Quest Journals
Journal of Research in Humanities and Social Science
Volume 9 ~ Issue 1 (2021)pp: 62-68
ISSN(Online):2321-9467
www.questjournals.org

Research Paper

Impact of Biology Terminologies Subsumers on Secondary School Students' Achievement in Jalingo Education Zone, Taraba State, Nigeria

OBIOHA, N.C
Department of Science Education, Taraba State University Jalingo

DANJUMA, G. S.
Department of Science Education, Taraba State University Jalingo

ABSTRACT
The study tried to find out the impact of subsumers of biology terminologies on secondary school students' achievement in Jalingo education zone. The Research design was Quasi-experimental.2 intact classes comprising of 184 students randomly sampled out of 366 Secondary School 2 students were used for the study. 3 objectives, 3 research questions and 3 hypotheses guided the study. The research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 level of significance using ANCOVA. The reliability of the instrument "Biology Achievement Test (BAT)" was found to be 0.77 with Spearman Brown correlation coefficient. Results showed that the use of subsumers improves students' achievement among others. It was concluded among others that gender is a significant factor in biology achievement. One the recommendations was that Biology teachers should endeavour to use subsumers to Biological terminologies ahead of instruction
KEYWORDS*: Biologic Terminologies, sub-sumption, Binomial Nomenclature, Academic Performance.*

Received 27 December, 2020; Accepted 07 January, 2021 © The author(s) 2021.
Published with open access at www.questjournals.org

I. INTRODUCTION

Biology is one of the secondary school science subjects that equip the learner with the knowledge of living organisms and their vital processes. It encompasses diverse fields, including botany, conservation, ecology, evolution, genetics, marine biology, medicine, microbiology, molecular biology, physiology, and zoology (Kara Rogers, 2012). The subject aims at increasing understanding of living systems and to allow one to consider the systems in relationship to self and other organisms in the natural environment. An advantage of biology is the application of theory to the real world. The goal is to be able to test theories developed about living things by utilizing the scientific method and then to apply the new information in a beneficial way. One of the strategies of attaining this goal is the use of Science fairs and field trips as avenues of providing opportunities for students to gain hands-on and minds-on knowledge of living systems (NPE, 2004). This may enable students to understand biology terminologies they could not come to terms with during classroom instruction.

The excessive terminologies load in biology may be a hurdle for developing conceptual understanding as well as achieving core competencies such as scientific literacy and communication in Science terminologies which are predominately based in the Latin and Greek languages. Terminology is the doctrine of terms; a theory of terms or appellations; a treatise on terms. Science involves the usage of myriad of terms, which essentially need to be comprehended correctly. People involved in the science field encounter innumerable terms during their study, research, or work. Moreover, since science is a part of everyone's life, it is something that is important to all individuals.

Understanding some basic terminologies in biology could be helpful when learning the subject. One of the factors identified by WAEC biology chief examiner was students' inability to understand biology terminologies (WAEC 2017 -2018). Understanding basic terminology around investigations, graphing and common representations can make learning biology a whole lot easier. To achieve scientific literacy and

successfully communicate about concepts in biology, the learner should be able to master (understand and effectively use) the discipline-specific vocabulary (National Academies of Sciences, Engineering, and Medicine, 2016). Hence, learning in biology requires not only developing an understanding of the concepts and mastery of skills, but it is also about learning the language of the subject which could be attained through the use of subsumptions.

Subsumption to biological terminologies is a multidimensional and hierarchical entity that is dynamic in nature and consists of different types of knowledge and skills. It simply means exposing students to commonly used terms in the field of biology and the meaning of such terms before the commencement of the proper lesson. Also, Hartlay and Davis in Igboji nwaekwu (2012) opined that when students are exposed to biological terminologies before the commencement of a lesson, it gives the students good understanding during learning activities, permits students to study more effectively and reduce the time wasted on irrelevant materials. It should be noted that the way learning material is introduced to the learner has a great deal to do with students' motivation and learning. Carefully designed and adequately prepared introductory activities can do a great deal to bridge the gap between what had been learnt and what to be learnt. Trying to learn something without having adequate knowledge of its terminologies or, worse, having misconceptions, may result in rote memorization which could not be a good measure for academic achievement.

Academic achievement is the extent to which a student, teacher or institution has attained their short or long-term educational goals. Completion of educational benchmarks such as secondary school, diplomas and bachelor's degrees represent academic achievement (Annie Ward, 2016). Academic success is important because it directly decides the positive outcomes of the students after graduating. There is nothing out of the blue, a research shows that the students with good degrees or high levels of education are more probably to be employed and paid a higher salary grade than the others with no academic success irrespective of gender (Becton Loveless, 2011).

With regard to gender in academic achievement, the finding is somewhat not consistent. The findings of Danjuma (2015) revealed that gender gap in academic achievement is closing up While Amogne, (2015) reported no significant difference between male and female students' academic achievement. Obi (2013) found out that there is a statistically significant difference between male and female academic performance in favour of the male students.

This research was hinged on Ausubel's theory of meaningful learning propounded by David Ausubel in 1968. The theory is concerned with how individuals learn large amounts of meaningful material from verbal/textual presentations in a school setting (in contrast to theories developed in the context of laboratory experiments). According to Ausubel, learning is based upon the kinds of superordinate, representational, and combinatorial processes that occur during the reception of information. A primary process in learning is subsumption in which new material is related to relevant ideas in the existing cognitive structure on a substantive, non-verbatim basis. Cognitive structures represent the residue of all learning experiences; forgetting occurs because certain details get integrated and lose their individual identity. A major instructional mechanism proposed by Ausubel is the use of advance organizers: "These organizers are introduced in advance of learning itself, and are also presented at a higher level of abstraction, generality, and inclusiveness; and since the substantive content of a given organizer or series of organizers is selected on the basis of its suitability for explaining, integrating, and interrelating the material they precede, this strategy simultaneously satisfies the substantive as well as the programming criteria for enhancing the organization strength of cognitive structure." (1963, p. 81). Ausubel emphasizes that advance organizers are different from overviews and summaries which simply emphasize key ideas and are presented at the same level of abstraction and generality as the rest of the material. Organizers act as a subsuming bridge between new learning material and existing related ideas.

Ausubel's theory is particularly adopted for this research because He distinguishes reception learning from rote and discovery learning; the former because it doesn't involve subsumption (i.e., meaningful materials) and the latter because the learner must discover information through problem solving. Therefore since one of the reasons behind students' poor achievement in biology was related to their inability to understand biological terminologies the researchers hinged the study on Ausubel's theory of meaningful learning hoping that the use of subsumers might improve students' achievement in the subject.

Statement of Problem

Based on the WAEC biology chief examiners report 2017 -2018 students' achievement is poor on binomial nomenclature, the researcher is motivated to investigate if the introduction of subsumers of biological terminologies to students before the presentation of instructions because not much research has been carried out in that area in Taraba State, Nigeria.

Purpose of the study

The purpose of this study is to find out the impact of subsumption to biology terminologies on academic achievement of secondary students in Jalingo Educational Zone. Specifically the study intends to:

(1) Find out the relative effect of subsumption of biological terminologies on the mean achievement scores of secondary school students in Binomial nomenclature.

(2) Determine the relative difference between the mean achievement scores of students exposed to binomial nomenclature before teaching and those not exposed binomial nomenclature

(3) To find out if there is any interactive effect of subsumption to biological terminologies and gender on students' achievement in biology

Research Questions

(1) What is the relative effect of subsumption and non-subsumption to biological terminologies on the mean achievement scores of secondary school students in Binomial nomenclature?

(2) What is the relative difference between the mean achievement scores of students exposed to biological terminologies prior to delivery of instruction and those taught without being exposed to biological terminologies before teaching?

(3) Is there any difference in the mean achievement scores of females and male students exposed to biological terminologies with subsumption and non-subsumption

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance as a guide:

$H0_1$: There is no significant difference in the mean achievement scores of students taught Binomial nomenclature with subsumption to biological terminologies and those taught without subsumption to biological terminologies.

$H0_2$: There is no significant difference in the mean achievement scores of male students taught binomial nomenclature with subsumption compared to their female counterparts.

$H0_3$: There is no significant difference in the mean academic achievement scores of female students taught binomial nomenclature with subsumption compared to their male counterparts.

II. METHODOLOGY

The design of the study is a quasi-experimental study. The specific design the researcher used for the study is a pretest – posttest design. The area of study is Jalingo Educational Zone of Taraba State. For the Experimental group (With Subsumption to Biology Terminologies) a total of 91 SS2 Biology students were used (46 males and 45 females) while for the treatment group (Without Subsumption to Biology Terminologies) a total of 93 SS 2 Biology students (44 males and 49 females) were used. Therefore, the sample size for this study is 184.

The instrument for data collection was Biology Achievement Test (BAT) developed by the researcher. The BAT is a 40-item multiple choice achievement test. The instrument contains four options A – D for each of the 40 items. The BAT was designed to measure secondary Biology students' achievement on binomial nomenclature. The BAT was found to have discriminating power of between 0.50 and 0.66 and difficulty index of between 0.45 and 0.57. The instrument was used for both pretest and posttest. The BAT was face and content validated by three experts in biology education from the department of Science Education, faculty of education, Taraba State University (TSU), Jalingo, Taraba State.

Pretest was administered two weeks before the experiments. This measure reduced the Hawthorne effect. Score of the students on the pretest were recorded and kept for use after the experiment. At the end of the experiment posttest (BAT) was rearranged and administered to the subjects of the study. For each of the groups, data for the pretest and posttest were recorded separately. The test items were scored one mark each. A student scores a maximum of 40 marks and minimum of zero.

Research questions 1, 2 and 3 were analyzed using mean and standard deviation. Analysis of covariance was used to test the three hypotheses at 0.05 level of significance. ANCOVA was used in order to correct the error of initial difference in the ability levels among the research subjects. The null hypotheses is to be rejected if the calculated value of test statistics f-ratio is equal to or greater than the critical or table value (f-cal $\geq$ f-critical) at 0.05 level of significance, and appropriate difference, otherwise accept.

III. RESULT

Research Question 1

What is the relative difference between the mean achievement scores of students exposed to biological terminologies prior to delivery of instruction and those taught without being exposed to biological terminologies before teaching?

Table-1: mean achievement, standard deviation and gain score of Students of experimental (WSBT) and Control (WOSBT) groups

Group	No. of Students	Pretest Mean	Posttest Mean	Mean Gain Score	Pretest SD	Posttest SD	SD Gain
Experimental	90	1.37	26.90	25.53	0.95	9.34	8.39
Control	94	1.31	12.13	10.82	0.90	6.05	5.9

Mean gain = 26.90 – 12.13 = 14.77 in favour of experimental group. Mean gain = 25.53– 10.82 = 14.71 in favour of experimental group. Table-1 indicates that the experimental group obtained mean achievement score of 1.37 and 26.90 respectively in the pretest and posttest. The subject also got standard deviations of 0.95 and 9.34 respectively in the pretest and posttest. On the other hand, control group had mean scores of 1.31 and 12.13 respectively in the pretest and posttest. The standard deviation for the control group in the pretest and posttest were 0.90 and 6.05 respectively. The result presented in the Table1 indicates that the experimental group obtained a mean gain score of 25.53 as against the mean gain score of 10.82 by the control group.

Research Question 2

What is the mean achievement and standard deviation scores of the male students in the experimental (WSBT) and control (WOSBT) groups?

Table-2: Mean achievement, Standard deviation and gain scores of male and female students of the experimental (PE) and control (NPE) groups

Gender	Group	Pretest Mean	Posttest Mean	Mean Gain Score	Pretest SD	Posttest SD	SD Gain	No. of Students
Males	Experimental (PE)	1.56	29.47	27.91	0.93	4.52	3.59	43
	Control (NPE)	1.40	14.62	13.21	0.90	3.73	2.83	47

Mean gain = 29.47 – 14.62 = 14.62 in favour of experimental group. Mean gain = 27.91– 13.21 = 14.7 in favour of experimental group. Table-2 indicates that the experimental group males obtained mean achievement scores of 1.56 and 29.47 respectively in the pretest and posttest. The subjects also got standard deviation of 0.93 and 4.52 respectively in the pretest and posttest. On the other hand, the control group males obtained mean scores of 1.40 and 14.62 respectively in the pretest and posttest. The standard deviation for the control group males in the pretest and posttest were 0.90 and 3.73 respectively and standard deviation of 0.94 and 6.81.

Research Question 3

What is the mean achievement and standard deviation scores of the female students in the experimental (WSBT) control (WOSBT) group?

Table-3: Mean achievement scores and standard deviation of Female students in experimental and control group

Gender	Group	Pretest Mean	Posttest Mean	Mean Gain Score	Pretest SD	Posttest SD	SD Gain	No. of Students
Female	Experimental (PE)	1.29	24.55	23.26	0.94	6.81	5.87	47
	Control (NPE)	1.21	9.46	8.43	0.83	4.01	3.18	47

Mean gain = 24.55 – 9.46 = 15.09 in favour of experimental group. Mean gain = 23.26– 8.43 = 14.81 in favour of experimental group. In table-3 the experimental group females obtained 1.29 and 24.55 in pretest and posttest respectively and standard deviations of 0.94 and 6.81 in the pretest and posttest respectively. In the control group females obtained 1.21 and 9.64 in the pretest and posttest respectively. The result showed that males achieved better than the females in the experimental and control groups.

What is the influence of gender on the mean achievement and standard deviation score of the students of the experimental (WSBT) and control (WOSBT) groups?

Table-4: Mean achievement scores and standard deviation of males students in experimental and control group

	Mean (x)			Standard Deviation			
Group	**Pretest**	**Posttest**	**Mean gain Score**	**Pretest**	**Posttest**	**SD Gain Score**	**N**
Experimental (PE)	1.56	29.47	27.91	0.93	4.52	3.59	46
Control (NPE)	1.40	14.62	13.21	0.90	3.73	2.83	44

Mean gain = 29.47 – 14.62 = 14.85 in favour of experimental group. Mean gain = 27.91– 13.21 = 14.7 in favour of experimental group.

Table-4 indicates that in the experimental group males obtained mean scores of 1.56 and 29.47 in the pretest and posttest respectively and standard deviations of 0.93 and 4.52. In the pretest and posttest respectively. In the control group males obtained mean scores of 1.40 and 14.62 in the pretest and posttest respectively and standard deviations of 0.90 and 3.73 in the pretest and posttest respectively.

Test of the Null Hypotheses

The 3 hypotheses were tested at 0.05 level of significance, using analysis of t-test score. Summary of the result for the hypotheses is in table-5 below:

Table-5: t-test of strategy and gender on students mean achievement scores of the Biology achievement test

Source of variation	Sum of squares	d.f	Mean squares	t-cal	t-crit.	Sign	Decision
Covariance	25730.52	1	25730.52	818.85	3.84	0.00	S
Main effect	205.62	1	205.62	6.54	4.39	0.011	S
Gender	1246.58	1	1246.58	39.67	2.21	0.00	S
Strategy	10264.31	1	10264.31	36.67	3.32	0.030	S
Strategy x gender	217	1	217	0.007	1	0.93	S
Error	5624.65	179	31.42	0.007	1	0.93	NS
Total	85905.00	184					

S = Significant, NS = Not significant at 0.05 level of probability

Null Hypothesis 1

There is no statistically significant difference in the mean academic achievement scores of students taught Binomial nomenclature with subsumptionto biological terminologies (WSBT) and those taught with out subsumption to biological terminologies (WOSBT). Table-8 shows that the calculated t-ratio (t.cal) due to strategy is 36.67 while t-critical is 3.32. Since the calculated t value is greater than the critical value, the null hypothesis is rejected. Meaning that there is a significant difference in the mean achievement scores of students taught Binomial nomenclature with subsumption to biological terminologies and those taught without subsumption to biological terminologies.

Null Hypothesis 2

Table 6: t-test of mean score difference between those taught with subsumption to biological terminologies and those taught without subsumption to biological terminologies

Variable	N	Mean	T-cal	df	t-critical
Experimental group	90	31.03			
Control group			15.01	62	2.21
	94	16.02			

There is no interaction effect of gender and the strategy on students' mean achievement in SS 2 Biology. Result presented in table 6 shows that for the two-way interaction, the t-cal is 15.01 while the t.critical is 2.21. Null hypothesis is not rejected. It is accepted. The researcher therefore, concluded that there is no significant interaction of gender and strategy on students' mean achievement in Biology.

Null Hypothesis 3

Table 7:t-test of mean score difference between those taught with subsumption to biological terminologies on gender

Variable	N	Mean	T-cal	df	t-critical
Male	43	31.03			
Female			14.01	88	2.21
	47	16.02			

There is no statistically significant interaction effect between prior exposure of students to biological terminologies and the gender of students in the mean achievement scores in Biology. Table-5 shows that the t-cal due to gender is 14.01 while t-critical is 2.21. since the calculate value is greater than the critical value, the null hypothesis is rejected. The researcher concludes that there is a significant difference in the mean achievement of male and female students as measured by Biology achievement test.

IV. DISCUSSION

This study revealed that the students taught with subsumption had significant higher academic achievement than their counterparts were not exposed to biology terminologies before the actual lesson presentation. This revelation is in agreement with the findings of Hartlay and Davis in Igboji nwaekwu (2012) which states that students exposed to biological terminologies before the commencement of a lesson, display good understanding during learning activities. Hartley and Davis (2012) agree in one of their findings that students exposure to biological terminologies as a method of instruction provided a clear goal that can be used to organize learning activities, permitted to study more effectively and to reduce the time wasted on irrelevances as well as provide a bench work against which they can objectively evaluate their own progress. Nzewi (2010) through her research finding agreed that a way material is introduced has a great deal to do with students' motivation and learning; carefully designed introductory activities can do a great deal to bridge the gap between what is known and what the students need to know. The author further reported that learning relies on complex synthesis of biological maturation, prior exposure to biological terminologies of study questions and behavioural objectives, experienced reasoning ability and instructional methods.

This research also revealed that there is a significant difference in the mean achievement of male and female students as measured by Biology achievement test. The finding agrees with the finding of Busola (2011) which revealed that there is a statistically significant difference between male and female academic performance in favour of the male students but contrary to the submission of Danjuma (2015) in which Gender showed no significant influence on students' achievement in Basic Science. The disparity in the findings of science educators on the influence of gender on students' achievement seems to be inconclusive. This calls for intensive research in that area.

V. CONCLUSIONS

From the result obtained the researcher concluded that:

- There is a significant difference in the mean achievement score of secondary school students taught with subsumption to binomial nomenclature terminologies and those taught without subsumption to binomial nomenclature terminologies.
- Gender is a significant factor in biology achievement.
- There is no interaction effect of gender and subsumption to binomial nomenclature on secondary students' mean achievement.

Recommendations

Based on the findings of the study, the following recommendations are made.

Biology teachers should endeavour to use subsumers to Biological terminologies ahead of instruction

The study should be replicated in other areas in science education.

REFERENCES

[1]. Amogne, A. E. (2015). *Analysis of gender disparity in regional examination: Case of Dessie Town;*Ethopia. Basic Research Journal of Education Research and Review, 4(2), 29– 36

[2]. Ausubel, D. (1963). *The Psychology of Meaningful Verbal Learning*. New York: Grune& Stratton.

[3]. Ausubel, D. (1978). *In defense of advance organizers:* A reply to the critics. Review of Educational Research, 48, 251-257.

[4]. Busola, A. J. (2011). *Gender difference in student's achievement in chemistry in secondary schools of Kakamega District, Kenya* Retrieved from www.scholarsresearchlibrary.com 0n 16 – 06 2011

[5]. Danjuma G.S. (2015). Effects of collaborative and competitive learning strategies on upper basic ii students' interest and achievement in basic science (*Unpublished PhD Thesis*). University of Nigeria Nsukka.

[6]. Denga DI (2017) *Educational Measurements, Continuous Assessment and Psychological Testing*. Calabar: Rapid Educ. Publishers.

[7]. Draper S (2011). *Why show learners the objectives*? Online: www/psy.gla.ac.uk/steve/lobjis.html.

[8]. Edinyang, S.D. (2006). *Prior knowledge of general objectives and specific behavioural objectives on students' academic achievement and retention in social studies in AkwaIbom State of Nigeria*. *An Unpublished Ph.D thesis* Faculty of Education. University of Calabar, Calabar, Cross River State-Nigeria.

[9]. Ezeudu, F. O., & Obi, T.N. (2013). *Effects of gender and location on students' achievement in chemistry in secondary schools in Nsukka Local Government Area of Enugu State. Research on Humanities and Social Sciences*, 3(15). Retrieved from http:pt.slideshare.net/AlexanderDecker.

[10]. Guat TB, THE GPL (2012). *The Effectiveness of using instructional objectives with less able secondary school pupils*. Aust. J. Edu. Technol. 3(2):135-144

[11]. Hartley, J. & Davis, I.K. (2016), *Pre-instructional strategies: the Role of Pre-test, Behavioural Objectives,* Overview and Advance Organizers. Review of Educational Research. 46 (2).
[12]. Igbojinwaekwu, P.C. (2012). *Gender Difference in Enrolment Pattern and Academic Achievement in Senior Secondary School Science and Mathematics*. Unpublished. Ph.D Thesis Unizik Awka.
[13]. Iyang-Abia ME (2018). *Essentials of Educational Technology*. Uyo : Legacy (Nig) Ltd.
[14]. Nzewi, U. (2010). *The Effect of Prior Knowledge of Behavioural Objectives and Study Questions on Achievement in Biology*. Unpublished Ph.D. Dissertation, University of Nigeria
[15]. Ward A.; Howard W. S.; Mildred M-W (2016). *"Achievement and Ability Tests - Definition of the Domain", Educational Measurement*, **2**, University Press of America, pp. 2–5, ISBN 978-0-7618-0385-0