

IMPACT OF HANDS -ON LEARNING ACTIVITIES ON ACADEMIC ACHIEVEMENT OF SENIOR SECONDARY BIOLOGY STUDENTS IN ZARIA, KADUNA STATE KADUNA STATE

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Abstract

This study was designed to find out the impacts of hands- on learning activities on academic achievement of senior secondary school biology students in Zaria, Kaduna State. A pretest-posttest quasi-experimental-Control group research design was used for the study. The population of the study consisted of 4360 SS1 Students in Zaria educationa Zone, Kaduna State. Two co-educational secondary schools were purposely selected .In each of the two schools a total of 50 SS I biology students of both sexes (25 Males and 25 Females) were selected randomly and assigned to experimental group and a control group. The Experimental group was taught Biology concepts with hands-on learning activities while the control group was taught with Lecture Method. Two research questions and two null hypotheses guided the study. Biology Achievement Test (BAT) validated by experts with reliability co-efficient 0.77 was the instrument for data collection. Independent sample t-test through SPSS was used to analyze the data at 0.05 alpha levels of significance. The findings showed that the students taught Biology concepts with hands - on learning activities achieved higher than those taught with lecture method. Based on the finding of the study some recommendations were made among which was that Biology teachers should use hands - on learning activities during teaching and learning as it encourage active students participation and also facilitate higher achievements in biology.

Introduction

The constant use of lecture method is not encouraging learning of biology in secondary school. Findings from the study of Adeyemi (2008) and Lawal (2009) revealed poor performance of students when teacher-centered instructional strategy is used in the classroom. Thus, creativity in the classroom is not being encouraged (Nwosu, 2004). Bolaji (2004) questioned the possibility of the Nigerian child coping with the workforce of the 21st century which requires manipulative skills and ability to create and solve problems on their own. To achieve this objective, teachers have to use methods that encourage creativity in biology among which is hands-on learning activities. According to Ibe (2011) and Ornstein (2006) science instructions should be hands-on-mind-on activity in order to promote process skills acquisition and creativity in students.

Thomas and Aaron (2009) defined hands-on learning as materials-centered learning, activity-centered learning, manipulative learning, inquiry learning or students-centered learning. It involve learning by doing rather than learning from books or lectures .According to Ruby (2001), Hands- on science activities are variety of activities that may or may not be

actual experiments, such as observation or measurement, not necessarily carried out in laboratories. Lumpe and olive (1991) defined hands-on activities as activities that allow the students to handle, manipulate or observed the scientific processes. According to Flannery (2001), hands-on science learning fosters the mind in more basic ways by extending the links between the brain and the hand. Different memories such as auditory, visual, tactile and body motor functions are all involved in hands-on learning activities and this makes information which involves all the memories become stronger and retrievable.

Researchers such as Randler and Hulde (2007), Hussain and Akhtar (2013), and Ozlem and Ali (2011), have shown that students who were exposed to learning using hands-on activities in different areas achieved better than those not exposed. But, Areepattamannil (2012) and Kalender and Berberoglo (2009) in their separate findings found out that Hands-learning activities had negative effects on science achievement of schools students in Qatar. Hence, studies in this area is inconclusive and this is the rationale for this study.

In study on gender and academic achievement using hands-on learning activities. Hussain and Akhtar (2013), Pine, Aschbacher, Roth, Jones, McPhee, Martin, Phelps, Kyle, and Foley, (2006), found no gender differences in academic achievement but studies by Randler and Hulde (2007), Burkam, Lee and Smerdon (1997), Hussain and Akhtar (2013) found out that female students achieved better than boys. These studies also investigated the effects of gender on academic achievement using hands-on learning activities.

Purpose of the Study

This study sought to find out:

- (i) The impact of hands-on learning activities on the academic achievement of senior secondary Biology students in Zaria.
- (ii) Whether there was any significant difference in the academic achievement of students taught using hands-on learning activities based on gender.

Research Questions

In the cause of this study, answers were provided to the following research questions:

- (i) Will there be any impact of hands-on learning activities on the academic achievement of students in biology?
- (ii) Is there any difference in the academic achievement of students in Biology based on gender when taught using hands- on learning activities?

Null Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

- Ho₁ There is no significant difference between the mean achievement scores of students taught with hands-on learning activities and those taught with lecture method.
- Ho₂ There is no significant difference in the achievement of male and female students taught biology with hands-on learning activities.

Methods

A Pretest-Posttest quasi- experimental-Control group research design was used for the study. The population consisted all the SS I students in Zaria Educational Zone with the total of four thousand three hundred and sixty students (4360). Two co-educational senior schools were purposively selected for the study and a sample of one hundred (50) students comprising 25 Males and 25 Females were randomly drawn from each of the two co-educational schools and were assigned to experimental and the control group by simple random sampling method.

The instrument used was Biology Achievement Test (BAT) constructed by the researcher, which comprises thirty (30) items multiple choice questions with options A to D. The instrument was validated by experts in Biology Education and Measurement and Evaluation who are master's degree holders in their fields of study. The corrections made by these experts were noted and used to improve the quality of the final instrument. The reliability of BAT was established using test re-test method. The correlation co-efficient was 0.77 which was considered adequate for the study. The BAT was administered to both the students in experimental and control group as pretest before the treatment commenced and scores were recorded. Students in experimental group were taught some biology concepts with hands-on learning activities by the teacher while students in control group were taught with Lecture Method (LM) without exposing them to hands-on activities. After 6 weeks, the same test (BAT) was re-administered to the groups as post-test. Data from the two administrations were analyzed using t-test statistics to test for significant difference at 0.05 level.

Results

Research Question 1

Will there be any impact of hands-on learning activities on the academic achievement of students in biology?

Table 1: Summary of the descriptive statistics of means scores of hands - on learning activities and lecture method

Groups	N	Mean	SD	SE
Experimental	50	57.56	7.5	2.05
Control	50	9.7	4.6	1.51

Table 1 shows that, the mean achievements score of experimental and control group was 57.56 and 9.7. This implied that students taught biology using hands-on learning activities has the highest means scores than those taught with lecture method. In order to test for significant difference, the students mean academic achievement based on the use of hands-on learning activities and lecture method, hypothesis one was tested as:

HO₁: There is no significant difference between the mean gain scores of students taught with hands-on learning activities and those taught with lecture Method (LM).

Table 2: Comparison of posttest means scores of experimental and control group using BAT

Groups	N	X	SD	SE	df	t-cal	t-crit	P-value	Remark
Experimental	50	57.56	7.5	2.05	46	6.6	2.86	0.01	Significant
Control	50	9.7	4.6	1.51					

The result in Table 2 shows a calculated p-value of 0.01 which is less than p-value of 0.05 significant levels. This shows that, there was statistical significant difference between the means scores of the experimental and the control group in favor of the experimental group. The null hypothesis of no significant difference is therefore rejected. This by implication means that, the students who were taught with hands-on learning activities performed better than those in the lecture class. Hence, hands -on learning activities produced a higher effect on students' academic achievement.

Research Question 2

Ho₁: To what extent do the mean scores of male students taught biology using hands-on learning activities differ from the mean scores of the female taught by the same method?

Table 3: Summary of descriptive statistics of means scores of male and female taught using hands-on learning activities

Groups	N	Mean	SD
Male	25	26.69	4.71
Female	25	18.23	3.42

Table 3 showed that, the mean achievement score of male students was 26.69 and that of the female was 18.23. This implied that male students had the highest means score. In order to test for significance difference of the students mean academic achievement based on gender, hypothesis 2 was tested as:

Ho₂: There is no significant difference in the achievement of male and female students taught biology with hands-on learning activities.

Table 4: Comparison of male and female Biology students taught using hands-on learning activities

Groups	N	X	SD	df	t-cal	t-crit	P-value	Remark
Male	25	26.69	4.71	46	3.94	2.86	0.004	Significant
Female	25	18.23	3.4					

The result in Table 4 reveals that t-value observed was 3.94 and the p- value of 0.004 at degree of freedom 66. Since p-value 0.04 is less than $p \leq 0.05$. There was significance difference in the means scores of male and female exposed to hands-on learning activities. The significance is in favor of male as revealed in the mean scores.

Discussion

The results of the study showed that hands-on learning activities had a significant effect on student's achievements in Biology. Students who were taught biology by hands-on learning activities achieved better with a mean achievement score of 57.56 than the control group that went through lecture method with a mean achievement score of 9.7. This result is in line with Young and Lee, (2005), Pine *et al.* (2006), Randler and Hulde (2007), Hussain and Akhtar (2013), and Ozlem and Ali (2011), who found that students exposed to hands-on learning activities achieved better than those taught with lecture method. This by implication, means that students taught with hands-on learning activities learned biology concepts better than those taught with lecture method as earlier stated by Ornstein (2006), but the finding of this study contradict that of Areepattamannil (2012) and Kalender and Berberoglo, (2009) who found negative effect of science achievement when hands-on learning activities was used. The hands-on learning activities enable the students to participate fully in the lesson since is activity-based. Furthermore, Tharp and Gallimore (2008) stated that classroom instructions should be child-cantered. Biology teachers should provide variety of learning experiences for the students, give individual student the opportunity to ask questions and draw inferences from their observations. The hands-on learning activities not only provided enough learning experiences but also allowed the students to ask questions relevant to the lesson.

Findings from the study also revealed a significant difference in biology achievement between male and female students: The t-cal. of 3.94 is greater than t-crit of 2.86 in favour of the male. This contradict the finding of Young and Lee (2005), Pine *et al.* (2006), Hussain and Akhtar (2013), who found no gender differences in academic achievement when students were taught with hands-on learning activities. It also negates the findings of Burkam, Lee and Smerdon (1997), and Randler and Hulde (2007). The hands-on learning activities in this study proved that male achieved more than female students.

Conclusion

The finding of this study has shown that hands-on learning activities increases biology student's academic achievement as stated by Ornstein (2006). This is because hands-on learning activities involve active participation of students during classroom lesson and it involves manipulation of objects using the processes of science. The study also revealed that male students achieved higher in science classroom than the female students looking at the means scores of their achievement test.

Recommendations

The following recommendations were made:

- (i) Biology teachers should enhance their teaching effectiveness by adopting hands-on learning activities.
- (ii) Regular workshops, seminars and conferences should be organized by stakeholders in education for science teachers to update their teaching strategies; and
- (iii) The teacher training institutions should include hands-on learning activities in biology course content.

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