

**APPRAISAL OF ADDIE INSTRUCTIONAL DESIGN TEACHING STRATEGY ON
ACADEMIC PERFORMANCE OF GEOMETRIC CONCEPTS AMONG UPPER BASIC
STUDENTS IN SOKOTO STATE, NIGERIA**

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ABSTRACT

This paper investigated the effects of ADDIE Instructional Design Teaching Strategy on Academic Performance of Geometric Concepts among Upper Basic Students in Sokoto States. Eight (8) schools with a total of 291 Upper Basic 3 students were sampled for the study using stratified sampling technique. Two research questions and two null hypotheses were raised to guide the conduct of the study. Two instruments GSPT and AFDJYH with reliability indices 0.87 and 0.84 respectively were adapted for data collection. T-test statistical analysis at $\alpha = 0.05$ level of significance was used to test the hypotheses. The two null hypotheses were rejected. Since the results of teaching through the use of ADDIE instructional design teaching strategy was proved to be better than traditional method, it was therefore recommended that Ministry of Educations (MOEs), Ministry for Science and Technology, State Universal Basics Education Board Sokoto (SUBEB), Curriculum planners and Developers should review their policies to inculcate this strategy in teaching mathematics and science related subjects designed in the 9-year basic education curriculum in Nigeria.

Keywords: Appraisal, ADDIE Model, Geometric Concepts, Teaching Strategy, Academic Performance, Upper Basic Students.

Introduction

Looking at the numerous contributions mathematics is making in all aspects of human and societal development, the saying that no society can develop without making proper use of mathematical knowledge is a reality. Yusha'u (2016) mentioned that no country can be recognized as developed nation unless it has strong knowledge and application in Science and Technology, and this cannot be achieved without Mathematics, because it is a lubricant that made Science and Technology to be strong. That is why many countries in the world, including Nigeria, made mathematics as core and compulsory subject in all its educational institutions (Chado and Bala, 2014).

Geometry is the topic that constitutes the backbone of mathematics and it contributes to other disciplines like engineering, science, technology, architecture, buildings and computer education. It is a very vital branch of mathematics that is available in every aspect of the school mathematics curriculum, ranging from primary; lower basic and upper basic secondary schools. According to Nasiru (2022) Geometry constituted 60% to 70% of mathematics curriculum. In view of this importance, most countries in the world including Nigeria consider geometry in their mathematics curriculum.

Statement of the Problem

Although mathematics was made compulsory subject for all students in Nigerian schools, researchers found that it is the subject mostly failed by students in both their internal and external examinations (Adetula and Salman, 2017). Chief Examiner's Reports of WAEC (2015 - 2022) shows that many candidates in Nigeria avoided questions in geometry and those attempted them recorded very low marks due to language of instruction. Most of terminologies used in teaching geometry are either English words or borrowed words from other foreign languages such as Greeks, Latin, Hebrew, etc, which are completely foreign in nature and has no bearing with the culture and native language of learners (Adetula& Salman, 2017). In this study therefore new instructional strategy was designed and developed through ADDIE instructional model which was used in teaching geometric concepts to upper basic students in Sokoto State.

Objectives of the Study

The objectives of this study are:

1. To determine the effects of ADDIE instructional design teaching strategy on academic performance of upper basic students on geometric concepts in Sokoto State.
2. To determine the effects of ADDIE instructional design teaching strategy on academic performance of Urban and Rural upper basic students in Sokoto State.

Research Questions

The following research questions were raised to guide the conduct of this study:

- 1- Is there any difference in academic performance between students taught geometry using ADDIE instructional teaching strategy and those taught using traditional method in Sokoto State?
- 2- Is there any difference in academic performance between Urban and Rural students taught geometry using ADDIE instructional design teaching strategy in Sokoto State?

Null Hypotheses

- 1- H_{01} : There is no significant difference in academic performance between upper basic students taught geometry using ADDIE instructional design teaching strategy and those taught using traditional method in Sokoto State.
- 2- H_{02} : There is no significant difference in academic performance between Urban and Rural upper basic students taught geometry using ADDIE instructional design teaching strategy in Sokoto, State.

Concept of ADDIE Instructional Design Model

ADDIE model is an instructional design field approach that helps instructional designers, contents developers and teachers to create an efficient and effective teaching design process

considering both the learners' and environmental goals and objectives (Nada, 2015). The model was first created at Florida State University as a linear instructional design model in 1980s. In the year 2002 it was fully developed as a cyclic instructional design model for delivering effective and inclusive classroom teaching and learning process within the learners' needs and environmental constraints (Jeff, 2015). Although there are many instructional design models in educational teaching and learning process, ADDIE model is the only instructional design model in education that was found to certify all the characteristics of instructional models mentioned by Aris (2018). It is a learner-centered instructional model having five phases. These are: **A** - analysis, **D** - design, **D** - develop, **I** - implement, and **E** - evaluation.

School Geographical Location and Students' Academic Achievement

Schools location means Urban and Rural schools. Rural life is uniform, homogenous and less complex than that of Urban centers, with cultural diversity, which often is suspected to affect students' academic achievement. This is because Urban centers are better favoured with respect to distribution of social amenities such as pipe borne water, electricity, healthcare facilities while the Rural areas are less favoured (Akissani, Muntari& Ahmad, 2019). According to Akpan (2018), schools in Urban areas have more teachers more learning facilities and infrastructure better Rural areas. According to, Ezike (2021), Urban areas are those with high population density, high variety and beauty while Rural areas are those with low population, subsistence mode of life, monotonous and burden. Students attending rural schools face challenges of higher poverty than those attending urban schools.

In Nigeria, the lingual Franca is English language, which in most cases is not widely spoken in Rural schools. What obtains in most cases is the native language of that setting. This can greatly affect students' performance in mathematics since it is with English language mathematics is been taught and assessed in schools (Akissani, Muntari& Ahmad, 2019). However, one of the greatest advantages of Rural schools is the tendency for smaller classes, which promise increased student evaluation, and provide greater flexibility in teaching strategy. These prevailing conditions imply that learning opportunities in Nigerian schools differ from school to school. It would appear therefore that students in Nigerian Urban schools have more educational opportunities than their counterparts in the Rural schools. For the purpose of this research, all schools located in Sokoto metro polis were consider as Urban schools while those situated in the villages outside Sokoto metropolis were considered as Rural schools.

Review of Related Literatures

In the study to determine the effects of ADDIE and Dick and Carey instructional teaching models Ali (2021) carried out his study in the North Central Nigeria on Technical College Student's academic achievement in Motor Vehicle Mechanics Work. The instrument used for data collection was 40 multiple choice objectives Motor Vehicle Mechanics Work Achievement Test. ANCOVA was employed to analyzing data relating to the test of hypotheses. The result of the study indicated students taught using Dick and Carey Model performed academically higher in MVMW than their counterparts taught using the ADDIE instructional Model. Reynaldo (2023) also conducted a study on the Effects of ADDIE Model as an Instructional System Design for Senior High School Students in Natural Science through Alternative Delivery Learning. Three research questions and three null hypotheses were raised to guide

the study. The results revealed no significant difference in performance between students taught Physic and Chemistry using ADDIE model than those taught using traditional method. The finding also reveals no gender difference in performance seen.

Ugboduma & Samuel (2017) investigate the effects of using ADDIE instructional design model on e-learning based on students' interest in geometry in Ughelli educational zone of Delta State, Nigeria. Four null hypotheses were designed for the study. The hypotheses were tested using t-test and ANCOVA. The study found that there was no significant difference between the mean interest scores of students taught geometry using ADDIE model and those taught through other means. The findings also found the urban students performed significantly better than rural students. Finally male students are generally interested in geometry concepts teaching than the female students.

Uniqueness of the Study

The gap seen between this study and the previous studies reviewed is that, no new instructional teaching strategy was design by means of any instructional model which was used to teach students any topic in mathematics. In this study therefore the researchers applied the steps of ADDIE instructional model and designed a new strategy which was used it for teaching geometry to upper basic students in Sokoto State.

Population of the study

The target population of this study was the whole Upper Basic 3 Students in Sokoto, State. It was found that there are two hundred and ninety one (291) upper basic schools with a total of forty one thousand five hundred and eight (41,508) upper basic 3 students in Sokoto State. Twenty six thousand eight hundred and eighty four (26,884) were male students while fourteen thousand six hundred and twenty four (14,624) were female students (Examination Units MOE, MST, & AIEB Sokoto State, 2022/2023).

Sample and Sampling Techniques

Eight (8) schools with an estimated population of 3,492 upper basic 3 students were sampled for the study using stratified sampling techniques. Four schools (4) were sampled as experimental and the remaining four (4) were control schools according to their gender and geographical locations in the state. This sampling technique was in accordance with the advice in Sambo (2005). The table below shows the distribution of sampled schools according to their category, gender and locations

Instrumentation

Two instruments were adapted by the researchers for the purpose of gathering data for this research work. These are (1) Geometric Students' Performance Test (GSPT), and (2) Auna Fahimtar Dalibai a Jometiri da Yaren Hausa (AFDJYH). The first instrument, GSPT was adapted in English language while the second instrument AFDJYH was adapted in Hausa language. Each contains two sections A and B. Section A contains thirty (30) objective items, and section B contains three (3) theory questions in geometry topics.

Validity of the Instruments

The two instruments were validated by experts in Usmanu Danfodiyo University Sokoto (UDUS), Shehu Shagari College of Education Sokoto (SSCOE). Base on the advice made by

the experts some items were removed and some were modified. Section A of GSPT and AFDJYH which contains thirty (30) objective items were reduced to twenty (20) objectives questions while section B remains the same three (3) theory questions. Marking schemes were also adjusted to marks (3marks) while each theory question attracts twenty marks (20 marks) which will be sum up to 100 maximum marks.

Reliability of the instruments

Test and re-test method were conducted to obtained the reliability index of GSPT and AFDJYH questionnaires. Pearson's Product Moment Correlation was used to determine the reliability index of the two instruments and was found to be 0.87 and 0.84 respectively.

Administration of the instruments

A pre-test was administered to all sampled students on the same day with the help of research assistance in each school. Answered scripts were collected and marked immediately after the test is over. The Experimental Groups (EG) which consist of boys and girls were taught geometry using Hausa language as the medium of instruction for six weeks. The controls Group (CG) were taught using traditional methods for the same equal period of time as in the experimental groups. Post-test was then administered using GSPT for CG and AFDJYH for EG. After two weeks post-post-test was again re-administered to Experimental Groups to ascertain the level of their retention.

Data Analysis

The presentation of data was based on the two research questions and two null hypotheses generated from the two objectives of the study. The pre-test conducted for both the (CG) and (EG) show that their performance before giving the treatment was homogeneous.

Null Hypothesis One (H_{01})

There is no significant difference in academic performance between upper basic students taught geometry using ADDIE instructional teaching strategy and those taught using traditional method in Sokoto State. This hypothesis was tested using t-test at $\alpha = 0.05$ level of significance.

Table 1: Summary of T-test analysis of null hypothesis one (H_{01})

Groups	No. of Students	Mean ($\bar{x}$)	SD (σ)	SD Error ($\bar{x}$)	Mean Difference	df	t_{cal}	P	Decision
Exper. Groups	145	56.37	14.08	1.17	20.98	303	14.33	0.000	H_{01} Rejected
Control Group	160	35.39	11.46	0.91					

Source: Field work, 2024

$\alpha = 0.05$

Table 1 showed that the $P - value = 0.000$ is less than the $\alpha - value = 0.05$. From the rule, when the P-value is less than the alpha value, the null hypothesis is rejected. This implies that null-hypothesis one which says there is no significant difference in academic performance between upper basic students taught geometry ADDIE instructional design teaching strategy and those taught using traditional method in Sokoto State was therefore rejected.

Null Hypothesis Two (H_{02})

There is no significant difference in academic performance between Urban and Rural upper basic students taught geometry using ADDIE instructional design teaching strategy in Sokoto State.

Table 2: Summary of T-test analysis of null hypothesis Two(H_{02})

Variables	No. of Students	Mean Score	Standard Deviation	Mean Difference	df	t_{cal}	P	Decision
Urban Std.	72	53.0000	12.9244	6.6986	143	-	0.004	H_{04} Rejected
Rural Std.	73	59.6986	14.4575			2.950		

Source: Field work, 2024

$\alpha = 0.05$

Table 2 showed that the P – value ($P = 0.004$) is less than the alpha value ($\alpha = 0.05$). From the rule, when the P – value is less than the alpha value, the null hypothesis is rejected. This implies that null-hypothesis two which says that, there is no significant difference in academic performance between Urban and Rural upper basic students taught geometry using ADDIE instructional design teaching strategy in Sokoto State was rejected.

Summary of the Major Findings

The summary of the major findings were given as:

- 1- The first finding revealed that upper basic students taught geometry using ADDIE instructional design teaching strategy performed significantly better than those students taught geometry through traditional method in Sokoto State.
- 2- The second finding of this study revealed that students from rural schools performed significantly better than students from the urban schools in geometric concepts through the use of ADDIE instructional design teaching strategy in Sokoto State.

Discussion

The data collected for the purpose of this study contained the results of upper basic students in their pre-test and post-test. Two null hypotheses were generated and tested using t – test analysis at $\alpha = 0.05$ level of significance. All the two hypotheses were rejected.

The first finding revealed that upper basic students taught geometry using ADDIE instructional design teaching strategy performed significantly better than those students taught geometry through traditional method in Sokoto States. This result confirmed the finding of Modesta and Anthony (2021), Akaazua (2021), Adamu (2022), Omere and Precious (2022). However, this result disagreed with the finding of Yasha'u (2018), Ali (2021), Reynaldo (2023), and Ugboduma & Samuel (2027).

The second finding shows that students from rural schools performed significantly better than students from the urban schools in geometric concepts through the use of ADDIE instructional design teaching strategy in Sokoto States. This finding confirmed the finding of Reynaldo (2023), Adamu (2022), Omere & Precious (2022), Umar, Tudunkaya & Muawuya (2019). However, the finding disagreed with the finding of Ali (2022), Ugboduma & Samuel (2017) and Yusha'u (2018).

Conclusion

Based on the findings of this study, the paper draws the following conclusion:

- 1- The use of ADDIE instructional design teaching strategy resulted in higher performance over traditional method in the teaching of geometry to upper basic students in Sokoto State.
- 2- Rural students were found to performed significantly better in geometric concepts than urban students through the use ADDIE instructional design teaching strategy because they are more cultured and unified Hausa speaking students than those in the urban areas

Recommendations

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

- 1- Since ADDIE instructional design teaching strategy has proved to be a viable option in promoting meaningful learning in geometry with high students' performance, it is recommended that teachers should be trained through refresher course on the use of ADDIE Instructional Design Teaching Strategy in their lessons.
- 2- It was also recommended that Government, stake holders, curriculum planners, teachers, and parents should use the findings of the study to give adequate attention to children basic education especially in the rural areas since it was proved that they can perform equally and even better than urban students if ADDIE instructional design teaching strategy was given proper consideration in the curriculum policies of Science, Mathematics and Basic Technology subjects designed in the 9-year basic education curriculum in Nigeria.

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