

**EFFECT OF TINS MNEMONIC STRATEGY ON ACHIEVEMENT AND RETENTION IN
CONCEPT ALGEBRAIC WORD PROBLEMS AMONG BASIC EDUCATION STUDENTS IN
NASARAWA STATE**

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Citation: Azige, G. D. & Nyezon N. E. (2024). Effect of Tins Mnemonic strategy on achievement and retention in concept algebraic word problems among basic education students in Nasarawa State. *Journal of Science, Technology, and Education (JSTE)*; www.nsjkste.com/ 7(7), 78-91.

Abstract

This study investigated the Effect of Tins Mnemonic Strategy on achievement and retention in Concept Algebraic Word Problems Among Basic Education Students in Nasarawa State. The study was based on a quasi – experimental, non-equivalent pre-test, post-test and post- post-test, control group design. four research questions were posed and four hypotheses formulated to guide the study. The subjects were all 1853 students (1012 males and 841 females). The sample used for the study consisted of 83 (46 Males and 37 Females) JSII students belonging to two intact classes, randomly assigned to experimental and control groups using multilevel sampling technique, their selection is purposeful in order to have data that have state representative. A stratified random sampling approach base on coeducation was used for students' selection. The instrument for data collection was Algebraic Word Problems Achievement Test. The reliability of AWPAT was found to be $r = 0.82$ using K-R₂₁. The data collected were analyzed and

interpreted using mean and standard deviation to answer research questions and analysis of covariance to test the null hypotheses at 0.05 level of significance. The findings suggest that Tins Mnemonic strategy is an effective tool for improving retention in concept algebraic word problems among basic education students in Nasarawa state. The result of the study recommend that incorporating mnemonics strategies, specifically the Tins strategy, can be beneficial in improving academic achievement and retention among basic education students in Nasarawa State. It was also recommended that Tins mnemonic strategy should be employed by mathematics teachers in teaching concept algebraic word problems in Nasarawa State. The study concluded that Tins mnemonic strategy can be used as an intervention to improve students retention in concept algebraic word problems.

Keywords: TINS Mnemonic, Achievement, Retention, Algebraic Word Problems and Students

Introduction

Mathematics is the study of numbers, quantities, shapes, patterns and structures. It is an important tool for solving problems and improving our understanding of the world by providing the basis for accurate measurement, calculations and analysis. Mathematics is a subject that affects all aspects of human life at various levels. Nneji and Alio (2017) stated that mathematics reveals hidden patterns that help us understand the world around us. According to Malik (2017), mathematics is a way to develop the habit of thinking in children's minds. More importantly, accordingly to the National Education Act states that mathematics education is about producing people who can think mathematically and use mathematical knowledge effectively, and have a high sense of responsibility for problem solving and decision making (Federal Republic of Nigeria, 2014). To learn, students need to engage with mathematical concepts in meaningful and appropriate ways. Scholars such as Obi, Abugu, and Ayogu (2015) discovered that despite its great value, science, art, and culture, mathematics still faces many challenges in its teaching. Abdulhamid, Abubakar, and Tela (2017) stated that mathematics teachers should use effective methods to ensure effective learning, but the absence of this causes

students not to be included in the mathematics lesson.

According to Adeniyi and Ibrahim (2015), algebra is an aspect of mathematics that involves the use of letters and numbers. Combining these letters and numbers causes a lot of confusion for the students as the letters change value at regular intervals and one letter replaces another. Again, algebraic word problems, also known as algebra word problems or simply word problems are mathematical problems presented in the form of written or verbal descriptions rather than equations or numerical expressions. These problems require you to translate the information given in words into algebraic expressions or equations and then solve for one or more unknown variables. Masina and Timayi (2015) blamed the curriculum and teaching methods rather than the lack of student learning ability. The need to find reliable methods to improve student performance and mathematics retention is becoming an international issue. This is because traditional mathematics teaching methods are no longer effective (Bolaji, Kajuru & Timayi, 2015). Students typically perform poorly in these areas, and the NECO Chief Examiner Report (2018-2022) attributes students' failures to poor grammatical expression, misinterpretation of questions,

weak algebraic expression, It is said that there are problems such as One of the recommendations in the Chief Examiner's report was that students should try to read and understand the questions before answering.

Mnemonics strategy in teaching mathematics: mnemonics is a valuable teaching strategy in mathematics to help students remember and recall mathematical concepts, formulas, and procedures more easily. Mnemonics are memory aids or technique that use associations, acronyms, or patterns to facilitate learning. Further research is needed to determine whether teaching mnemonics can be considered an evidence-based practice in mathematics. There are a number of mathematical memory strategies (TINS, SOLVE) used by US secondary school teachers.

Tins processes include: Think about what you need to do to solve the problem and circle the keywords. Circle the information you need to solve the problem and write it down. Write a set of numbers that present the problem, and then write a solution sentence like this: I will explain your answer. Tin's mnemonic strategies are also explicitly taught to students. Tins is a mnemonic tool for middle school students to improve their math mnemonic skills (Matropieri & Scruggs, 2013). Effective teaching often combines mnemonics with

hands-on practice, explanations, and problem-solving to ensure a well-rounded math education.

Closely connected to achievement is retention. In mathematics, “retention” generally refers to the ability to remember and apply previously learned mathematical concepts, skills or knowledge over time. It has to do with how well a person can remember and use mathematical information they have learned. Good memorization is critical to building a solid foundation in math and for solving more complex math problems as you progresses in your studies. Preservation takes precedence over recall. It is recall that shows how much knowledge the students have retained after the teaching and learning. Retention may be the extent to which information can be retrieved from long-term memory. The success of retrieval depends on effective encoding (meaningful learning), which involves creating associations with existing knowledge that can foster future retrieval among students regardless of their gender. Research evidence have consistently indicates that instructional methods are major factor in determining student achievement and retention of in mathematics. Therefore, findinding better methods and new innovations is a major challenge facing mathematics educators. In one study, Akinsola and Odeyemi (2014)

investigated the impact of mnemonic and prior knowledge teaching strategies on students' retention in mathematics. It is important to note that the teacher assesses the student's knowledge at the beginning of the lesson by creating mnemonics that link old and new information in the student's memory, through examples that connect student's previous knowledge with new knowledge for improvement. This means we need to ensure good progress and improve mathematics education.

Also, Maghy (2015) investigated the effect of mnemonics on students' memory in high school mathematics algebraic word problems. Results showed a significant difference in performance in favor of the mnemonic group. We also observed that the mnemonic group performed better than their conventional counterparts. In a related study, Shafi (2016) revealed the impact of Tin strategy on mathematics student retention. Studies have shown that students who use the Tins strategy to teach mathematics perform better in mathematics content than those who do not, and that boys who teach mathematics using the Tins strategy significantly outperform girls in academic performance. It was shown that it did not exceed . strategy.

Gender is the moderating variable whose influence was investigated in this study. This variable was chosen due to the fact that gender issues in mathematics have not yet been resolved. The effect of gender on student performance in mathematics remains a controversial and topical issue among educators and psychologists. Freud (2011) suggested that differences in the mathematical performance of male and female anatomy are meaningful and indeed responsible for the observed differences in male and female personalities. These traits, perspectives, and relationships are socially constructed and learned through the process of socialization. Gisela (2011) observed the effects of gender on performance and found that male and female students performed differently in different subject areas of instruction. Gender issues and their impact on school performance in school subjects are not yet fully clarified due to conflicting research results in individual school subjects. Falayojo (2013) found performance differences between boys and girls at different school levels, noting that student age was important and determined achievement, not gender. Australian research shows that the gender gap in mathematics performance is narrowing (Forgasz, Leder & Vale, 2010). Vale (2009) noted that many studies in Australia between 2004 and 2009

showed no significant differences in mathematics performance between male and female students, although male students had higher tended to achieve average scores.

Objectives of the Study

The objectives of the study are to determine;

1. effects of Tins mnemonics strategy and conventional method on JS students achievement in algebraic word problems.
2. effect of TINS mnemonic strategy on JS students' achievement by gender in algebraic word problems.
3. effect of Tins Mnemonic strategy and conventioal method in Nasarawa State on students retention in concept algebraic words problem.
4. Effect of Tins mnemonic strategy on students' retention by gender in concept algebraic words problem in Nasarawa State..

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of JS students taught algebraic word problems using TINS Mnemonics strategy and conventional method?

2. What are the mean achievement scores of male and female JS students taught algebraic word problems using TINS mnemonic strategy?
3. What is the mean retention scores of students exposed to Algebraic words problem using Tins Mnemonic strategy and those taught using lecture method in Nasarawa State?.
4. What is the mean retention scores of male and female students exposed to Algebraic words problem using Tins Mnemonic strategy in Nasarawa State?.

Statement of Hypotheses

The following null hypotheses were formulated and tested at 0.05 levels of significance.

H₀₁: There is no significant difference in the mean achievement scores of students taught algebraic word problems using Tins Mnemonics strategy and conventional method.

H₀₂: There is no significant difference in the mean achievement scores of male and female JS students taught algebraic word problems using Tins mnemonic strategy.

H₀₃: There is no significant difference between mean retention scores of students exposed to Algebraic words problem using Tins Mnemonic strategy and those taught using lecture method in Nasarawa State?.

H₀₄: There is no significant difference between mean retention scores of male and female students exposed to Algebraic words problem using Tins Mnemonic strategy in Nasarawa State?.

Methodology

This study adopted a quasi- experimental design of pretest post-test, post-post-test non-equivalent control group design. The study population included of all the Basic Education students' offering mathematics in Nasarawa state. The target population of the study comprised of all the JSII students attending coeducational public schools numbering 1853 students (1012 males and 841 females) in the 2021-2022 academic Session. The study sample consisted of 83 JS II students from six junior secondary schools. This study used a multi-stage random sampling procedure. Out of the three senatorial zones in Nasarawa State, three local government were selected, namely; Akwanga, Lafia and Keffi local government areas. Their selection was purposeful in order to have a

data that have State representative. Using the ballot technique, two schools from each of the three selected local areas were used, co-educational schools were drawn from the list of schools in the area of study, the bases for the selection of the participating schools were: The schools must be co-educational, there must be qualified Mathematics teachers who have been in the schools for a minimum of 3 years, willingness on the part of the schools to cooperate with the researcher, and the schools must be distant from each other to avoid interaction effects. In each school, one intact classes were randomly drawn and the number in each class was collected through physical presence of students'. Algebraic word problem achievement test (AWPAT) was an instrument developed by the researcher consisting of 50 objective test items using content on algebraic word problem concepts. This topic is taken from the national curriculum for junior secondary school Mathematics and it was chosen because it is included in the Mathematics curriculum (JSS2). This was used to determine the achievement of students in algebraic word problems concept in Mathematics. The AWPAT was a 50- item, multiple- choice test with four options labeled A-D. Pre - AWPAT was administered before treatment, Post - AWPAT was administered after treatment and

Post-post – AWPAT was also administered two weeks after treatment . The tools were organized according to cognitive domain levels. After validation, the instrument was trial tested on 32 JS II students to establish the reliability coefficient for the instrument. The **Results**

internal consistency of AWPAT was 0.82. The data collected were analyzed and interpreted using means and standard deviations to answer the research questions. ANCOVA was used to test the null hypotheses at a significance level of 0.05.

Research Question 1

What are the mean achievement scores of JS students taught algebraic word problems using Mnemonics strategies and conventional method?

Table 1 Mean and Standard Deviation of Basic Education Students’ taught AWP in Experimental and Control Groups

Strategies	N	Pre-Test		Post-Test	
		Mean	SD	Mean	SD
Tins	38	13.66	1.30	23.89	1.64
Conventional Method	45	10.40	2.35	13.76	1.45
Total	83				

Table 1 shows that the pretest and posttest mean score and standard deviation of students in algebraic word problem taught using TINS mnemonic strategy was (13.66, 1.30) and **Hypothesis 1**

(23.89, 1.64), while the pretest and posttest mean scores and standard deviation of their counterparts taught using conventional method was (10.40, 2.35) and (13.76, 1.45).

There is no significant difference in the mean achievement scores of JSII students taught algebraic word problems using TINS mnemonic strategy and Conventional Method.

Table 2: ANCOVA Results on Basic Education Students' Achievements Scores of

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	232.079	2	116.039	12.121	.000
Intercept	358.445	1	358.445	37.440	.000
Pretest	144.214	1	144.214	15.063	.000
Strategy	89.665	1	89.665	9.366	.003
Error	804.197	81	9.574		
Total	47891.000	83			
Corrected Total	1036.276	82			

Experimental and Control Groups

Table 2 shows that p- value of 0.03 is less than the α – value of 0.05 ($F_{(1, 81)} = 15.06, P = 0.03, \alpha = 0.05$). The null hypothesis of no significance was rejected at 0.05 alpha level.

The result implies that there is a significant difference between the mean achievement scores of students taught algebraic word problems using TINS mnemonic strategy than those taught using conventional strategy.

Research Question 2

What are the mean achievement scores of male and female JS students taught algebraic word problems using TINS mnemonic strategy?

Table 3: Mean Achievement Scores and Standard Deviation of Basic Education Students' Taught AWP using TINS Mnemonic Strategy Based on Gender

Gender	N	Pre-Test		Post-Test	
		Mean	SD	Mean	SD
Male	17	13.71	1.26	24.18	1.47
Female	21	13.62	1.36	23.52	1.69
Total	42				

Table 3: shows the pretest and posttest mean score and standard deviation of students taught algebraic word problem using TINS

mnemonic strategy in terms of gender, male was (13.71, 1.26) and (24.18, 1.47) and female was (13.62, 1.35) and (23.52, 1.69).

Hypothesis 2

Ho2: There is no significant difference in the mean achievement scores of male and female JS students taught algebraic word problems using TINS mnemonic strategy.

Table 4: ANCOVA Results on Basic Education Students’ taught AWP using TINS Mnemonic Strategy Based on Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8.667	2	4.333	1.742	0.190
Intercept	134.267	1	134.267	53.988	0.000
Pretest	4.665	1	4.665	1.876	0.180
Gender	3.712	1	3.712	1.493	0.230
Error	87.044	35	2.487		
Total	21649.000	38			
Corrected Total	95.711	37			

Table 4 reveals that there was no statistical significant mean difference between male and female students who were taught algebraic word problems using TINS mnemonic strategy ($F_{(1, 35)} = 1.493$, $P = 0.230$, $\alpha = 0.05$). Hypothesis 2 was not rejected at 0.05 alpha level of significance.

Research Question 3

What is the mean retention scores of students exposed to Algebraic words problem using Tins Mnemonic strategy and those taught using lecture method in Nasarawa State?.

Table 5: Retention Mean Scores and Standard Deviation of Basic Education Students’ Taught AWP in Experimental and Control Groups

Variable Name	Posttest Mean	SD	Retention Mean	SD	Retention Gain
Tins	23.89	1.64	29.90	1.75	6.05
Conventional Method	13.76	1.45	17.36	2.19	3.60

(field study 2021-2022 academic session)

Table 5 shows the retention scores and standard deviation of experimental groups and the control group in the posttest and post-posttest, TINS problem solving strategy was (23.90, 1.64) and

(29.95, 1.75) with retention gain of 6.05, lecture method was (13.76, 1.45) and (17.36, 2.19) with retention gain of 3.60

Hypothesis 3

There is no significant difference between mean retention scores of students exposed to Algebraic words problem using Tins Mnemonic strategy and those taught using lecture method in Nasarawa State?.

Table 6: ANCOVA Results on Basic Education Students’ retention Scores of Experimental

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	232.079	2	116.039	12.121	.000
Intercept	358.445	1	358.445	37.440	.000
Pretest	144.214	1	144.214	15.063	.000
Strategy	89.665	1	89.665	9.366	.003
Error	804.197	81	9.574		
Total	47891.000	83			
Corrected Total	1036.276	82			

and Control Groups

(Field study 2021-2022 academic session)

Table 6 shows that p- value of 0.00 is less than the α – value of 0.05. The null hypothesis of no significance was rejected at 0.05 alpha level. The result implies that there is a

significant difference between the mean retention scores of students taught algebraic word problems using TINS mnemonic strategy than those taught using conventional Method.

Research Question 4

What is the mean retention scores of male and female students exposed to Algebraic words problem using Tins Mnemonic strategy in Nasarawa State?.

Table 7: Mean Retention Scores and Standard Deviation of Basic Education students' taught AWP using TINS mnemonic Strategy Based on Gender

S/N	Variable Gender	Posttest Mean	SD	Retention Mean	SD	Retention Gain
1	Male	20.16	5.42	25.32	6.94	5.16
2	Female	20.51	5.21	25.60	5.80	5.09

(field study 2021-2022 academic session)

Table 7 shows the retention mean scores and standard deviation in the post-test and post-post-test of TINS mnemonic strategy in terms of gender.

Male students mean scores was (20.16, 5.42) and (25.32, 6.94) while their female counterparts mean scores was (20.51, 5.21) and (25.60, 5.80) with retention mean difference of 0.07.

Hypothesis 4

H₀₄: There is no significant difference between mean retention scores of male and female students exposed to Algebraic words problem using Tins Mnemonic strategy in Nasarawa State?.

Table 8: ANCOVA Results on Basic Education Students' Taught AWP Using TINS Mnemonic Strategy Based on Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	10.596	2	5.298	1.795	0.181
Intercept	76.840	1	76.840	26.035	0.000
Posttest	10.511	1	10.511	3.561	0.067
Gender	.142	1	0.142	0.148	0.827
Error	103.298	35	2.951		
Total	34194.000	38			
Corrected Total	113.895	37			

(field study 2021-2022 academic session)

Table 8 shows that there was no statistical significant retention mean difference between the male and female students that were taught algebraic word problems using TINS strategy P =

0.827, $\alpha = 0.05$. The hypothesis was not rejected at 0.05 alpha level of significance. The result implies that there is no significant difference between the mean retention scores of male and

female students taught algebraic word problems using TINS mnemonic strategy.

Discussion of Findings

The findings indicate that mnemonics strategies improved JS students' retention in concept algebraic word problems compared to students' taught using lecture method. The findings are consistent with that of Siegel (2017) who found that students' memory improved when using the TINS Mnemonic strategy. The results of this study is also coincide with the findings of Akinsola and Odeyemi (2014); because mnemonic strategy improve students' mathematics skills, teachers need create mnemonics that connect new and old information in students' memories. The findings is also consistent with Maghy (2015) findings showing that mnemonic strategies are more effective than lecture method.

The research results also show that male and female students' have similar memory when using TINS mnemonic strategy, male students' scores are higher than female students' . The findings are consistent with Shafi's (2016), study showing that students taught mathematics using TINS strategy retained and achieved more in mathematics content than students who were not and male students were not significantly better than their female counterparts in academic

achievement when they were taught Mathematics using TINS strategy. Forgasz, Leder and Vale (2010), suggested that gender differences in mathematics is decreasing. The findings of this study contradicted that of Johnson (2016), who observed that at the secondary level, girls could not measure with boys, because girls abandoned their study of mathematics before they entered the senior classes of secondary school. The results also show that gender is not an issue in students' retention of mathematics information when taught using mnemonic strategy.

Conclusion

This study provides evidence of the positive impact of the TINS mnemonic strategy on retention in concept algebraic word problems among basic education students in nasarawa state. Additionally, the TINS mnemonic strategy is gender friendly, so both male and female can benefit from it.

Recommendations

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

1. Mathematics teachers should be encouraged to include TINS mnemonic in their instructional

strategies to effectively cater for the diverse abilities level of students within their classrooms.

2. Periodic and regular training through seminars and workshops should be organized for in-service teachers to update their knowledge on current and innovative teaching strategies at secondary school level by state government.
3. Mathematics teachers should constantly look for current and innovative methods of teaching Mathematics that would be more effective.
4. The result of the study recommend that incorporating mnemonics strategies, specifically the Tins strategy, can be beneficial in improving academic achievement in basic education students in Nasarawa State.

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