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IMPACT OF EXPERIENTIAL LEARNING STRATEGIES ON SECONDARY SCHOOL STUDENTS SCHOLASTIC ACHIEVEMENT IN BIOLOGY

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Abstract

This study investigated the effects of experiential learning strategies on secondary school students' achievement in biology. The study conducted on a non equivalent control group quasi experimental design. The treatment group was taught biology using the experiential learning strategies while the control group was taught the same concepts in biology using the expository strategies. A biology Achievement Test was used to collect data . The result revealed that experiential learning which a vital aspect of "Live Science" is superior to the conventional expository strategy in enhancing students' achievement in biology.

Introduction

There has been a gradual paradigm shift in biology education from transmission of biological information to the processes by which biological knowledge is acquired. Emphasis in biology education, therefore, is now on students' involvement in their own learning through active participation in the learning process. In this way, students will be able to connect the biological facts, theories and principles they have learnt in biology classrooms to real purposes and practices in the world in which they live. To achieve this, appropriate opportunities should be provided during biology instructions for students to learn from direct experiences through manipulation of materials and engaging in science processes. This method of learning is referred to as experiential learning. An experiential learning classroom is characterized by students active participation in the learning process such that learning becomes interactive, cooperative and collaborative (Wikipedia 2013). In such a classroom, students are provided opportunities to make discoveries and gain firsthand knowledge through observation and experimentation rather than learning or reading about others people's experiences (Moon, 2004).

At the heart of all learning is the way we process our experiences, especially our critical reflections on our experiences. This module introduces experiential education as a key

approach to student-centred learning for a sustainable future. Experiential learning engages students in critical thinking, problem solving and decision making in contexts that are personally relevant to them. This approach to learning also involves making opportunities for debriefing and consolidation of ideas and skills through feedback, reflection, and the application of the ideas and skills to new situations. The great Greek Philosopher and teacher Aristotle who once said: For the things we have to learn before we can do them, we learn by doing them". Experiential learning focuses on the learning process for the individual and can exist with or without a teacher or facilitator (Kolb, 1999). Experiential learning is in contrast to rote didactic learning that is popular with most biology teachers. Most biology teachers are pre-occupied with verbal instructions through lecturing, exposition, discussions and questioning and neglect concrete sensory experiences which give meaning to words.

With the recognition that science is more than just a subject at school, to impact knowledge and skills adopted from past approaches it has become very obvious that approaches aimed at integrating love learning and live science be emphasized in our science instructions. This will facilitate the acquisition of 21st Century skills not only for sustainable and responsibly citizenship but for a career in an increasing science and technology driven world society. Although experiential learning is said to expose the learners to real life situations in the classroom, its efficacy for biology instruction has not yet been explores empirically in our conventional classrooms. This study is, therefore, focused on the exploration of the effects of experiential learning on secondary school students' achievement in biology.

Achievement tests have always been part of school, but they have taken on more pronounced importance in American education with the passage of the 2001 No Child Left Behind Act. Achievement tests are typically standardized and designed to measure subject and grade-level specific knowledge. Historically, they have been used as a way to determine at what level a student is performing in subjects such as math and reading. The 2001 law, which was replaced in 2015 with President Obama's Every Student Succeeds Act, linked the results on achievement tests to a wide range of political and administrative outcomes, from funding of school programs to individual teacher salaries.

History

The origins of standardized testing go back to the Confucian era in China when would-be government officials were screened for their aptitudes. Western societies, indebted to the models provided by Greek culture, favored testing by essay or oral examination. With the industrial revolution and the explosion in childhood education, standardized tests emerged as a way of assessing large groups of children quickly.

In France in the early 20th century, the psychologist Alfred Binet developed a standardized test that would eventually become the Stanford-Binet Intelligence Test, a major component of the modern IQ test. By World War I, standardized tests were a common way to assess the fitness for various branches of the armed forces.

Achievement Test and Measurement

The most common standardized tests are the ACT and SAT. Both are used to determine the fitness of prospective college students. Different tests are more popular in different parts of the country, and they test slightly differently. Students show a propensity for one test or the other: the SAT is geared toward testing logic, while the ACT is considered more a test of accumulated knowledge. No Child Left Behind opened the door to more extensive testing, as the results of achievements became a measure of a school's effectiveness. The explosive growth in the testing industry answered a call for assessments in grade schools as well, with students typically facing standardized testing every year after the third grade.

Popular Achievement Tests

In addition to the ACT and SAT, there are a number of achievement tests that are given to students in American public schools. Some of the most popular assessments are:

Wechsler Individual Achievement Test (WIAT)

Kaufman Test of Educational Achievement (KTEA)

Woodcock-Johnson Tests of Achievement (WJ)

Peabody Individual Achievement Test (PIAT-R)

Metropolitan Achievement Test (MAT)

National Assessment of Educational Progress (NAEP)

Statement of the study: TO STUDY THE IMPACT OF EXPERIENTIAL LEARNING STRATEGIES ON SECONDARY SCHOOL STUDENTS SCHOLASTIC ACHIEVEMENT IN BIOLOGY

Definition of Keywords

Achievement test :

Achievement tests are paper-and-pencil, usually group administered tests that emphasize factual information and its use in problem solving.

Scholastic achievement:

Scholastic achievement means academic achievement relating to school education. Pupil will learn various subjects in Secondary School. Achievement in those subjects is called Scholastic achievement.

Experiential Learning:

Experiential learning is the process of learning through experience, and is more specifically defined as "learning through reflection on doing".

Objectives of the study

The main objective of this study is to explore the effects of experiential learning on secondary school students' achievement in biology. Specifically the study explored:

(i) The effects of experiential learning on students achievement in biology

(ii) The effects of experiential learning on the mean achievement of male and female students in biology

(ii) The interaction effects of methods and gender on students mean achievement in biology.

Research Questions

1. What is the effect of experiential learning on the mean achievement scores of secondary school students in biology?

2. What are the mean achievement scores of male and female students taught biology concepts using experiential learning strategy?

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

Ho$_1$: There is no significant difference in the mean achievement scores of students taught biology concepts by experiential learning strategy and students taught same concepts using expository method of teaching.

Ho$_2$: There is no significant difference ($P<0.05$) in the mean achievement scores of male and female students taught biology concepts using experiential learning strategy

Ho$_3$ There is no significant interaction effect between teaching method and gender on students' achievement in biology.

Method

A quasi experimental research of the pre test post test non equivalent control group design was used for the study. The study was conducted in senior secondary schools in Awka urban area of Anambra State in Nigeria. The sample consisted of 72 senior secondary year I (SSI) biology students (32 males and 40 females) drawn from two co-educational secondary schools. In each school one intact class of SSI was randomly sampled by balloting and all the students in the two intact classes were used for the study. One of the two schools was designated experimental school and the other control school. The experimental school was assigned the experiential learning strategy while the control school was assigned the expository method of teaching. The experimental group consisted of 18 boys and 20 girls (N=36) while the control group consisted of 16 boys and 20 girls (N=36).

The instrument used for data collection was a Biology Achievement Test (BAT). BAT has a 20 item achievement test developed by the researchers based on the following biology

Units and Subunits:

Skeleton and supporting tissues, Types of skeleton, Structure and functions of Different bones of the human skeleton.

Experimental Procedure

The regular biology teachers in the selected schools were used for the study. The teacher in the experimental school was trained on how to conduct instructions in biology using experimental learning strategy. The teacher in the experimental school involved the students in assembling bones and skeletons from paper craft, clay modeling . In addition the students in the experimental school were given individual projects involving assembling different

bones of large mammals like goats, sheep or cattle to preparing a skeleton of a rat or rabbit. In general the students were made to learn by doing. The students were then taught different bones of the skeleton system using the bones they collected and the skeleton they prepared. During the lesson the students interacted among themselves, with the teacher and with the instructional materials they had produced themselves. The students in the control schools were taught using the already preserved bones and the commercially produced skeleton in the biology laboratory. BAT was administered as pretest before treatment and as posttest at the end of treatment. Research questions were answered using mean and SD while the hypotheses were tested at an alpha level of 0.05 using Analysis of Co-variance (ANCOVA).

Results

Table I: Mean achievement and standard Deviation scores of student in BAT due to teaching method

Teaching Method	Statistic	Mean Achievement	Mean Difference
Experiential learning with sample size N = 36	X	71.01	
	SD	9.90	20.61
Expository method with sample size N = 36	X	50.53	
	SD	9.63	

Table I shows that the mean achievement score of students taught biology concepts using experiential learning strategy was 71.21 while those taught the same biology concepts using expository method had a mean achievement score of 50.53. This shows a mean difference of 20.68 in favour of the experiential learning group.

Table 2: Mean achievement and standard Deviation scores of male and female students in BAT due to teaching methods and gender.

Teaching Method	Statistic	Achievement test scores		
		Male	Female	Mean Difference
Experiential learning	X	74.95	69.00	
	SD	7.77	10.71	6.78
	N	16	20	
Expository method	X	54.09	49.50	
	SD	9.063	10.03	2.99
	N	16	20	

Table 2 shows that the mean achievement scores of male and female students taught biology concepts using experiential learning strategy were 74.78 and 68.00 respectively while the

mean scores for male and female students taught with expository method were 52.19 and 49.20. The gender difference in mean score for the experiential group was 6.78 in favour of the male students while the expository group gender difference in mean score was 2.99 in favour of the male students.

Table 3: Analysis of Covariance (ANCOVA) on students Achievement due to teaching method.

Source of variation	Sum of squares	N	df	Mean square	F	F.Crit value
Covariates	218.899	72	1	218.999	2.430	
Pretest	218.899	72	1	218.999	2.430	
Main Effect	8326.400	72	2	4163.400	46.298	
Method	7555.541	72	1	7555.545	84.023	3.96

Table 3 shows that F.calculated value (84.023) > F.critical value (3.98) at an alpha level of 0.05, therefore, is a statistically significant difference in the mean achievement scores of students taught biology concepts using experiential learning strategy and those taught the same concept using expository method. This shows that the mean score for students taught using experiential learning strategy (mean = 71.21) was significantly higher than the mean score of those taught with expository method (Mean= 50.53).

Table 4: Analysis of Covariance (ANCOVA) on achievement of male and female students in the experiential learning group.

Source of variation	Sum of squares	Df	Mean square	F	F.Crit value
Covariates	358.280	1	358.280	4.035	
Pretest	358.280	1	358.280	4.035	
Main Effect	202.365	1	222.365	2.279	
Gender	202.365	1	222.365	2.279	4.11
Explained	560.645	2	280.322	3.157	
Residual	3107.671	35	88.791		
Total	3668.316	37	99.144		

Table 4 shows the F.calculated value (2.279) < critical value (4.11) at 95% confidence level implying that there is no significant difference between the mean scores of male and female students taught using experiential learning strategy. This implies that the mean score for male students taught using experiential learning strategy (Mean 74.78) and that of female students taught using the same experiential learning strategy (Mean 68.00) do not differ significantly.

Table 5: Analysis of Covariance (ANCOVA) on the interaction effect between teaching methods and students gender on achievement.

Source of variation	Sum of squares	Df	Mean square	F	F.Crit value
Covariates	218.999	1	218.999	2.434	
Pretest	218.999	1	218.999	2.434	
2-way interactions	53.453	1	53.453	.594	3.98
METHOD GENDER	53.453	1	53.453	.594	
Explained	8598.751	4	2149.688	23.906	
Residual	6204.613	69	89.922		
Total	14803.365	73	202.786		

Table 5 shows that the F= .594 (calculated) while the critical value is 3.98 at an alpha of 0.05. As such there is no significant interaction between method and gender on students mean achievement in biology.

Discussion

The results of this study showed that experiential learning strategies enhanced male and female students' achievement in biology more than the expository method of teaching. This showed that involving the students in hand-on-mind-on scientific activities enabled them to understand the biology concepts better than they would if they were just given verbal information. In this study, students produced mammalian bones from clay modeling and paper craft participate in sorting, classifying, identifying and labeling the bones of the humans and animals. In addition the students related each bone type to its function. All these experiences enable the students in the experimental group to learn the "skeletal system" in Human and animals better than students in the control group who were given verbal instructions on the "Skeletal System" and shown samples of different types of bones.

These findings are in agreement with what the great Greek Philosopher and teacher Aristotle who once said: For the things we have to learn before we can do them, we learn by doing them". Experiential learning is learning by doing, hence the biology students in the experience learning group excelled. The study also showed that experiential learning strategies can enhance achievement in biology for both male and female students.

Conclusions and Recommendations

Experiential learning strategy has been found from this study to be an effective instructional strategy in biology. Experiential learning provides an excellent opportunity for students to gain real-world experiences while learning biology

Based on the findings of this study, the following recommendations were made;

1. Biology teachers should adopt experiential learning strategy as an effective strategy for teaching biology to secondary school students.
2. Curriculum development personeels should incorporate experiential learning as an approach for effective teaching of biology in secondary schools.
3. The various science teacher education programmes in Colleges of education should incorporate experiential learning strategies into their various teacher education programs so as to prepare teachers on how to conduct instructions in biology using experiential learning strategy.

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