.ngja.com

Torty, O. U., & Offorma, G. C. (2013). Effect of collaborative learning method on secondary students_ interest in English language tenses. *International. Journal of Education,* **12**(2).128-135.

Ude, V. C., & Ezugwu, E. N. (2019). Extent of provision and utilization of instructional media Umoh, C. G. (2013). A theoretical analysis of the effects of gender and family education on human resources development. *Journal of Curriculum Organization of Nigeria*, **10**(1)

Ward, R. E, & Wandersee, J. (2013). Visualizing science using roundhouse diagram. *Science Scope, **24*** (4), p.p.17-21.

Ward, R. E., & Wandersee, J. H. (2012). Students' perceptions of roundhouse diagramming: A Middle-School viewpoint. *International Journal of Science Education,* **24**(2): 205-225.

Ward, R. E., & Wandersee, J. H. (2014). Struggling to understand abstract science iopics: Roundhouse diagram-based study. *International Journal of Science Education,* **24**(6): 575-591.

West African Examination Council (2017). *West African Examination Council, Chief Examiners Report.* Published by WAEC.

West African Examination Council (2018). *West African Examination Council, Chief Examiners Report.* Published by WAEC.