JOURNAL OF NEW TRENDS IN TEACHER EDUCATION (JONTTE)

Vol. 3 No. 1
2018

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EDITORIAL STATEMENT

In September of2017, the Delta State College of Education, Mosogar, organized its Second National Conference on Teacher Education. The Theme of this conference was, The College of Education System in Nigeria: Past, Present and Future. During the Conference three renowned Professors of Education delivered one Keynote address and two lead papers respectively. In addition to these presentations, several other conferees presented paper on different aspects of College of Education System in Nigeria.

This Conference was motivated by the desire of the College to play its part in the quest by concern educators to continuously search for ways and means of improving the quality of teachers education as this is a fundamental requirement towards ensuring that Nigerian education is endowed with the quality teachers it needs to achieve its goals.

This edition of this journal is a product of the forgoing conference. It was deemed necessary to select and peer-review some of the presentations for the purpose of sharing with scholars, practitioners and the general public the several issues and perspectives on The College of Education System in Nigeria: Past, Present and Future. It is our hope that the contributions by the conferees as published in this journal would have provided useful insight and perspectives on this very important subject matter.

Prof. Emmanuel Ojeme
Editor-in-Chief

EDITORIAL POLICY/GUIDELINES FOR AUTHORS

Journal of New trends in Teachers Education (JONTTE) is Interdisciplinary and accepts both empirical and theoretical articles for publication.

Manuscripts for publication should meet the following guidelines:

I. One paragraph abstract of not more than 200 words.

ii. The American Psychology Association (APA) 6th edition format should be used throughout the manuscript.

iii. The first page of each manuscript should contain the title of the article, author's name and affiliation, (including phone number, and email address).

iv. The manuscripts should be typed double space with a 15 inch margin and 12pt font size.

v. Manuscript should not exceed 12 pages in length, including tables, figures and references. The body of the manuscripts should not contain any information identifying the author(s).

vi. The journal is published annually and from papers presented at the annual conference on Education organised by the Delta State College of Physical Education, Mosogar. The evaluation of manuscripts is by a blind review process. Authors are notified as to the position of their manuscripts as soon as all reviews are completed. All submission should be by e-mail or soft copy in Microsoft word. Send articles to the two e-mails address ogudeesther@yahoo.com and copemconference@gmail.com

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ADDIE INSTRUCTIONAL STRATEGY: AN EFFECTIVE TOOL FOR RE-ENGINEERING THE SENIOR SECONDARY SCHOOL SYSTEM FOR SUSTAINABLE STUDENTS ACHIEVEMENT IN GEOMETRY

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Abstract

The present study examined the effectiveness of ADDIE (Analysis, Design, Development, Implementation and Evaluation) instructional strategy in re-engineering the senior secondary school system for students' sustainable achievement in geometry. The study adopted quasi-experimental design of pretest and posttest non-randomized control group. The population was the entire senior secondary school one (SS1) in Ughelli Educational Zone of Delta State. Stratified sampling technique was adopted to select four-intact classes with 177 students assigned to treatment and control groups. The experimental groups (90) were taught geometry using ADDIE instructional strategy to see its cause effect on students achievement for academic sustainability; while, the control groups (87) expository method. Two research questions and two null hypotheses were answered and tested using mean sustainable achievement scores and ANCOVA respectively. The instrument used for data collection was Geometry Achievement Test (GAT) to measure students' achievement whether it will be sustained with internal reliability index of 0.72 using Kuder-Richardson's formula 20. Data analysis shown that students taught geometry using ADDIE was re-engineered to achieve higher for sustainable instructional development in the GAT (experimental groups) than the control groups. Also, there is a significant difference between the mean scored of SS1 students who were re-engineered in learning geometry with ADDIE strategy. Finally, female students were more re-engineered with the use of ADDIE instructional strategy applications in geometry learning than male students in the pretest and posttest for sustainable achievement development.

Keywords: ADDIE, Instructional Strategy, Re-engineering, Achievement, and Geometry.

Introduction

Mathematics education instructions over the past few years had changed dramatically both in quantity, quality and speed (Khosravi, 2012). In today's changing world, Mathematics educators need to be equipped with the ability to change the classroom instruction using instructional model strategy to drive home students' interest. Mathematics is the bedrock of leader's decision (Format, 2000). It is the science that concerned with the logical deduction of consequences from the general premises of all reasoning. No wonder, Osafehinti (2000) observed that achievement contributed more than anything else to enhance students' creativity tendencies for positive results. As Nnadi(2002) pointed out students' poor achievement in Mathematics for sustainability instructional development is due to poor teaching methods adopted by the Mathematics teachers. This means that it is

time to address the problem of teaching method. Many methods (discovering, laboratory, discussion, team teaching etc) have been used in the past for teaching Mathematics in secondary schools. There is need to adopt a more proactive scientific method called ADDIE instructional strategy. Remember that effective teaching facilitates and re-engineered students learning and making concept teaching more meaningful in the class. An effective teaching that is engineered through good scientific methodologies helps students to learn more quantitatively; while, poor teaching would naturally lead to poor learning and poor performance.

ADDIE is an instructional strategy which is valid for any kind of education comprises of five steps components (**A**nalysis, **D**esign, **D**evelopment, **I**mplementation, and **E**valuation) (McGriff, 2000; Kaminski, 2007). The **Analysis** step is what is going to be taught (geometry) forming the basis of all other steps. In doing this, the mathematics teacher determines the needs of the students, difference knowledge levels, skills, and behaviours they presently have, or expected to have during the cause of instructing them in the geometry class. **Design,** is the process of how the Mathematical information is going to be learnt in the geometrical class. In this step, the developmental strategy is determined in accordance with the data obtained during the analysis stage and how the Mathematical objectives will be achieved. This is achievable when the instruction method and learning activities are properly utilise; then, evaluation process become clear to both teacher and students. **Development** is the process of producing all the instructional materials to be used during the geometry instruction and any other kind of support materials needed to re-engineer the students. The detailed geometry lesson

plan prepared by the Mathematics teacher, during this stage is used with the design implemented which contained the various components of the learning environmental materials developed. **Implementation** stage is putting the design (geometrical material in used) into practice with the actual students in the experimental groups. This is done by introducing the designed instruction to the students in a way that it will be benefiting, effective and efficient to them to enhance permanent learning. This will remove doubt from the students mind that the geometrical information being transferred to them is real. **Evaluation** is the process of determining the geometrical instruction past whether sufficient to measure the effects of the lesson to achieve sustainable learning development; checking the extent the design meets the learning objectives of the students' needs.

ADDIE instructional strategy has the necessary elements to enhance quality learning (Rad and Fallah, 2014). This model is based on the student-centered approach that places highest attention to the needs of the students (Armitage and Leary, 2003). This strategy starts with an assessment of students' needs and their current knowledge in relation to the geometrical topic being taught to arouse their interest. This will encourage students' active participation in the geometric concept learning process. Most Mathematics teachers seem to be totally unaware that any instructional strategy other than lecturing used in geometric learning processes does not do well to the students. Students learn in different ways and likely to have the greatest affect for things that are taught in the class in way they learn best. Various studies have shown that to be effective in classroom instruction, instructional strategy to be use must consider the students' characteristics to

arouse their interest to achieve good achievement. Therefore, it would be very important to consider students' needs when organizing geometry content that will increase the likelihood of students' achievement for learning sustainability. As Dick, Carey and Carey (2005:25) stated "the most important aspect of an instructional goal is the description of what students will be able to do, and that description is not complete without an indication of: (a) who the students are; (b) the content in which they will use the skills; and (c) the tools that will be available.

The instructional strategy which depends on structural approach of students' oriented, supported by cooperation in learning, flexible to be adapted in teaching different Mathematical topics to make students to be active and responsible for their own learning is ADDIE. Do ADDIE instructional strategy has an implementation oriented structure to stimulate students' interest to enhance good academic achievement for learning sustainability? This is what this study seeks to examined whether ADDIE instructional strategy can positively re-engineer students' learning towards sustaining their academic achievement in geometry.

Purpose of the study
The purpose of the study was to examine the effective use of ADDIE instructional strategy on achievement of senior secondary school one (SS1) students in geometry for sustainable learning development. Specifically, the study intends to investigate ADDIE effective tool on:
(1)   Students' achievement in geometry for sustainable learning development;

(2)   Re-engineering male and female SS1 students' academic achievement in geometry for learning sustainability.

Research Questions
The following research questions were posed to guide the study:
(1)   What are the mean achievement scores of SS1 Mathematics students taught with ADDIE instructional strategy for learning sustainability and those taught with expository method of teaching as measured by Geometry Achievement Test (GAT)?;

(2)   What are the mean achievement scores of male and female SS1 students taught geometry using ADDIE (Experimental group) for sustainable learning development and those taught using expository method (Control group), as measured by the GAT?

Null Hypotheses
The study was guided by the following two null hypotheses to be tested at 0.05 alpha level of significance:
1.   There is no significant difference between the mean achievement scores of SS1 students taught geometry with ADDIE and those taught with expository method for sustainable learning development;

2.   There is no significant difference between the mean achievement scores of male and female SS1 students taught geometry with ADDIE instructional strategy for learning sustainability.

Significance of the study
The quest to find an acceptable, relevant, functional and conclusive method for teaching and learning of Mathematics has been of great concern to Mathematics educators. The innovations in the use of Mathematics instructional materials to

identify some good qualities of technology which when adequately utilized during normal classroom instructions by the mathematics teachers may improve students' interest and achievement in Mathematics. The study evaluated the extent to which the use of ADDIE model in teaching geometry could facilitate the acquisition of geometrical skills, thereby ensuring better achievement and interest in geometry by the students.

Government would benefit from the outcome of this study, because it will serve as an eye opened to government to effectively put in place necessary machineries in implementing different teaching strategies that will enhance students' active participation in classroom instruction. It will make the government also to be proactive in providing new instructional strategies equipment and tools to schools to ensure efficient and effective classroom instructions.

The outcomes of this study would benefit the ministry of education and school heads in organizing seminars and workshops for the Mathematics teachers under their cares on new instructional strategies who in turn will make use of them in the classrooms.

Population
Statistical Population in this research has been all Senior Secondary School one (SS1) in Ughelli Educational Zone of Delta State.

Sample and Sampling Procedure
Stratified random sampling technique was adopted. First, the population was divided into two; mixed and single sex schools. Two mixed schools were then randomly selected and assigned as the treatment group; while, the other the control group. In the second stage of the sampling, one class out of the four classes was randomly selected in each of the schools. Thus, a total of 177 students were sampled.

Materials and methods
Pretest-posttest non-randomised control group quasi-experimental design was adopted for the study. Reason for this choice is that the subjects used could not be manipulated. Intact classes were used and randomly assigned to treatment and control groups. The experimental groups were taught geometry using ADDIE instructional strategy whether learning will be sustain; while, the control groups were taught geometry with the expository method. Instrument for data collection was teacher-made test to measure students' achievement called Geometry Achievement Test (GAT).Face and content validation of the instrument was done by three experts from departments of mathematics, measurement and evaluation, and science education respectively. Reliability of the instrument was carried out using Kuder-Richardson's formula 20 for the GAT, because it involved multiple choice items; yielded 0.72. Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 alpha level of significance; while, mean scores to answer the research questions.

Quantitative as well as qualitative data analysis was done. First of all, experimental and control groups were given pretest. The ADDIE instructional strategy was used to teach the geometry on the experimental group; while, expository method on the control group. After, four weeks of implementation, both experimental and control groups were given posttest and results compared. The tests were administered by the researcher in conjunction with two mathematics classroom teachers' as assistances.

Results

The results of data analysed were presented based on research questions and hypotheses already stated as following:

Research question one: What is the mean achievement scores of SS1 students taught with ADDIE instructional strategy and those taught with expository method for sustainable learning development, as measured by the Pretest and Post test Geometry Achievement Test (GAT)?

Table 1: Mean achievement scores of SS1 students taught geometry with ADDIE and those taught with expository method for sustainable learning development.

Groups	PRETEST		POSTTEST		Gain Score	No of students
	Mean	SD	Mean	SD		
Experimental (ADDIE)	27.82	8.30	43.92	11.56	16.10	90
Control (Expository)	36.31	12.80	39.64	13.20	3.33	87

Table 1 shows that mean scores of students in the experimental group (ADDIE) in the pretest and posttest are 27.82 and 43.92 respectively; with gain score of 16.10. On the other hand, the pretest and posttest scores of students in the control group (Expository) are 36.31 and 39.64 respectively with gain score of 3.33. This shows that students in the experimental group (those taught with ADDIE) achieved higher in the geometry achievement test than their control group counterparts (those taught with expository method).

Hypothesis 1: There is no significant difference between the mean achievement scores of SS1 students taught geometry with ADDIE and those taught with expository method for sustainable learning development.

Table 2: ANCOVA summary table for students' achievement in geometry by instructional package (ADDIE) and gender for sustainable learning development.

Source	Sum of Squares	Df	Mean Squares	F	Level of Significance	Decision
Method (ADDIE)	3236.62	1	3236.62	29.06	0.000	S
Gender	826.24	1	826.24	7.42	0.007	S
Gender by Method	3871.69	2	1935.85	17.25	0.000	S
Error	19381.54	174	140.20			

Table 2, shows that the calculated F-value is 29.06 at 0.000 level of significant which is less that 0.05 level of significant set for the study. The null hypothesis is therefore rejected. This invariably means that there is a significant difference between the mean scores of SS1 students taught geometry using ADDIE and those taught using expository method.

Research question 2: What are the mean achievement scores of male and female SS1 students taught geometry using ADDIE and those taught using expository method for learning sustainability, as measured by the Pretest and Posttest GAT scores?

Table 3: Mean achievement scores of SS1 male and female students in the experimental and control groups learning sustainability, as measured by the Pretest and Posttest scores.

Method	Sex	No of Students	PRETEST MEAN	SD	POSTTEST MEAN	SD	Gain Score
ADDIE (Experimental)	M	40	25.13	8.36	36.18	12.44	11.05
	F	50	29.98	7.66	42.42	10.10	12.44
Expository (Control)	M	40	34.25	11.37	39.15	12.22	4.90
	F	47	38.06	13.78	47.98	12.75	9.92

Table 3 shows that female students taught geometry using ADDIE instructional design had mean scores of 29.98 and 42.42 in the pretest and posttest respectively. The gain score for the female students in the experimental group is 12.44. Similarly, the male students in the experimental had mean scores of 25.13 and 36.18 in the pretest and posttest respectively, with gain scores of 11.05. Moreso, the mean achievement scores of the female students in the control group for the pretest and posttest are 38.06 and 47.98 respectively, giving a gain score of 9.92. The mean scores of the male students in the control group are 34.25 and 39.15 for the pretest and posttest respectively. The result also shows that the female students outperformed the male counterparts in both the experimental and control groups, with the experimental group having more gain score than the control group. This means that the use of ADDIE as an instructional strategy for students' learning sustainability favours female students' more than male students in the achievement in geometry.

In testing hypothesis 2 (gender), table 2 shown the calculated value of F is 7.42, at 0.007 level of significance. Since 0.007 is less than 0.05 which is the level of significance set for the study, the null hypothesis is then rejected. This implies that a significant difference exists between the mean achievement scores of male and female SS1 students taught geometry for sustainable learning development using ADDIE as an instructional strategy.

Discussions
The results from the tables showed that students in the experimental group (those taught with ADDIE) achieved higher in the geometry achievement test than their control group counterparts (those taught with expository method) for learning

sustainability development. This is in line with McCauley (2000) research finding that multimedia (ADDIE) provides information for the students in a simple way in class; and it gives them control of information ensuring full participation during interaction to enhance personal learning development. Results of the researches of Arkun and Akkoyunlu (2008); and Tsou, Wang and Tzeng (2006) that students' achievement increased using ADDIE design model in instructions is in line with the present study finding. The freedom provided for the students using ADDIE model design learning environment is one of the reasons why they obtain positive achievement results for their learning sustainability. This is in collaboration with Bolliger (2004), freedom and the provision of instructional choice provided for the students in their multimedia (ADDIE) learning environment is one of the reasons why they obtain positive results (achievements) to sustain learning becoming permanent.

The tables also indicated that there is a significant difference between the mean scores of SS1 students taught geometry using ADDIE and those taught using expository method. This finding is in consonance with Thakur (2014) that the posttest achievement scores revealed that experimental and control groups differed significantly in favour of the experimental group for sustainability in learning. The result also shows that the female students outperformed the male counterparts in both the experimental and control groups, with the experimental group having more gain score than the control group. This means that the use of ADDIE as an instructional strategy favours female students' more than male students in the achievement in geometry. Furthermore, the result revealed that a significant difference exists between the

mean achievement scores of males and females SS1 students taught geometry using ADDIE as an instructional strategy. This is in agreement with Rad and Fallah (2014) results showing significant meaningful differences between academic achievements of students mean score in the pretest-posttest of both control and experimental groups. This is not in collaboration with Thakur (2014) analysis investigation that there was no significant difference between posttest scores of control and experimental group with respect to gender.

Conclusion

Based on the findings of this study, ADDIE instructional strategy should be used to teach mathematics topics helping to promote students attitude towards Mathematics education enhancing positive achievement for sustainable learning development. It is vital to design different geometrical instructional materials in teaching different geometrical concepts in a comfortable environment using them for different learning purposes. This will promote positive achievement of students for sustainability development.

Recommendations

Based on the findings of this research study, the following recommendations were made in order to enhance students' achievement using ADDIE instructional strategy in geometry instructions:

1. Mathematics teachers should be given training on how to use ADDIE instructional strategy so that they can develop the content suitable to meet students' geometrical knowledge needs. This will make students assimilate geometrical concepts instructions quicker and sharper.

2. ADDIE instructional strategy should be part of pre-service and in-service training of the Mathematics teachers to be.

3. Mathematics teachers should be trained from tertiary institutions on how to implement this new cooperative multimedia learning instructional strategy ADDIE to the knowledge of their students. This will make them to apply them in teaching any Mathematical concept when they leave school.

4. Furthermore, curriculum planners and designers should include ADDIE as one of the instructional strategies in teaching Mathematics in secondary schools to keep everybody abreast of the new innovation in Mathematics education instructions.

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