



Effect of Thematic Learning Strategy on Senior Secondary School Students Academic Performance in Trigonometry in Adamawa State, Nigeria

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Abstract

This study investigated the effect of thematic learning strategy on senior secondary school students' academic performance in trigonometry in Adamawa State, Nigeria. The study employs a pretest, posttest non-randomized control group design. The population consisted of 3,450 co-education Senior Secondary two (SSII) mathematics students of government-owned schools in Girei Local Government Area of Adamawa State. A total of 245 students in four intact classes formed the sample for the study. The four classes were randomly assigned to experimental (N=176) and control groups (N=69). The Trigonometry Performance Test (TPT) adapted from past questions of WASSCE (2016-2021) with a computed Kuder-Richardson formula 20 (K-R20) reliability coefficient $\rho_{KR20} = 0.79$ was used for data collection. Data were analyzed using mean, standard deviation and analysis of covariance (ANCOVA). Results indicated that there was a significant effect of thematic learning strategy on the academic performance of mathematics students [F = 26.873 (df 1, 242); P<0.05]. Gender was not found to have a significant effect on students' performance in Trigonometry Performance Test [F = 2.572, df (1,173); P> 0.05]. There was a statistically significant difference in the performance of low, moderate, and high-level scoring students when exposed to treatment [F =269.124, df (2,172); P<0.05]. It is therefore recommended that mathematics teachers, as well as pre-service mathematics teachers' trainees, should be trained on the use of thematic learning strategy to improve students' academic performance in Trigonometry and mathematics in general.

Keywords: Thematic learning strategy, Trigonometry, Gender

Introduction

Education is the bedrock of growth and development for any nation and the only way to guarantee child's rights. This is why stakeholders have pushed for incentives and enabling environment that would encourage more Nigerians to embrace education. The declining standard of education in Nigeria has continued to raise concerns from stakeholders in the country and international communities (Sunday, Obed, &Yalwa 2018). More problematic are the issue of poor teacher quality and their mode of teaching in the institutions of learning (Sunday et al, 2018). Poor teacher quality is of great concern because these are educators that have primary contact with the students. In realizing this, the Nigerian government has been making instructive policies to bring about a robust reform in the sector, especially in the teaching profession, which it plans to make implicitly dynamic, nationally relevant, and globally competitive. Some of the efforts made by government to encourage students include awards of scholarship, introduction of school feeding programme to encourage students' enrolment, attendance and full concentration on studies. There seems to be a general agreement, both in Nigeria and most other countries of the world, that every school learners and teachers need a rudimentary knowledge of

mathematics before they can function well in society, especially in this era of the technological age, which is highly rooted in mathematics (Terna, kuje & Jamila 2018).

Mathematics is defined as a branch of human inquiry involving the study of numbers, quantities, data, shape, and space and their relationships, especially their generalizations and abstractions and their application to situations in the real world (Eze& Bot 2014). Mathematics is also an essential discipline that forms the basis of all other sciences and deals with the material substance of space and time. It focuses on peoples approach to problem solving especially while trying to find practical solutions to everyday problems (Ogunode, 2020). The National Education Policy of the Federal Republic of Nigeria (2020) regards mathematics as a core subject and makes it a compulsory subject for all students in Nigeria and a credit level pass is also required to secure admission to higher institutions in Nigeria. As important as the subject is, the tremendous and persistent failures of the Nigerian students in it have remained a major threat to its learning. Attempts to find a solution to this incessant failure have made researchers in mathematics education to consider several factors. One such factor carefully reviewed in this study is incorrect



teaching by mathematics teachers. (Selvianiresa, & Prabawanto, 2017) pointed out that the use of inappropriate teacher centered strategies, such as lectures or traditional methods, is responsible for the lowest student achievement in science and mathematics. The traditional teaching method has many shortcomings because it only appeals to the learners' auditory sense, thus learners who are weak in cognition especially those in the secondary school level learn little and will not acquire the desired skills because of rote learning, so students are often led to believe that mathematics is irrelevant and boring as it passively calls for learning rules without a clear purpose and that it restricts the chances of working collaboratively, neglecting the needs of the low, moderate and high level scoring students which are ability grouping in the classroom. (Mohammed, 2020). The common purpose of ability grouping is to provide instruction that is appropriate for students and their individual needs (Kristina & Beth 2016). Ogenyi (2015), stressed that there is a need for better instructional strategies to be used to ensure effective and meaningful learning irrespective of ability levels of students.

In an attempt to shift from the traditional strategy of teaching and to identify a suitable pedagogical strategy for teaching mathematics to enhance students' achievement, many conceptual patterns and models which are student-centered approaches such as guided inquiry, constructivism, Polya's four and Styer three stages problem solving instructional strategies among others have been advocated for, yet they seem not to be sufficient as failure rate keeps skyrocketing every year (Achor, Gbadamosi, 2020; Ergen & Kanadli, 2017). The situation, therefore, calls for the use of other teaching or learning strategies that have been found effective in some other subject areas and other countries, hence thematic learning strategy was opted for in this current study to improve comprehension and learning mathematics especially trigonometry which form substantial part of senior secondary school mathematics curriculum. Thematic learning (often synonym with thematic instruction) is an instructional method of teaching in which emphasis is given to choosing a specific theme for teaching one or many concepts (Sheppard, 2012). It is based on integrating various- information and using it to demonstrate the topic (Connors, Gelzheiser, Hallgren-Flynn, & Scanlon, 2014). Thematic units encourage the involvement of all students through topics relevant to them. Students can relate to real-world experiences

and build on prior knowledge of a topic in mathematics most especially Trigonometry which forms a great part in their assessment in standardized examination such as the West African Examination Council (WAEC) and National Examination Council.

Trigonometry is a branch of mathematics that studies various properties of functions to find unknown angles and sides of a triangle and it also forms an important basis for problem solving in many disciplines such as astronomy, technology, engineering and constructions. Knowledge of trigonometry helps students to understand shapes and situations in their environment and helps to develop their inductive reasoning skills that are necessary ingredients for learning mathematics (Balarabe & Mohammed 2018). Unfortunately students' performances in this aspect of mathematics remain poor (Abakpa, 2011). For instance, female students tend to achieve poorly and develop negative attitudes towards mathematics compared to male students in the general mathematics tasks (Gupta, Sharma, & Gupta 2012). This thereby give rise the problem of gender disparity in mathematics which needs to be addressed in the overall interest of national development. One of the means of effective teaching and learning of mathematics towards raising students' performance especially in trigonometry is the use of thematic learning instructional strategy (Ichsan & Nafi 2019).

In line with the purpose of this study, the researcher investigates the effect of the use of thematic teaching strategy on senior secondary school students' academic performance in trigonometry in Girei Local Government Area of Adamawa State. The specific objectives of the study are to:

1. Determine the effect of thematic learning strategy on the academic performance of senior secondary school students in Trigonometry
2. Investigate the effect of thematic learning strategy on the academic performance of male and female senior secondary school students in Trigonometry
3. Determine the effect of thematic learning strategy on high, medium and low scoring level senior secondary school students after learning Trigonometry.

Also in line with the purpose of the study, the following research questions were posed

1. What is the difference between the academic performance mean scores of senior secondary

school students taught trigonometry with thematic learning strategy and those taught using the lecture method?

2. What is the difference between the academic performance mean scores of male and female students taught trigonometry with thematic learning strategy and those taught lecture method?
3. What is the difference in the mean academic performance scores of high, medium and low scoring level senior secondary school students taught trigonometry with thematic learning strategy and those taught lecture method?

Based on the research questions, the following hypotheses were formulated

1. There is no statistically significant difference in the mean performance scores of senior secondary school students taught trigonometry with thematic learning strategy and those taught using lecture methods.
2. There is no statistically significant difference in the mean performance scores of male and female students taught trigonometry with thematic learning strategy and those taught using lecture methods.
3. There is no statistically significant difference in the mean performance scores of high, medium, low scoring level students taught trigonometry with thematic learning strategy and those taught using lecture methods.

Method

This study adopted the pre-test, post-test, control group of quasi-experimental design. The target population comprised 3,450 co-educational senior secondary (SS) 2 mathematics students of government owned schools in Girei Local Government Area of Adamawa State. The choice of this local government is due to the fact that an observation over the years is that students' achievement in mathematics at Senior Secondary level (SSCE) has not been very encouraging. A total of 245 students in four intact classes formed the sample for the study. The four classes were randomly assigned to experimental (N=176) and control groups (N= 69). The subjects' age ranged between 13 and 20years. Furthermore, mathematics teachers in each of the schools who were previously trained and certified to meet the selection criteria were used for the study. A total of six weeks was spent for the study. The instrument for data

collection was Trigonometry Performance Test (TPT) which was patterned after West African Senior School Certificate Examination (WASSCE). The researcher developed the TPT which consists of 50-items with four options drawn from Trigonometry-Sine and Cosine rules and applications. The instrument was validated by three experts from the Department of Physical Sciences Education, Modibbo Adama University, Yola .. Their inputs further improved the quality of the instrument. A trial-testing was conducted in one secondary school in Yola town to determine the reliability of the instrument, the result obtained was used in the computation of reliability coefficient using Kuder-Richarson formula 20 (K-R20) and was found to be 0.79. The instrument is considered reliable according to literature. One set of lesson plans was written based on the thematic learning strategies used by researchers in the experimental group, and another set of lesson plans was written according to conventional methods and used by researchers in the control group. Treatment was rigorously conducted on selected topics in the Senior Secondary School II curriculum, which included the rules and applications of trigonometry-sines and cosines.

A pre-test was administered to both experimental and control groups to establish equivalence in terms of academic ability in the first week. In addition, subjects in the experimental group were trained on what thematic learning strategy is all about. The result of the pre-test was used to group the students into the three scoring levels i.e high, medium, and low scoring levels in the participating schools that formed the experimental group. The control group subjects were not trained because the conventional lecture method was used as their treatment. Treatment which lasted for five weeks commenced in the second week with the experimental group exposed to a thematic learning strategy while the conventional lecture method was employed for the control group. Post-test which lasted for one hour and thirty minutes were administered in the sixth week in the respective schools. The students' scores from (TPT) were collected and analyzed using mean and standard deviation to answer the research questions and ANCOVA was used to analyze data for testing the hypotheses at 0.05 level of significance.

Results

Data collected were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics – Analysis of Covariance (ANCOVA).



Table 1: Mean and Standard Deviation of Achievement Scores of Subjects by Treatment Groups

Teaching Methods	N	Pretest		Posttest		Mean Gain
		Mean	SD	Mean	SD	
Thematic Strategy	176	23.90	11.36	29.78	9.83	5.88
Lecture Method	69	20.54	10.37	22.14	9.49	1.6
Mean diff		3.36		7.64		4.28

Table 1 indicates both learning strategy improved students' performances after treatments; however, students in the Thematic Learning Strategy achieved better than those taught using conventional strategy.

The difference in performance was put to test statistically to ascertain whether it was significant. Data relevant to research hypothesis 1 are presented in Table 2

Table 2: Tests of Between-subjects Effects on Means of Pretest and Posttest of Students Taught with Thematic Learning Strategy and Conventional Strategy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig	Partial Eta Squared
Corrected Model	10430.554 ^a	2	5215.277	81.403	0.000	0.402
Intercept	10176.690	1	10176.690	158.843	0.000	0.396
Posttest scores	7537.961	1	7537.961	117.656	0.000	0.327
Treatment	1721.713	1	1721.713	26.873	0.000	0.100
Error	15504.385	242	64.068			
Total	213008.000	245				
Corrected Total	25934.939	244				

a. R Squared=0.402 (Adjusted R Squared= 0.397)

The result of the analysis in table 2 shows that, the computed F = 26.873 (df 1, 242); P<0.05. This implies that there is a significant difference between the two groups to the advantage of those taught trigonometry using thematic learning strategy. The

partial eta squared value of 0.10 indicated that, 10% of the difference in score is accounted by the instructional strategy used to teach trigonometry. Data relevant to research question two are presented in table 3

Table 3: Mean and Standard Deviation of Pretest and Posttest scores of Male and Female Students in Thematic Class

Gender	N	Pretest		Posttest		Mean Gain
		Mean	SD	Mean	SD	
Male	120	24.72	12.02	30.83	9.99	6.11
Female	56	22.16	9.70	27.55	9.17	5.39
Mean diff		2.56		3.28		0.72

Table 3 shows the mean gains are 6.11 and 5.39 for males and females respectively and with a mean difference of 0.72 in favour of the males. This means that the male students' performance was slightly better

than their female counterparts in Thematic Learning strategy. To test how significant this difference was, hypothesis 2 was tested and reported in Table 4. Data relevant to hypothesis 2 are presented in Table 4

Table 4: Tests of Between-subjects Effects on Means of Pretest and Posttest of Students Taught with Thematic Learning Strategy based on Gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig	Partial Eta Squared
Correctedmodel	3844.837	2	1922.418	25.429	0.000	0.227
Intercept	12854.417	1	12854.417	170.030	0.000	0.496
Pretest	3436.206	1	3436.206	45.452	0.000	0.208
Gender	194.475	1	194.475	2.572	0.111	0.015
Error	13078.959	173	75.601			



Total	173052.000	176
Corrected Total	16923.795	175

Results in Table 4 indicate that for gender, $F = 2.572$, $df(1,173)$; $P > 0.05$. Hence, the null hypothesis of no significant difference between male and female

students taught using Thematic Learning strategy is not rejected. Data relevant to research question 3 are presented in Table 5

Table 5: Analysis of Mean Scores of High, Medium and Low Scoring Level Students Taught Using Thematic Learning Strategy

Scoring Levels	N	Pretest		Posttest		Mean Gain
		Mean	SD	Mean	SD	
Highscorer	85	27.66	11.24	37.95	5.30	10.29
MediumScorer	59	22.69	9.09	25.93	3.49	3.24
Low Scorer	32	16.16	11.36	16.19	3.99	0.03

Table 5 shows that high scoring students had the highest mean gain, followed by medium scoring students and lastly the low scoring students. The result

was put into test in hypothesis 3 to ascertain whether the difference is statistically significant.

Table 6: Analysis of Covariance on the Post-Test Scores of High, Medium and Low Scoring Level Students

Source	Typell Sum of Squares	Df	Mean	F	Sig	Partial Eta Squared
Corrected Model	13709.386 ^a	3	4569.795	244.525	0.000	0.810
Intercept	17121.523	1	17121.523	916.157	0.000	0.842
Pretestscore	344.006	1	344.006	18.407	0.000	0.097
Scoring Level	10059.024	2	5029.512	269.124	0.000	0.758
Error	3214.409	172	18.688			
Total	173052.000	176				
Corrected Total	16923.795	175				

a. R Squared=0.810 (Adjusted R Squared=0.807)

Results in Table 6 indicate that for scoring levels of students, $F = 269.124$, $df(2,172)$; $P < 0.05$. It implies there was a significant difference in the performances of high, medium and low scoring students taught mathematics using thematic learning strategy.

Discussion

Findings showed that there was an appreciable difference in the mean score of the experimental group. This means that the treatment has a positive effect on the experimental group. A statistically significant difference also exists between the performance of students exposed to the Thematic Learning Strategy and those exposed to the Lecture method. The students exposed to Thematic Learning Strategy performed better than students exposed to the lecture method in Trigonometry Performance Test. This could be because a thematic learning environment makes all students active and engaged, regardless of their learning ability. Furthermore, thematic learning provides opportunities for a variety of potential involvement in the learning process, as well as accommodating students' differences in the internal

representation of knowledge reflecting real-life examples. This finding is in line with Nurlaela, Samani, Asto, and Wibawa(2018). who found out that, students exposed to thematic learning strategy performed better than students exposed to the lecture method. The research findings also showed that there was no difference in the performance of students exposed to the Thematic Learning Strategy based on gender. This finding is in line with (Abubakar & Bada 2012; Abubakar & Oguguo 2011; Bonomo, 2010) who found that there was no significant difference between post-test mean scores of male and female students in the mathematics achievement test. The non-gender bias nature of the thematic learning strategy in the mathematics classroom setting found in this study could be an advantage to the mathematics teacher. The implication of this finding could be that what matters in teaching and learning is the effectiveness of the instructional strategy used by the teacher. Accordingly, once an instructional strategy is motivating and engages students' attention and activities based; it does not discriminate in the performance of male and female students. Thematic



learning strategy seemed to have provided an environment for free interaction of students with one another in which male and female students have achieved some level of equilibrium in mathematics as reported in the findings of (Connors, Gelzheiser, Hallgren-Flynn, & Scanlon, 2014.; Bolak, Bialach & Dunphy, 2005).

The research also showed significant differences in the performance of high, medium, and low-scoring students taught using the Thematic Learning Strategy. This is also in agreement with the findings of Adeniran (2011). The varying scores among students scoring levels could be attributed to a lack of ability of mathematical connection when studying mathematics which is caused by many things, one of them is because students are not able to relate the mathematical ideas that have been taught to real-life ideas especially the low level scoring students. This happens because the students often memorize the mathematical ideas without trying to interpret the ideas as pointed out by (Mauliana, Ikhsan, & Subianto 2018). Learning is considered meaningful if the information learned by the learner is prepared by cognitive structures in such a way that learning transfer can be easily achieved.

Conclusion

The findings of this study revealed that the achievement of the group using the thematic learning instructional strategy was found to be significantly higher than the group taught using the conventional method of teaching. It was also revealed that thematic learning instructional strategy is not gendered biased. These results, therefore, show that the thematic learning instructional strategy is an effective strategy for teaching Trigonometry in senior secondary schools and should be adopted by mathematics teachers.

Recommendations

Based on the research findings, the following recommendations were made;

1. Mathematics teachers should vary their instructional approach by using a thematic learning strategy against the consistent use of conventional teaching method because the thematic learning strategy has been found to enhance the academic performance of mathematics students.
2. Mathematics teachers should endeavor to use the thematic learning strategy in teaching

trigonometry since this strategy enhances achievement and has the potential of developing critical thinking and creative abilities in the students without being gender biased.

3. Extra lessons should be organized by schools to bridge the gap existing between high, moderate, and low-level scoring students in mathematics.

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