

## EFFECT OF SHORT-TERM MEMORY AND NON-VERBAL REASONING ABILITY ON BIOLOGY PERFORMANCE AMONG SECONDARY SCHOOL STUDENTS IN KATSINA ZONAL EDUCATION QUALITY ASSURANCE

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### Abstract

*The purpose of this study is to find out how biology performance of students is affected by short term memory and non-verbal reasoning ability with special reference to some selected secondary schools students in Katsina zonal education quality assurance, Katsina state. The study stated two objectives and formulated and tested two hypotheses at .05 level of significant. The population of the study consists of all SS II students in secondary schools in Katsina zonal education quality assurance. A total of five schools from three local governments under Katsina zonal education quality assurance were randomly selected from which a sample of 100 SS II students was finally drawn. The research designed used was survey design. The instrument adapted for the study was the Non-verbal Reasoning Test-AH<sub>4</sub> part II NVR, Short-Term memory Digit Span Test and Biology Achievement Test (BAT) were administered to the students. Hypotheses were tested at 0.5 level of significance. Analysis, discussion and interpretation of data collected were done and the data was analyzed using Chi-Square analysis. Result of the study revealed that Short-Term memory and Non-Verbal reasoning ability has no significance effect on academic performance of students in Biology in secondary schools in Katsina zonal education quality assurance, the result further revealed that Non-Verbal reasoning ability has significance effect on academic performance of students in Biology in secondary schools in Katsina zonal education quality assurance concluded that students with effective Short-Term memory and Non-Verbal reasoning ability (intelligence) can produce better result in biology if encourage and appreciated. The researchers also recommended that Students should be trained to seek understanding and retain the meaning of concepts taught.*

**Keywords:** Academic performance, biology, Non-verbal reasoning ability, Short-term memory

### Introduction

The ability to retain learned materials is no doubt central to learning and problems solving. However, the mere retention of information without understanding will not permit the use of such information in problem-solving. Both retention (memory) and understanding are essential for learning and problem-solving. It is often clearly seen that failures in academic performance at all levels in our educational system becoming a something conversant. Many researchers worked tirelessly to cut the causes of these failures in the academic performance among secondary school students and a lot of these researchers even developed some theories after the causes are found and even some suggestions on how to reduce or eradicate the total failures among students were forwarded. But all these being also contributing factors, short-term memory and non-verbal reasoning ability (intelligence) among secondary school

students play the most important role in academic performance leading to effective and successful learning (Mukerjee, 2002).

In reality, memory is an active system that receives stores, organizes, alters and recovers information (Baddley, 2003). In some ways memory acts like a computer, incoming information is first encoded or changed into a usable form. This step is like typing data into computers and it is stored or holds in the system. Memories must be retrieved or taken out of storage to be useful. Psychologists have offered explanations on their understandings of the meaning and nature of human memory. Plato and Aristotle as cited in Alloway and Alloway, (2010) suggested that sensory images may be impressed in the same way as images may be impressed on a block of wax. This approach further encouraged some early experimentation on memory mechanism such as those undertaken by Ebbinghaus in Abu-Rabia, (2003), provided the basis for the postulation that Short-Term Memory has a limited capacity and can hold just seven digits/bits of information at a time.

Individuals with low STM span may be quite intelligence, but they need to be given more time to process information while learning. As you recall, in such individuals, information takes a longer time to pass into the LTM due to the lower capacity of the STM in information processing. General factors may be responsible for this Low information-processing capacity. They include: high levels of anxiety, emotional disturbance, lack of interest/motivation on the task or the materials bring unfamiliar. If individuals with low memory capacity are given information at slow rate, and if the contents of learning are repeated over time, their performance at school will be enhanced. (Baddeley, 2003),

It is necessary to understand that memory cannot be properly assessed without first addressing learning. Learning can be defined as the process of acquiring new information where as 'Memory' refers to the persistence of learning in a state that can be revealed at a later time (Squire, 1993). As such, memory cannot be adequately assessed unless it is verified that the to be remembered information has indeed been learned. The ability to compare things learned in the past with present experiences depends on the ability to retain the previous learning. In the process of learning and problem solving, individuals are able to keep in their conscious mind for a limited period of time, usually not exceeding 20-30 second quite a number of variables with are used in the thinking process to solve mental problems (Hilgard, Atkinson & Artkinson, 1999).

Academic achievement or (academic) performance is the outcome of education, the extent to which a student, teacher or institution has achieved their educational goals. Academic achievement is commonly measured by examinations or continuous assessment but there is no general agreement on how it is best tested or which aspects are more important.

Biology is the science that deals with the study of varieties of living organism including ourselves (Lawal 2011). It is also studies the way our environment evolved from triple organisms and this intimately part of our environment (Nwosu, 2006). The study of dreaded diseases, their causative agents, cure as well as the action of drugs are a way of Biological enlightenment that strives at minimizing human suffering, its tries to find cure for hereditary abnormalities like hemophilia, Down's syndrome etc. (Ahmad, 2010).

The above importance has made Biology a course or subject of impact in the life of individuals and the nation and world as a whole; thereby prompting the learners to make it a compulsory course of study in every level of education (primary, secondary and tertiary).

### **Statement of the Problems**

Short-term memory ability (STM) and non-verbal reasoning ability (intelligence) play a vital role in determine the academic performance of secondary school students. Life without memory would be meaningless. Imagine the fear and confusion of having all of your memories wiped out from birth to present, you would have no identity no knowledge, no life history, no recognition of friends or family, your fast would be a total blank without memory. In a real sense we are our memories. There are some problems which affects Short-Term Memory ability (STM) and academic performance among secondary students. Therefore some of the problems include the following:- Lack of motivation, Interference; the tendency for new memories to impair retrieval of older memories and reverse. Poor learning environment, Difficulties in remembering information (forgetting), lack of qualified teachers and hereditary influence.

Intelligence (Non-verbal reasoning ability) determines the ability of students to learn and solve problems in the classroom and outside. For this reason, the problem of poor academic performance could be explained by the student's level of intelligence. Also, the ability to retain and process the contents of learning has great effect on students' academic performance.

This study will therefore investigate the effect of Short-Term Memory (STM) and Non-verbal reasoning ability (intelligence) on academic performance among secondary school students in Katsina state.

### **Objectives**

The following objectives guided the study:-

1. To determine how short-term memory (STM) affect the biology performance of secondary school students in Katsina zonal education quality assurance
2. To determine how non-verbal reasoning ability affect the biology performance of senior secondary school students in Katsina zonal education quality assurance

### **Hypotheses**

For the purpose of this study, the following are the hypotheses:-

The following research questions will guide the study:

- i. Short-Term Memory (STM) has no significant effect on the academic performance of secondary school students in Katsina education quality assurance.
- ii. Non-verbal reasoning ability has no significant effect on the academic performance of secondary school students in Katsina education quality assurance.

### **Methodology**

The research design used in this study is the survey research design. The population of the study comprises of all SS II students of senior secondary schools in Katsina zonal education quality assurance. For the sample schools to reflect the entire population and to reduce the degree of error or bias that may occur the researcher adopted the stratified method of sampling. The instruments used in the collection of data are Non-verbal Reasoning Test (AH4 part II NVT), Short-Term Memory Digit Span and Biology Achievement Test (BAT). These instruments were administered to the sampled students (respondents) by the researchers with the aid of research assistant.

### **Results**

**Hypothesis 1:** Short-Term Memory (STM) has no significant effect on the academic performance of secondary school students in Katsina state.

**Table 1. Chi-square analysis of Short-Term Memory by Academic performance.**

	ACH			TOTAL
	1 Low	2 Average	3 High	
STM 1 Count	15	11	24	50
LOW % within STM	30.0%	22.0%	48.0%	100.0%
% within ACH	53.6%	61.1%	44.4%	50.0%
% of Total	15.0%	11.0%	24.0%	50.0%
2 Count	8	3	16	27
Average % within STM	29.6%	11.1%	9.3%	100.0%
% within ACH	28.6%	16.7%	29.6%	27.0%
% of Total	8.0%	3.0%	16.0%	27.0%
3 Count	5	4	14	23
High % within STM	21.7%	17.4%	60.9%	100.0%
% within ACH	17.9%	22.2%	25.9%	23.0%
% of Total	5.0%	4.0%	14.0%	23.0%
Total Count	28	18	54	100
% within STM	28.0%	18.0%	54.0%	100.0%
% within ACH	100.0%	100.0%	100.0%	100.0%
% of Total	28.0%	18.0%	54.0%	100.0%

$X^2 = 2.253$ ,  $df = 4$ ,  $P = .689$ ,

**Note:**

STM 1 = Low/≤ 4 digits; 2 = Average/5-7 digits;

3 =High ≥ 8 digits

Achievement 1 = Low/ ≤ 35%; 2 = Average/36-45%;

3 = High/≥46%.

The table above shows that Short-term Memory has no significance effect on academic achievement of students in Biology in secondary schools in Katsina education quality assurance.

**Hypothesis 2:** Non-verbal reasoning ability has no significant effect on the academic performance of secondary school students in Katsina education quality assurance.

This hypothesis was tested using chi-square ( $X^2$ ) analysis. The result obtained are presented in the table below:

**Table 2. Chi-square analysis of Non-verbal reasoning ability (NVR) by Academic performance**

	ACH			Total
	1 Low	2 Average	3 High	
IQ 1 Count	9	10	14	33
Low % within IQ	27.3%	30.3%	42.4%	100.0%
% within ACH	32.1%	55.6%	25.9%	33.0%
% of Total	9.0%	10.0%	14.0%	33.0%
2 Count	9	4	11	24
Average % within IQ	37.5%	16.7%	45.8%	100.0%
% within ACH	32.1%	22.2%	20.4%	24.0%
% of Total	9.0%	4.0%	11.0%	24.0%
3Count	10	4	29	43
High % within IQ	23.3%	9.3%	67.4%	100.0%
% within ACH	35.7%	22.2%	53.7%	24.0%
% of Total	10.0%	4.0%	29.0%	24.0%
Total Count	28	18	54	100
% within IQ	28.0%	18.0%	54.0%	100.0%
% within ACH	100.0%	100.0%	100.0%	100.0%
% of Total	28.0%	18.0%	54.0%	100.0%

$\chi^2 = 8.285$ ;  $df = 4$ ;  $P = .042$

**Note:**

IQ 1 = Low/≤ 8 scores in AH\$ part II; 2 = Average/ 9-12 scores in AH4 part II;

3 = High/≥ 13 scores in AH4 part II.

The table above shows that Non-Verbal Reasoning ability (intelligence) have effect on students performance in Biology in secondary schools in Katsina zonal education quality assurance However, it is noted that in the analysis intelligence narrowly missed having a significance effect on the students’ academic performance as a P-value is 0.042.

**Discussion**

The test of hypothesis on effect of the performance of students in short term memory (recall and digit span) on their performance in biology revealed that there is no significant effect. This finding of present study is in agreement with the finding of Alloway, (2010) in their independent study found no effect of short term memory on performance despite short term memory been important requirement for children at school who need their memory on a daily basis for a variety of tasks such as following teachers’ instructions or remembering sentences they have been asked to write down (Alloway, 2010). The test

of the effect of the performance of students in Non-Verbal Reasoning ability on their performance in biology revealed that there is significant effect. This is in agreement with Espin and Deno (1993) who found significant effect exists between Non-Verbal Reasoning ability on their performance in biology.

### **Conclusion**

Based on the finding of the study it was concluded that Short-Term Memory has no effect on performance in biology among students of secondary schools in Katsina zonal education quality assurance and Non-Verbal Reasoning ability affects the academic performance of students in biology and for students to acquire basic Biology knowledge they must have high level of Non-Verbal Reasoning ability.

### **Recommendations**

Based on the findings of this study, it is recommended that:-

1. Teachers should be prepared to make provision and use relevant instructional materials, because when the learning aids are familiar and relevant to the learners then the contents of learning pass through memory easily and they are better retained.
2. Students should be trained to seek understanding and retain the meaning of concepts taught.

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