EFFECT OF ACTIVITY, STUDENT, EXPERIMENT AND IMPROVISATION STRATEGY ON MATHEMATICS PERFORMANCE AMONG PRIMARY FIVE PUPILS IN SABON-GARI LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

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Abstract

This study looks into the Impact of ASEI Strategy onMathematics Performance among Primary Five Pupils in Sabon-Gari Local Government Area of Kaduna State. The study adopts quasi experimental design which involves pretest-posttest control group.Two research questions and two hypotheses guided the study. The study randomly selected 200 pupils (100 males, 100 females) from Four (4) co-educational schools.Mathematics Performance Test (MAT) 1 & 2 were the instruments used in collecting data as pre-test and post-test respectively. A spearman Brown property of coefficient 0.71 was obtained. The data were analyzed using statistical package for social sciences (SPSS). Descriptive statistics (mean and standard deviation) was used to answer the research questions while the research hypotheses were tested at 0.05 level of significance using t-test. The result of the study shows that ASEI approach has significant effect on pupils' performance in mathematics over the conventional method. The study further shows that the strategy (ASEI) has no significant effect on location with regards to performance. Therefore, it is location friendly. The study concludes that ASEI strategy of teaching and learning mathematics has a significant effect on pupils' performance. It was recommended that a periodic (at least once a year) mathematics workshop on ASEI strategy should be organized by the Kaduna State Universal Basic Education board (SUBEB). Textbook publishers like STAN should make sure that the design of their pupils'and teachers' texts are ASEI compliant so as to achieve the stated objectives in mathematics curriculum.

Introduction

In Nigeria, the current obvious situation in mathematics and science education is the staggering decline in the performances of learners at all levels of our education system (Simon, 2000). The implications for this trend which has persisted for decades are threat to the technological and scientific development of the nation, especially now that the entire world is driven by scientific and technological advancement. In an attempt to provide a paradigm shift in Nigeria, the Department of Technology and Science Education (DTSE) and the Japan International Cooperation Agency (JICA), reached an agreement in 2006 to re-establish a system of retraining for serving teachers in the areas of mathematics and science education. Other beneficiaries of the In-service Education and Training (INSET) include countries like Kenya, Ghana, South Africa, Uganda, Malawi and Egypt among others.

This initiative in Africa has produced the Strengthening Mathematics and Science Education- Western, Eastern, Central and Southern Africa (SMASE-WECSA) network. The Federal Government of Nigeria (FGN) officially joined the SMASE-WECSA Association in 2004 and subsequently became interested in adopting/adapting and promoting student-centered method of teaching through the ASEI (Activity, Student Centered, Experiment and Improvisation) movement approach for excellence in mathematics education since mathematics teachers are more concerned with traditional lecture method of teaching which educationists' believe that it does not promote meaningful learning of mathematics leading to poor performance in the subject (FME, 2006).

The concept of ASEI.

According to SMASE Nigeria (2006) ASEI is an acronym for **A**ctivity, **S**tudent-centered, **E**xperiment, and **I**mprovisation. It is a teaching and learning approach which aims at making teaching and learning more pupil- centered. It is therefore, a paradigm shift from 'banking style/chalk and talk' approach to 'activity based/pupil centered approach'. ASEI as an intervention strategy that takes cognizance of how pupils learn. Pupils do not simply copy the science world rather they construct their own meaning out of it. They must be provided with the opportunity to construct scientific knowledge through the interaction of their observation, prior knowledge and mental processes. The four principles, which form the basis for the ASEI pedagogical paradigm (SMASE 2006) are:

1. activity-oriented teaching: carefully selected activities to enhance pupils' participation, interest, understanding and retention of knowledge.
2. student-focused learning: active pupils' involvement in the teaching and learning process where the teacher guides and gives them opportunity to express opinions, explain ideas based on prior experiences and verify their opinions/ideas through suitably designed activities.
3. experiment/Research based approach: scaled down, investigative experiments which are simpler, more relevant to specific lesson objectives, and enable pupils to discover or reinforce new concepts/ideas; rather than those prescribed in text books.
4. improvisation: teacher innovativeness to enhance pupils' interest, participation and learning; drawing from locally available resources and pupil's real life experiences.

The impact of ASEI principles on teachers and Pupils

According toStrengthening Mathematics and Science Education (SMASE) 2012, the practice of ASEI strategy enables teachers to become more confident to carry out practical activities and experiments previously thought to be difficult or dangerous and try out new ones, they also face the challenges arising from lack of resources and large classes because they are able to improvise instructional materials and become facilitators

of learning and not the ultimate source of knowledge since the classrooms are more active in terms of pupils participation in meaningful learning activities.

Pupils on the other handbecome actively involved whenever a lesson attains ASEI status. The lesson elicits great interest and responsiveness among pupils, they gradually attain the desired attitude and the level of understanding and retention of knowledge is increased since ASEI lesson through PDSI approach, among other things is easy to prepare, easy to use and is teacher friendly as advocated by SMASE (2006) and Adamu (2017).

Merits and Challenges of ASEI Strategy.

During SMASE 1ST post impact survey (2012), merits of ASEI strategy as well as the challenges connected to the strategy were identified. The report revealed that ASEI strategy

i. gives room for pupils' participation, Generates and sustains pupils' interest in mathematics.
ii. increases understanding, retention and application of mathematics concepts in real life experience and also arouses curiosity.
iii. develops cognitive and affective skills (minds-on activities), as well as psychomotor skills (hands-on activities).
iv. develops process skills such as observation, record keeping, analysis and interpretation of data and also takes care of the needs of pupils' individual differences.
v. simplifies attainment of learning objectives and encourages the use of locally made materials.

The Perceived challenges of ASEI as revealed in the report are as follows:

i. teachers workload is increased
ii. a lot of time is required for planning
iii. syllabus coverage is hardly attainable
iv. funding constraints
v. resistance by teachers to the new approach.

How to manage the perceived challenges.

At the end of the report, some suggestions were made on how to manage the perceived challenges as follows:

i. proffer storage and maintenance of materials
ii. consistent practice
iii. sensitizing curriculum developers and other stakeholders
iv. improvisation.

ASEI as a paradigm shift is not a new method of teaching; rather it is a rallying point for teachers to consciously focus on the pupil who is the main player in the teaching/learning process. Whenever a teacher looks at a lesson plan or observes a lesson

being taught, he/she should easily makes a quick evaluation by simply answering the question: is it an ASEI lesson? To succeed in attaining the ASEI condition in the classroom, every teacher has to go the Plan, Do, See and Improve (PDSI) way.

Urban –Rural Disparities in Academic Achievement.

Over the years**,** several studies investigated the influence of environment on academic achievement. In general, the results of these studies tend to indicate that the environment influences academic achievement. This is because, urban and rural areas differ markedly in terms of the operating environmental conditions or parameters. The rural areas suffer glaring deprivation in terms of social infrastructure and services (Loretta and Boniface, 2013). According to Yusuf ad Ukoje, (2010), this phenomenon of rural deprivation or neglect is evident in education, health, roads, water, electricity and so on which as a result, rural children tend to lag behind their urban counterparts in all key areas of academic achievement.

Consequently, this paper investigates the impact of ASEI strategy on urban and rural pupils in Sabon-Gari local government area, with regards to academic achievement.

Results of Related Studies on Activity-based Learning

Azuka (2013) that reported that students understood mathematics concepts and have retention when they actively participate in the lesson. Teachers should move away from the "teaching method" and select strategies promoting active learning in the classroom. It is important to involve the students while developing mathematical concepts as students need to participate actively in the learning process.

Muhammad and Niaz (2012) who reported that activity based teaching method is more effective than the traditional teaching method to develop higher order thinking skill (application). Also Tayyaba and Iqbal (2014) who reported that activity based method enhances the learning of students and also a significant difference was found between the achievement scores of the students in mathematics taught through activity based teaching method and traditional teaching method which is in favor of activity based teaching.

Loretta and Boniface, (2013) submitted that urban-rural disparities in learning achievement of primary four pupils in numeracy was not significant in Ebonyi and Imo States. However, the results showed that the disparities was significant in Abia, Anambra, and Enugu States. This result reported that there was no significant difference in learning achievement of primary four pupils from urban and rural areas in Numeracy.

Eme (2014) reported that school location does not influence students' performance in mathematics in AkwaIbom State. The result showed that 409 (47.95%) from school situated in urban area scored a mean value of 45.45 to be superior to the 444 (52.05%) rural counterparts with the mean score of 34.18 on the MAT. Though the mean difference was in favor of the urban pupils, but the f-ratio (1.377) showed no significant difference in the performance of rural and urban pupil's in mathematics.

Statement of the problem

According to Strengthening Mathematics and Science Education(SMASE) 2012, the use of teacher centered approach of teaching by mathematics teachers does not give room for adequate pupils' participation in the class room activities and they find it difficult to arouse the interest of the pupils during instruction, so that they appreciate the subject, learn the concept very well and apply the knowledge acquired in real life situations. Incompetence of the teachers to improvise relevant teaching materials is also a problem especially where the conventional ones are not available; as such the stated objectives of the lesson could not be achieved.

Therefore, to solve the problems mentioned the new approach of teaching and learning of mathematics has to be adopted. The teacher must ensure that their lesson is activity based, student centered, there is room for experimentation and finally improvises all the necessary and relevant materials that will facilitate the learning of the concept to be taught.Hoftein and Lunetta (2003) reported that insignificant factor that reduces learning of mathematics and other related science subjects is the recipe book style that limits students' opportunity to experience ownership, creativity and development of effective learning.Hence, the researcher feels it necessary to conduct a study on the effects of ASEI approach on the pupils' performance in mathematics in Sabon-GariLocal Government Area, Kaduna state.

Objectives of the study

The objectives of this study are to:

i. determine the impact of ASEI strategy on performance of pupils in some mathematical concepts.
ii. compare the impact of ASEI strategy on urban and rural pupils in some mathematical concepts.

Research questions

Based on the above objectives, the following questions were formulated:

i. What is the difference between the meanscores of pupils exposed to ASEI strategy and conventional method in some mathematical concepts?
ii. What is the difference between the mean scores of urban and rural pupils exposed to ASEI strategy in some mathematical concepts?

Hypotheses

The following null hypotheses were formulated for testing at 0.05 level of significance:

HO_1: There is no significant difference between the mean scores of Pupils exposed toASEI strategy and conventional method in some mathematical concepts.

HO_2: There is no significant difference between the mean scores of urban and rural pupils exposed to ASEI strategy in some mathematical concepts.

Methodology

A pre-test Post-test quasi experimental research design involvingtwo groups (one experimental and the other control) was used in the study. Four (4) schools were randomly selected from the six clusters in sabon-GariLocal government. G.R.A Model Primary School and Sakadadi L.G.E.A primary schools were used as the experimental groups from Hanwa and Basawa clusters respectively while Ranji L.G.E.A primary school and Basawa Model primary schools were used as control groups from same clusters.The experimental groupswere subjected to treatment (teaching some concepts with ASEI approach while the control groupswere taught the same concepts with the conventional method. The population of the study comprised of sixty two (62) public primary schools.A total of 200 pupils (male100, female100) randomly selected from the four (4) sampledschools.This is in accordance with Central Limit Theorem that regarded a minimum of thirty (30) sample size viable for experimental research (Sambo, 2008and Usman, 2000).The research questions were answered by the mean and standard deviation scores while the hypotheses were analyzed byt-test.

The sample of the study is presented in the Table 1 below:

Table 1: Gender Distribution of Pupils by Cluster, Group, School and Location.

Cluster	Group	School	Location	M	F	Total
1	Experimental	Sakadadi L.G.E.A	Rural	25	25	50
		G.R.A. Model	Urban	25	25	50
2	Control	Basawa Model	Urban	25	25	50
		Ranji L.G.E.A	Rural	25	25	50
Total				**100**	**100**	**200**

One instrument, Mathematics Achievement Test (MAT) was used for the pretest and posttest. A twenty (30) multiple choice objective items with options A-D were used for the tests based on the topics taught (fraction, equivalent ratios, areas of two dimensional shapes etc.). The questions were adopted from the past question papers of first leaving school certificate examination. Two experts in mathematics education validated the instruments. Split- half method was used to obtain the reliability coefficient value of 0.78 indicating that the research instrumentswas reliable.

Results

Research Question One: What is the difference between the mean score of pupils exposed to ASEI strategy and conventional method in some mathematics concepts?

Table 2: Mean and Standard Deviation for Performance of Experimental and Control Groups

Group	N	Mean	SD	Mean Diff

Experimental	100	68.47	3.289	
				12.2
Control	100	56.27	3.707	
Total				
	200			

Table 2 highlighted the mean and standard deviation of the experimental and control groups with 68.47, 3.289 and 56.27, 3.707 respectively. This revealed that the mean of the experimental group was higher than that of the control group with mean difference of 12.2.

Research Question Two: What is the difference between the mean scores of urban and rural pupils exposed toASEI strategy in some mathematical concepts?

Table 3: Mean and Standard Deviation for Performance of Urban and Rural Pupils

Pupils	Number	Mean	SD	Mean Diff
Urban	50	68.39	3.388	
				0.39
Rural	50	68.00	3.220	
Total	**100**			

Table 3 highlighted the mean and standard deviation of urban and rural pupils' performance when taught mathematical concepts using ASEI strategy. From the Table it was revealed that the mean of the urban pupils was slightly higher than that of the rural pupils as 68.39, 3.383 and 68.00, 3.220 respectively. The mean difference of 0.39 was found

Hypotheses Testing

Null Hypothesis One: There is no significant difference between the mean scores of pupils exposed to ASEI strategy and conventional method in some mathematical concepts.

To test this hypothesis, t-test statistics was used and the result is presented in the table below:

Table 4: Summary of t-test on Pupils' Performance in Mathematics Performance Test for Experimental and Control Groups

Group N	Mean	S.D	S.Dxdf	t-value.	P	Remark

Experiment100	68.47	3.289	0.329			
				7.385	0.000	*
			198			
Control100	56.27	3.707	0.371			

Key: * = Significant

From table 4, the result shown that t-value (7.385) was significant at 0.05 level of significance at 198 degree of freedom. Similarly, p-value (0.000) < 0.05. It implies that there is significant difference between the mean scores of pupils exposed to ASEI approach and that of conventional method. Therefore the null hypothesis 1 is rejected.

Null Hypothesis Two: There is no significant difference between the mean scores of urban and rural pupils exposed to ASEI approach in some mathematical concepts.

To test this hypothesis, t-test statistics was used and the result is presented in table below:

Table 5: Summary of t-test Analysis of Performance of Urban and Rural Pupils Exposed to ASEI approach

Location	N	Mean	S.D	SDx	DF	t-value	P	Decision
Urban	50	68.93	3.383	0.478				
Rural	50	68.00	3.220	0.455	98	0.424	0.673	**

Key: ** = Not significant

From the result of table 5 a t-value of 0.424 was not significant at 0.05 level of significance at98 degree of freedom. Similarly, p-value (0.424) is greater than 0.05 alpha value. Hence $H0_2$ thereforeretained. It shows that there is no significant difference between the mean score of urban and rural pupils exposed to ASEI approach, meaning that ASEI is location friendly.

Discussion of results

Table 2 revealed that the performance of pupils taught mathematics with ASEI approach is higher than the performance of those taught with the conventional method. This agrees with the findings of SMASE 1st post impact survey (2012) who claimed that there is significant improvement in teaching and learning of mathematics and science with respect to ASEI lesson observation if compared with the conventional method. Thisis also in agreement with the findings of Hoftein and Lunetta (2003), who reported that insignificant factor that reduces learning of mathematics and other related science subjects is the recipe book style that limits students' opportunity to experience ownership, creativity and development of effective learning.

Table 3 revealed that pupils from urban areas perform better in mathematics than those from rural areas when taught with ASEI strategy; where 68.39and 68.00 was recorded as their mean performance scores respectively.

Table 4 reported that the null hypothesis 1 was rejected showing the $\propto$ =0.05 higher than the p-value (0.000). It also revealed that the mean score of pupils taught with ASEI exceeds that of pupils taught with conventional method. Therefore significant difference was found when a t-test analysis at 0.05 level of significance was observed.

Table 5 highlights that the null hypothesis 2 is retained when the p-value (0.424) is greater than 0.05 level of significance. It also revealed that the difference between the performance of urban and that of rural pupils when taught mathematics with ASEI approach was not significant. This agrees with the findings of Loretta and Boniface (2013) who submitted that urban-rural disparities in learning achievement of primary four pupils in numeracy was insignificant in Ebonyi and Imo states. However, the result has shown that the disparities was significant in Abia state. The result is also in agreement with the findings of Eme (2014) who reported that school location does not influence students' performance in mathematics in AkwaIbom state.

Conclusion

The study concludes that ASEI strategy of teaching and learning mathematics and science has a significant impact on pupil's performance, for it gives the pupils room to interact, discuss with one another, experiment and come up with ideas themselves from the relevant and designed activities by the teacher so that the lesson is lively and pupil centered.Teachers of mathematics and science on the other hand benefit a lot from the ASEI strategy because it provides them with skills of improvisation (making use of locally available materials to teach concepts especially when the conventional ones are not available or expensive to purchase) there by making teaching and learning easier so that the knowledge acquired remain permanent in the pupils, they will also be able to relate it to their real life situations.

Recommendations

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

1. A periodic (at least once a year) mathematics workshops for primary school teachers on ASEI strategy should be organized by the State Universal Basic Education Board (SUBEB).

2. Curriculum developers should incorporate ASEI strategy in curriculum guidelines for achievement of intended learning outcomes and creativity.

.3. A paradigm shift from chalk and talk to activity based/pupil centered approach should be adopted especially in lower, middle and upper basic, so that pupils do not copy the science world, rather they construct their own meaning of it by providing them with the opportunity to construct scientific knowledge through the interaction of their observation, prior knowledge and mental processes. Therefore hands and minds on

activities should be encouraged in every mathematics and science lessons so as to make learning easy, real and permanent.

4. Textbook publishers like STAN should make sure that the design of the pupils' and teachers' texts are ASEI compliance so as to achieve the stated objectives planned in the mathematics curriculum.

References

Adamu, I. (2017). Impact of ASEI Strategy on MathematicsPerformance of Primary Six Pupils in Zaria Local Government Area of Kaduna State, Nigeria. UnpublishedM.ed Dissertation, Faculty of Education, Ahmadu Bello University, Zaria.

Azuka, B. F. (2013). Activity-based learning strategies in the mathematics classrooms. *Journal of Education and Practice 4(13), 8-14*

Eme, U. J. (2014). School variables and mathematics performance among students in AkwaIbom State. *International Journal of Development and Sustainability. 3(7), 1558-1568*

Federal Ministry of Education (2006). Baseline Survey on the Status of Mathematics and Science in Three PilotStates. Abuja.

Hoftein,A. &Lunetta, V.N. (2003). The Laboratory in science education foundation for the 21st century. *Science Education 88 (1), 28-53*

Loretta, N. N. & Boniface, G. N. (2013). Urban-Rural Disparities in Achievement at the Basic Education Level: The plight of the Rural Child in a Developing Country. *Developing Country Studies 3(14)*

Muhammad, K. &Niaz, M. (2012). Impact of activity-based technology on students' academic achievements in physics at secondary level. *Academic Research International Journal (3).*

Sambo, A.A. (2008). Research Methods in Education, 3rd Edition. Ibadan: Stirling-Horden. Publishers (Nig.) Ltd.

Simon, S. (2000).Student's Attitudes TowardsScience: A Good Practices in Science teaching, what research has to say. *Ed Monk M and Oshome J. Buckingham:* Open Press.

Strenghtening Mathematics and Science Education (2006). *Training Manual for In-Service Education and Training.* 2006 FME, ABUJA.

Strenghtening Mathematics and Science Education(2012). SMASE Newsletter on 1st Post Impact Survey. 3(1), SMASE Project, FME/JICA Edition. Abuja.

Tayyaba, R. & Iqbal, S. (2014). Effect of activity based teaching method in science. *International Journal of Humanities and Management Science (IJHMS). 2(1)*

Usman, I. A. (2000). The Relationship Between Students' Performance in Practical Activities and their Academic Achievement in Integrated Science Using NISTEP Mode of Teaching, Unpublished Ph.D. Dissertation, Faculty of Education, Ahmadu Bello University Zaria.

Yusuf, R.O. &Ukoje, J. A. (2010). Observations on rural geographic research in Nigeria. *Research Journal of Environmental and Earth Sciences. 2(2).*