EFFECTS OF ACRONYM AND EXPRESSION MNEMONICS ON SCIENCE STUDENTS' ACADEMIC ACHIEVEMENT AND RETENTION IN ANIMAL HORMONES IN UYO MUNICIPALITY

By

Udoh, Nsimeneabasi Michael (Mrs.)

nsimikudoh@yahoo.com

Department of Science Education, Faculty of Education, University of Uyo, Uyo.

And

Udo, Essien Edem (Ph.D)

essien-udo63@yahoo.com

Department of Science Education, Faculty of Education, University of Uyo, Uyo.

And

Anidu, Innocent I. (Ph.D)

innocentanidu@gmail.com

Department of Science Education, College of Education, Michael Okpara University of Agriculture, Umudike

Abstract

This study examined the effects of acronym and expression mnemonics on science students' academic achievement and retention in animal hormones. The design of the study was non-randomized pre-test, post-test control group design. Simple random sampling technique was used to select 150 students from the population of 5,926 Senior Secondary 2 students in Uyo municipality of Akwa Ibom State. Four research questions and four research hypotheses were raised and formulated to guide the study. The instruments used for data collection were Science Achievement Test on Animal Hormones (SATAH) and Science Retention Test on Animal Hormones (SRTAH). The instruments had a reliability coefficient of 0.75 determined using test-retest approach. The research questions were answered using mean and standard deviation while the hypotheses were tested using Analysis of Covariance (ANCOVA) at 0.05 level of significant. The results showed no significant difference between the mean achievement and retention scores of science students taught animal hormones using acronym and expression mnemonics teaching strategies, but showed a significant difference between the mean achievement and retention scores with expository teaching strategy. The result also showed no

significant difference between the mean retention scores of male and female science students taught animal hormones using acronym mnemonics but showed a significant difference between the mean retention scores of male and female taught using expression mnemonics. Based on the findings, it was recommended that science teachers should use innovative teaching strategies such as mnemonics in the teaching of science concepts in secondary schools and both male and female students should be encouraged to participate in sciences.

Key words: Acronym Mnemonic, Expression Mnemonic, Science Students, Academic Achievement, Animal Hormones

Introduction

Science teaching is the systematic process of acquiring the fundamental knowledge about the universe and the aim of teaching science teaching in secondary schools is to promote the understanding of the concepts taught with a view to applying knowledge of such understanding in real life situation. The National Policy on Education emphasizes that sciences should be taught in schools in such a way that it will have meaning and relevance to the needs of the students and society, provide the students the opportunity to explore, interact with and intercept certain scientific processes going on in their environment (FGN, 2013). Therefore, effective science teaching is necessary for positive outcome that will aid learners understanding and acquisition of basic science skills. Ado and Udoh (2018) opined that this can be achieved through science education with the utilization of teaching materials/ resources and effective teaching approaches which will creates enabling environment for responsible learning to thrive.

Science education plays a vital role in the lives of individuals and the development of a nation. It is generally acknowledged that the survival of a nation scientifically and technologically can only be achieved through science education which offers opportunities for science teachers to transmit meaningful learning through the use of adequate instructional strategy. Damar, Hulda and Jonah (2016) opined that effective science education offers opportunities for science teachers to transmit meaningful learning through innovative teaching strategies which could reverse poor academic achievement and retention of students in the subject. Udoh and Etiubon (2016) stated that teaching of science education has seen various transformations which give teachers and students opportunities to develop positive attitude

towards science concepts and to make learning of science less stressful but more practicable and meaningful. Ado and Udoh (2018) added that students must not only learn to understand the concepts of science but use the scientific knowledge to develop the ability to think and understand what is happening around them. According to Udoh (2015), teaching difficult concepts using appropriate instructional strategies could enable students to actively participate in the teaching-learning process thereby enhancing their achievement and retention.

The concept of animal hormones is one of the concepts in science that poses problem to students, and needs to be taught effectively using activity-based strategies. According to Okon (2018), animal hormone is a chemical signal that is selected into the circulatory system which communicates regulatory messages within the body and animal hormones are often transported in the blood stream. Endocrine glands or ductless glands are organs that secret these chemical substances. The endocrine system coordinates the activities of the body with the nervous system. The hormones produced by the endocrine glands act as messengers between the nervous system and the body organs. The endocrine glands in the body secrete different hormones, and these hormones have a major effect on the growth, development, shape, metabolic rate, blood pressure, digestion, behaviour, reproduction, and milk production of the animal. Some examples of animal hormones are Somatotropin, Tropic-hormone, Oestrogen, Prolactin Adrenaline, Thyroxine, Progesterone, Insulin, Growth-hormone, Tetosterone, Oxytocin, Glucagon, Estrogen, Thyroid, Gastrin, Luteolytics, Anti-diuretics, Serotonin, Epinephrine, Serotonin. These various animal hormones can be taught to students using mnemonics in a systematic way, making it possible for students to easily grasp and retain the concept learned.

A mnemonic is an instructional strategy designed to help students achieve and improve their memory of important information. Kenneth (2017) describes mnemonics as a strategy or a device that help students "store information in the long-term memory so that it will be much easier to remember". They are memory devices that help learners recall larger pieces of information especially in the form of lists like characteristics, steps and stages. Nayani (2016) added that mnemonic help students have and recall enormous amounts of information in a short period of time. Stalder and Olson (2011) suggested mnemonics as aids for science students to be able to connect various scientific facts and procedures to more familiar words and phrases that would enhance easy learning and recall of scientific facts, parts and phases. The particular task in

developing mnemonics strategies is to find a way to relate new information to information students already have locked in their long-term memory.

Mnemonics instructional strategies are theoretically based on the Ausubel's assimilation theory of cognitive learning and Gardner's theory of Multiple Intelligences which information is organized by mind in a hierarchical top-down fashion. The learning seeks to understand how incoming information is processed and structured into memory (Akinsola and Odeyemi, 2014). Learning is best achieved when the information is presented systematically and stored in the students' brain in an organized, meaningful and useable manner (Congos, 2006). Hunt (2010) observed that in science classes, students usually have to recall enormous amount of information in a short period of time, so, in order to facilitate meaningful learning and to enhance recall of scientific facts as well as aid long-term memory, mnemonics strategy must be enhanced. The task of science teachers would be that of helping science students to relate the new concepts to be taught using mnemonics with what they already know or with what they would find interesting and easy to remember. All that the science teacher would do to assist students in remembering the new concept is to modify the lesson plan and materials to fit the prior knowledge of their students and by using mnemonic devices in a systematic manner.

Akinsola and Odeyemi (2014) identified types of mnemonics to include; name, expression/word, model, music, ode/rhyme, note organization, image connection and spelling mnemonics. According to Lesser (2011a), other mnemonic devices are loci, acronyms or acrostic, rhymes, imagery, chunking and organization. Congos (2006) asserted that when students are able to remember, assimilate and relate information previously learned to the new ones, they can quickly organize their thoughts and delve into more critical thinking and this can be achieved through the use of acronyms and expression mnemonics.

Acronym mnemonic is a word formed from the first letter of a list of words. Akinsola and Odeyemi (2014) stated that an acronym is typically the most familiar type of mnemonic strategies. It uses a simple formula of a letter to represent each word or phrase that needs to be remembered. According to Hunt (2010), in acronym mnemonics, only abbreviations that form a pronounceable word qualify as an acronym. He also added that, an acronym mnemonics can simply be an invented combination of letters for memorization of concepts and every letter is a

cue to an item one needs to remember. McAlum and Seay (2010) also stated that acronym mnemonics is created by taking the list of the words that one wants to remember and putting them in an order so that the first letters of each word spell a real word or a made-up word. In order words, acronym mnemonics use the first letters of the target words to create an easily remembered phrase or sentence. It generates a sentence that helps one to remember information. For example, from examples of animal hormones above, acronym mnemonics can be created thus; **Stephen Told Okon, Please, Ask Thompson Pius In Goshen To Organise Good Entertainment To Give Lunch At Site Especially Soup**. Acronym mnemonics assists students in remembering a process, list, or set of facts. This process develops students' metacognition, and helps them to become more mindful and effective in their study.

Expression or word mnemonic is another type of mnemonic formed from the first letter of each item in a list which is arranged to form a phrase or word. From example of animal hormone above, expression mnemonics can be created as; **STOP AT PIG TO GET GLASES.** The information is constructed to promote academic achievement and the recall of information when needed. It can be modified to fit a variety of learning content. This method enhances memory of complex words or ideas and promotes better retention of concept to be learned. Researchers such as Saarela (2018); Hunt (2010); Akinsola & Odeyemi, 2014; Lesser (2011a) have found that mnemonics strategies of instruction appear to be of great value to the learning process of students and is especially beneficial for students (male and female) who may have difficulty with information recall.

Gender differences are still a concern to many researchers because indications on gender differences on students' academic achievement and retention still differ among science subjects. There are still different viewpoints and conclusions concerning gender on academic achievement and retention. Akanwa, Ndirika and Udoh (2018) described gender as a range of physical, mental and behavioural characteristics differentiating the masculinity and feminity of an individual. In the process of learning science-based subjects, some researches show superiority of male over female students and others show superiority of females over males. Udoh (2015) argued that in a classroom setting where male and female students are actively involved in an interactive lesson with the teacher, there will be no difference in their academic achievement. Fabunmi (2010) also opined that gender is not a significant factor to be associated

with students' performance. If given equal opportunity with the right teaching and learning process, male and female students will achieve equally. The observations agree with Adepoju (2014) and Udoh (2015) which showed no significant difference in gender on students' academic achievement and retention in Biology when taught nervous coordination using computer simulation and charts. Udoh and Etiubon (2016) also found that there was no significant effect on gender with regards to students' achievement in science. On the contrary, Enohuean (2015) observed that there is a significant difference in the retention ability of male and female students exposed to the use of instructional strategy. Etiubon (2011) also observed that female students achieved and retained significantly better when exposed to the use of different technological tools in electrolysis than their male counterparts in chemistry and Ekeh (2004) observed that male students achieved and retained significantly better than their female counterparts in mathematics when taught using iconic models. Since the study on gender is inconclusive this study included gender as one of its intervening variables.

Statement of the Problem

Academic achievement and retention of science students are still below average despite the fact that many researches have been carried out to salvage the situation. The growing member of failures in Senior Secondary School Certificate Examination in recent times among science students have been a cause of concern to many researchers. This raises doubts on the efficacy of the instructional strategies and devices used by the teachers. It is often noted that science teachers, more often than not, use the expository approach of teaching to dominate their classroom which only requires theoretical and lecture approaches. Urbina-Lilback (2016) posited that this method of teaching makes science lessons boring and the students find it difficult to grasp some scientific concepts, skills and principles. Udoh and Etiubon (2016) also noted that the expository approach of teaching to a large extent is responsible for the observed consistent poor achievement and retention in science. This situation has stimulated the search for strategies for teaching of science concepts that aims at understanding and retention of concepts. This state has resulted to this study which intends to find out if acronym and expression mnemonics can enhance the academic achievement and retention of students in the teaching of animal hormones.

Research Questions

The following research questions guided the study:

1. What difference exists among the achievement mean scores of science students taught animal hormones using acronym mnemonics, expression mnemonics and those taught using expository teaching strategy?
2. What difference exists among the retention mean scores of science students taught animal hormones using acronym mnemonics, expression mnemonics and those taught using expository teaching strategy?
3. What is the difference between the retention mean scores of male and female science students taught animal hormones using acronym mnemonics teaching strategy?
4. What difference exists between the retention mean scores of male and female science students taught animal hormones using expression mnemonics teaching strategy?

Research Hypotheses

The following research hypotheses guided the study:

1. There is no significant difference among the achievement mean scores of science students taught the concept of animal hormones using acronym mnemonics, expression mnemonics and those taught using expository teaching strategy.
2. There is no significant difference among the retention mean scores of science students taught animal hormones using acronym mnemonics, expression mnemonics and those taught using expository teaching strategy.
3. There is no significant difference between retention mean scores of male and female science students taught animal hormones using acronym mnemonics teaching strategy.
4. There is no significant difference between retention mean scores of male and female science students taught animal hormones using expression mnemonics teaching strategy.

Methodology

The research design adopted for this study was pre-test, post-test controls group design with three groups, two experimental groups and a control group. Experimental group one was taught the concept of animal hormones using acronym mnemonics strategy, experimental group two was taught the same concept with expression mnemonics teaching strategy and group three was

the control group taught the same concept with expository teaching strategy. The area of the study was Uyo municipality of Akwa Ibom State.

The size of the population was five thousand, nine hundred and twenty six (5,926) science students from all senior secondary two (SS2) students in the thirteen (13) public secondary schools in Uyo municipality during 2018/2019 academic session. The sample size was one hundred and fifty (150) students in their intact classes in the three (3) selected public secondary schools in the study area. Simple random sampling technique was used to select the three (3) secondary schools for the study from the population by balloting. The instruments used for data collection were Science Achievement Test on Animal Hormones (SATAH) and Science Retention Test on Animal Hormones (SRTAH) structured on four options A – D. The instruments consisted of two sections of twenty items. The first section contain the student's detail such as serial number, gender, class and school name while the second section consist of the 20 multi-choice items with one correct option and three wrong options. The test was based on a maximum score of one hundred (100) marks which is 100%. Each correct answer was scored 5 marks and incorrect answer was scored 0 mark. The retention test SRTAH contained the same questions as SATAH but arranged in different order. It was used to determine the retention scores of Science students on animal hormones.

The instruments were subject to face validation by five experts, three science teachers and two educational research lecturers. To ascertain the reliability of the instruments, a split-half technique was used to determine the reliability of the instruments with the reliability coefficient of 0.75. The instruments were administered on equivalent group of students who were not part of the study. The students assigned as experimental groups were taught the animal hormones using acronym mnemonics and expression mnemonics, those in the control group were taught with expository strategy. At the end of the lessons, the three groups were given science achievement test on animal hormones (SATAH). After three weeks of administration of SATAH, retention test, a reshuffle form of SATAH, was also administered to the students to determine the level of retention of the concepts. Finally, scripts were retrieved, marked and the data generated were analysed using descriptive statistics and Analysis of Covariance (ANCOVA).

Results

Research Question 1

What difference exists among the achievement mean scores of science students taught animal hormone using acronym, expression and expository teaching strategies?

Table 1:

Mean and Standard Deviation Scores of Students' Pre-test and Post-test Achievement taught Animal Hormone Classified by Instructional Strategies.

Instructional Strategies		Pre-test		Post-test		
	N	$\overline{X}$	SD	$\overline{X}$	SD	Mean Gain
Acronym	50	19.28	4.63	69.96	5.81	50.68
Expression	50	21.04	4.24	67.74	7.05	46.70
Expository	50	20.00	4.98	61.34	8.62	41.34

Table 1 shows the mean gain scores of students taught animal hormone using acronym, expression and conventional teaching strategies. Students who were taught with acronym strategy had the highest mean gain score of 50.68 followed by expression teaching strategy with a mean gain score of 46.70 and then expository teaching strategy with 41.34 as the mean gain score.

Hypothesis 1

There is no significant difference among the achievement mean scores of science students taught the concept of animal hormone using acronym, expression and expository teaching strategies.

Table 2:

Summary of Analysis of Covariance (ANCOVA) of Students'.Post-test Classified by Instructional Strategy with Pre-test as Covariate

Source	Sum of Squares	Df	Mean Square	F	Sign at P < .05	Decision
Corrected Model	2522.30[a]	3	840.766	15.238	.000	*
Intercept	31362.537	1	31362.537	568.416	.000	*
Pre-test (Covarate)	7.724	1	7.724	.140	.709	NS
Strategy	2518.978	2	1259.489	22.827	.000	*
Error	8055.596	146	55.175			
Total	664506.000	150				
Corrected Total	10577.893	149				

* = significant at .05 level of significance

NS = Not significant at .05 level of significance

In Table 2, the calculated Probability value (P-value) .000 of the main effect of instructional strategy is less than the declared Probability value (alpha level) .05. Therefore, the null hypothesis one is rejected. This implied that there exists a significant difference between the mean achievement scores of science students taught animal hormones using acronym, expression and expository teaching strategies. In order to determine the direction of significance, the scores were subjected to post hoc analysis as shown in table 3.

Table 3

Post hoc Analysis of Students' Post-test Classified by Instructional Strategy with Pre-test as Covariate.

(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig
Acronym	Expression	2.307	1.504	.127
	Expository	9.616*	1.489	.000
Expression	Acronym	-2.307	1.504	.127
	Expository	7.309*	1.492	.000
Expository	Acronym	-9.616*	1.489	.000
	Expression	-7.309*	1.492	.000

* = significant at -05 level of significance

Table 3 shows the post hoc analysis scores of students taught animal hormone using acronym, expression and expository teaching strategies. Students taught using acronym strategy significantly achieved when compared with those taught using expository method. Also students taught using expression strategy significantly achieved when compared with those taught using expository strategy. A non-significant difference existed between the achievement of students taught using acronym strategy and expression strategy.

Research Question 2

What difference exists among the retention mean scores of science students taught animal hormone using acronym, expression and expository teaching strategies?

Table 4

Mean and Standard Deviation Scores of Students' Post-test and Retention test on Animal Hormone Classified by Instructional Strategies.

Instructional Strategies		Post-test		Retention test		
	N	$\overline{X}$	SD	$\overline{X}$	SD	Mean Gain
Acronym	50	69.96	5.81	57.50	5.60	12.46
Expression	50	67.74	7.06	56.52	4.76	11.22
Expository	50	60.38	8.62	52.26	5.99	8.12

Table 4 shows the retention mean gain scores of students taught animal hormone using acronym, expression and expository teaching strategies. Students who were taught with acronym strategy had the highest retention mean gain score of 12.46 followed by expression teaching strategy with a mean gain score of 11.22 and then expository teaching strategy with 8.12 as the mean gain score.

Hypothesis 2

There is no significant difference among the retention mean scores of science students taught the concept of animal hormone using acronym, expression and expository teaching strategies.

Table 5:

Summary of Analysis of Covariance (ANCOVA) of Students' Retention Score Classified by Instructional Strategy with Post-test Scores as Covariate.

Source	Sum of Squares	df	Mean Square	F	Sign at p < .05	Decision
Corrected Model	1259.754[a]	3	419.918	15.628	.000	*
Intercept	2815.534	1	2815.534	104.786	.000	*
Post-test (Covarate)	483.661	1	483.661	18.000	.000	NS
Strategy	185.923	2	92.961	3.460	.034	*
Error	3922.939	146	26.869			
Total	466000.000	150				
Corrected Total	5182.693	149				

* = Significant at P < 0.05 alpha

NS = Not significant at .05 level of significance

As shown in Table 5, the calculated P-value .000 of the main effect of instructional strategy is less than the alpha level .05. Therefore, the null hypothesis is rejected. This implied that there exists a significant difference between the retention of science students taught animal hormones using acronym, expression and expository teaching strategies. In order to determine the direction of significance, the scores were subjected to post hoc analysis as shown in table 6.

Table 6

Post hoc Analysis of Students' Retention Classified by Instructional Strategy with Posttest as Covariate.

(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig
Acronym	Expression	0.44	1.05	.68
	Expository	2.89*	1.18	.02
Expression	Acronym	-0.44	1.05	.68
	Expository	2.46*	1.12	.03
Expository	Acronym	-2.89*	1.18	.02
	Expression	-2.46*	1.12	.03

* = significant at -05 level of significance

Table 6 shows the post hoc analysis scores of students taught animal hormone using acronym, expression and expository teaching strategies. Students taught using acronym strategy significantly retained the concept when compared with those taught using expository method. Also students taught using expression strategy significantly retained the concept when compared with those taught using expository method. A non-significant difference existed between the retention of students taught using acronym and expression strategies. Therefore, hypothesis 2 is retained.

Research Question Three: What is the difference between the retention mean scores of male and female science students taught animal hormones using acronym mnemonics teaching strategy?

Table 7:

Mean and Standard Deviation Scores of Male and Female Students' Post-test and Retention Test Taught Animal Hormones using Acronym Mnemonics.

Gender		Post-test		Retention		
	N	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	Mean Gain
Male	25	70.08	5.79	56.32	5.74	13.76
Female	25	69.84	5.94	58.68	5.30	11.16

In Table 7, the results showed that male students had a mean gain of 13.76 and their female counterparts had a mean gain score of 11.16. The result indicated that male students retained the concept better than their female counterparts when both groups were taught using acronym mnemonics.

Hypothesis Three: There is no significant difference in the retention scores of male and female science students taught animal hormones using acronym mnemonics teaching strategy?

Table 8:

Summary of Analysis of Covariance (ANCOVA) of Science Students' Retention Scores Based on Gender Using Post-test Scores as Covariate

Source	Sum of Squares	Df	Mean Square	F	Sign at $p < .05$	Decision
Corrected Model	125.618[a]	2	62.809	2.095	.134	NS
Intercept	667.065	1	667.065	22.253	.000	*
Pre-test (Covarate)	55.998	1	55.998	1.868	.178	NS
Gender	72.221	1	72.221	2.409	.127	NS
Error	1408.882	47	29.976			
Total	166847.000	50				
Corrected Total	1534.500	49				

* = Significant at P < 0.05 alpha
NS = Not significant at .05 level of significance

As shown in Table 8, the calculated P value .127 is greater than alpha level .05. Therefore, null hypothesis four is retained. This implied that there is no significant gender difference on the retention of science students taught animal hormones using acronym teaching strategy.

Research Questions Four: What is the difference between the retention mean scores of male and female science students taught animal hormones using expression mnemonics teaching strategy?

Table 9:
Mean and Standard Deviation Scores of Male and Female Science Students' Post-test and Retention Test Taught Animal Hormones using Expression Mnemonics.

Gender		Post-test		Retention		
	N	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	Mean Gain
Male	23	66.74	6.74	54.96	4.30	11.78
Female	27	68.59	7.33	57.85	4.80	10.74

In Table 9, the results showed that male students had a mean gain of 11.78 and their female counterparts had a mean gain score of 10.74. The result indicated that male students performed better than their female counterparts when both groups were taught using expression mnemonics.

Hypothesis Four: There is no significant difference in the retention scores of male and female science students taught animal hormones using expression mnemonics teaching strategy?

Table 10:
Summary of Analysis of Covariance (ANCOVA) of Students' Retention Scores Based on Gender Using Post-test Scores as Covariate

Source	Sum of Squares	Df	Mean Square	F	Sign at p < .05	Decision
Corrected Model	124.680[b]	2	62.340	2.978	.061	NS
Intercept	1303.414	1	1303.414	62.269	.000	*
Pre-test (Covarate)	20.564	1	20.564	.982	.327	NS
Gender	90.530	1	90.530	4.325	.043	S
Error	983.800	47	20.932			
Total	160834.000	50				
Corrected Total	1108.480	49				

* = Significant at P < 0.05 alpha
NS = Not significant at .05 level of significance

As shown in Table 10, the calculated P-value 0.43 of gender is less than alpha level .05. Therefore, null hypothesis is rejected. This implied that there is a significant gender difference on the retention of students taught animal hormones using expression mnemonics teaching strategy

Discussion of Findings

The findings of the results from post hoc analyses scores of students taught animal hormone using acronym, expression and expository teaching strategies showed that students taught using acronym strategy significantly achieved and retained the concept when compared with those taught using expository teaching strategy. Also students taught using expression strategy significantly achieved and retained the concept when compared with those taught using

expository teaching strategy. A non-significant difference existed between the achievement and retention ability of students taught using acronym and expression strategies. This implied that the use of acronym mnemonics to teach animal hormones in science is effective as the use of expression mnemonics in teaching the same concept in science. The non-significant effect of acronym and expression mnemonics teaching strategies could be attributed to the type of teaching strategies used which make learning more meaningful. This is in line with Akinsola and Odeyemi (2014), McAlum and Seay (2010) and Hunt (2010) who observed that teachers' lack of using acronym and expression mnemonics as instructional strategies during teaching and learning significantly influence students' academic achievement and retention in science. This may be due to the fact that, science teachers who utilized acronym and expression mnemonics instructional strategies made the lesson very simple and so students were able to assimilate and internalize the concept effectively.

The findings of the results on gender showed no significant difference between the retention ability of students taught animal hormone using acronym mnemonics teaching strategy. The observation from the results confirms that both male and female students receive the same impact and retained equally when exposed to acronym mnemonics teaching strategy. This comparable retention ability of males and females students observed agreed with Udoh (2015) which showed no significant difference in gender on students' achievement and retention ability in science when taught nervous coordination using computer simulation and charts. The findings also are in line with Akanwa, Ndirika and Udoh (2018), Fabunmi (2010), Adepoju, (2014). Udoh and Etiubon (2016) also found that there were no significant effects on gender with regards to students' retention in science. This implied that when male and female students are exposed to the same learning environment with appropriate instructional strategies irrespective of gender, they will assimilate faster and perform equally since knowledge has to do with intellectual ability. However, the findings disagreed with Etiubon (2011) that female students achieved and retained significantly better than their male counterparts in chemistry using technological resources in electrolysis and Ekeh (2004) who observed that male students achieved and retained significantly better than their female counterparts in mathematics using science iconic models.

The findings of the results on gender also showed a significant difference between the retention ability of students taught animal hormone using expression mnemonics teaching strategy. The findings revealed that male students who were taught animal hormones using expression mnemonics teaching strategy had significant higher retention ability than female who were taught the same concept using the same teaching strategy. The observation from the results may be that male students are more interested in science than female. The findings are in line with Enohuean (2015) who observed that there is a significant difference in the retention ability of male and female students exposed to the use of instructional strategy. The findings are also in line with Ekeh (2004) who observed that male students achieved and retained significantly better than their female counterparts in mathematics using science iconic models. However, the findings disagreed with Etiubon (2011) that female students achieved and retained significantly better than their male counterparts in chemistry using technological resources in electrolysis. The study also disagrees with the findings of Akanwa, Ndirika and Udoh (2018). Fabunmi (2010), Adepoju, (2014). Udoh and Etiubon (2016) also found that there were no significant effects on gender with regards to students' retention in science.

4.1 Conclusion

The use of acronym mnemonics teaching strategy to teach animal hormones in science is as effective as the use of expression mnemonics teaching strategy in the achievement and retention of science students. This is due to the fact that the lessons were interesting and the students were carried along with appropriate instructional teaching strategies. The study also showed that male and female students retained equally when both gender were taught animal hormones using acronym mnemonics teaching strategy but showed a significant difference between the retention ability of male and female students taught animal hormone using expression mnemonics teaching strategy.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Science teachers should endeavour to use student-centered teaching strategies such as acronym and expression mnemonics to enhance academic achievement and retention in science concepts.

2. Teachers should not consider gender as a significant factor in students' academic achievement and retention but should encourage both male and female students in their classes toward academic excellence irrespective of gender differences.

3. Curriculum developers should provide adequate information in the curriculum regarding how mnemonics teaching strategies should be used by science teachers.

References

Adepoju, O. A. (2014). Mnemonic as an Innovative Approach to Creative Teaching of Secondary School Chemistry. *Journal of AJCE*, 4 (2), 122-138.

Ado, I. B. and Udoh, N. M. (2018). Awareness and Mathematics and Biology Teachers' Research Pedagogy, Material Resources and Assessment Strategies for Innovative Teaching in Uyo Municipality, Akwa Ibom State, Nigeria. *Researchjournali's Journal of Education* 6 (4): 120-132

Akanwa, U. N., Ndirika, M. C. and Udoh, N. M. (2018). Effects of Jigsaw and Debriefing Teaching Techniques on Biology Students' Academic Achievement on Water Holding Capacity of Soil in Uyo Municipality

Akinsola, M. K. and Odeyemi, E. O. (2014). Effect of Mnemonic and Prior Knowledge Instructional Strategies on Students' Achievement in Mathematics. *Internal Journal of Educational Research*, 2(7), 2201-6333.

Barbara, J. E. (2010). Mnemonic Devices University of Kansas Center for Research on Learning. Retrieved from http://ite.gsn.edu/academymodules/9304.

Congos, D. (2006). 9 Types of Mnemonics for Better Memory. The Learning Center. Newsletter. Retrieved at http://www.learning assistance.com/2006/January/mnemonics.html.

Damar, D. N., Hulda, M. D., and Jonah, M. D. (2016). Impact of Iconic Models on Senior Secondary School Students' Academic Archievement in Physical Geography in Plateau State, Nigeria. *Asia Pacific Journal of Education, Arts and Sciences*. 3 (1), 121-127.

Ekeh, P. U. (2004). Gender Bias and Achievement in Science and Mathematics among Primary School Pupils: Implications for Human Resource Development. *Journal of Curriculum Organization of Nigeria*, 11(2): 30-33.

Enohuean, V. O. (2015). Effects of Instructional Materials on Achievement and Retention of Biology Concepts among Secondary School Students in Delta state, Nigeria. Retrieved from http://effect.edu/academymodules/pdf.

Etiubon, R. U. (2011). Employing Technological Resources to Enhance Students' Performance in Chemisty. *Journal of Education*, 4 (1), 230-239.

Fabunmi, M. (2010). The Role of Gender on Secondary School Students' Academic Performance in Edo State, Nigeria. *West African Journal of Education,* 24 (1), 90 – 93.

Federal Ministry of Education (FME, 2013). National Policy on Education. Abuja. NERDC.

Hunt, N. (2010), "Using Mnemonics in Teaching Statistics," *Teaching Statistics*, 32(3), 73–90

Kenneth, B. M. (2017). The Effectiveness of Musical Mnemonics in Teaching Biology: Krebs Cycle. *The American Biology Teacher* 3 (5), 166-171.

Lesser, L. (2011a), "On the Use of Mnemonics for Teaching Statistics," *Model Assisted Statistics and Applications*, 6 (2), 151–160.

McAlum, H G. & Seay, S. S. (2010). The Use/Application of Mnemonics as a Pedagogical Tool in Auditing. *Academy of Educational Leadership Journal.* 1 (1), 101- 115.

Nayani, S. (2016). Mnemonics In Science. Retrieved from: https://www.researchgate.net/institution/seamo_recam.

Okon, R. E. (2018). Effect of Mnemonics and Visual Organizers on Biology Students' Academic Performance on the Concept of Animal Hormones in Uyo Municipality. Unpublished B.Sc. Project, Department of Science Education, University of Uyo, Uyo.

Saarela, M. S. (2018). Reading Mnemonics. *Journal of the American Oriental Society*, 138 (2), 327-356.

Stalder, D. R. and Olson, E. A. (2011), "t for Two: Using Mnemonics to Teach Statistics," *Teaching of Psychology*, 38 (4), 247–250.

Udoh, N. M. and Etiubon, R. U. (2016). Effects of Iconic Models and Charts on Science Students' Academic Performance in Uyo Municipality. *Journal of Research and Development in Education (JORDE),* 6 (1), 83-92.

Udoh, N. M. (2015). Effects of Computer Simulation and Charts on Biology Students Academic Performance and Retention on the concept of Nervous Coordination. Unpublished M.Sc. Dissertation, Department of Science Education, University of Uyo. Uyo.

Urbina-Lilback, R. N. (2016), "Snapshots of Equitable Teaching in a Highly Diverse Classroom," *Mathematics Teacher*, 110 (2), 126–132.