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## Enhancing Children's Achievement in Basic Science using Library Electronic Books: A Case of Simple Repeated Evaluation

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### Abstract

The 21<sup>st</sup> century classrooms demand a lot from both the teachers and the learners due to the technological developments and demands in teaching and learning. These days, most parents buy their children (smart/android phones, tablets, or laptops without knowing the educational benefits of these gadgets in accessing online learning materials. The 21<sup>st</sup> century technology has made the use of e-books very beneficial to the teaming population of learners who have access to the internet, but it is worrisome that there is a dearth of research on such issues in the Nigerian context. Thus, this research examined the effect of library electronic books on children's academic achievement in Basic Science. This research was conducted within the quantitative research approach using simple repeated measures design. A sample of 45 class three pupils purposively sampled from three primary schools in Igbo-Eze North Local Government Education Authority participated in the study. Basic Science Achievement Test, which was properly validated, and trial-tested ( $\alpha = 0.79$ ) was used for data collection. Data collected were analysed using mix-design repeated measures analysis of variance. It was revealed that library electronic books had a significant effect on children's achievement in Basic Science. Thus, it was recommended that primary school children should be exposed to the use of the library electronic books for the proper improvement of their academic achievement.

**Keywords:** Academic achievement, Basic Science, children, Library Electronic Books, teaching and learning, simple repeated measures

### Introduction

Recent research reports have shown that pupils' achievement in Basic science has been on the downward trend (Ugwuanyi et al., 2020; Ugwuanyi et al., 2021). This poor status of pupils' achievement has been attributed to continuous usage of the traditional method of teaching by the teachers (Adonu et al., 2021; Offordile et al., 2021). This ugly situation continues to thrive despite that we are in the 21<sup>st</sup> century that is dominated by the use of technological gadgets. The era of

information and communication technology in the 21<sup>st</sup> century has brought a lot of changes in the mode of instruction in school. This century demands technologically enhanced teaching and learning approaches on the parts of both teachers and learners. This century has made it possible for teachers to have numerous educational resources for instructional delivery (Kaminski, 2018). Among such resources are electronic books (library electronic books) which allow learners to see a story come to life through a technologically enhanced gadget.

These kinds of electronic resources promote learners' engagement in areas of imagination and gaining knowledge about the world (Kaminski, 2018). Multidisciplinary technology era which characterized the 21<sup>st</sup> century world has yielded among other innovations an opulence of library electronic books for instructional delivery (Korat et al., 2014). Research results have indicated the educational importance of library electronic books. Buttressing that, Korat et al. (2014) found that library electronic books are very effective in the facilitation of the acquisition of word meaning at different levels of education. In this 21<sup>st</sup> century world, most children's acquisition of principal literacy experiences takes place through the use of iPads, Smartphones/Android phones among other digital devices (Miller & Warschauer, 2014). Studies have shown that electronic learning improve students' success in Science (Ugwuanyi, Okeke et al., Ugwuanyi, Okenyi et al., 2020; Ugwuanyi, Nduji et al., 2020; Ugwuanyi et al., 2019; Ugwuanyi et al., 2019; Ugwuanyi & Okeke, 2020), in Biology (Adonu et al., 2021), in Mathematics (Onah et al., 2020), and in Social Science courses (Ejimuonye et al., 2020; Ejimuonye, Ugwuanyi et al., 2020).

Digital texts significantly improved students' reading achievement and motivation than the traditional or printed texts during Sustained Silent Reading condition (Snyder, 2016). The overall emergent literacy levels of children exposed to the use of e-book improved significantly from pre- to postintervention (Shamir & Korat, 2008). It was revealed that educational activity with an e-

book on children's language retention produced a significant effect on their vocabulary development (Shamir et al., 2018). There was a significant effect of using digital storytelling in teaching and learning scientific concepts among students (Shemy, 2020). Jones et al. (2011) found that the use of e-book made children comfortable during learning and as a result, there was a significantly improved achievement in reading than their group exposed to traditional textbooks.

Based on the foregoing, it could be seen that library electronic books are good educational resources, but teachers are seen not to be using them for classroom instructional delivery. The reviewed empirical studies indicated that library electronic books are mostly used in the teaching of reading and vocabulary while only one study was conducted using the library electronic books for science instruction. However, none of these studies was conducted in Nigeria and thus the need for the current study. Hence, the researchers explored the effect of library electronic books on children's academic achievement in Basic Science.

### **Purpose of the study**

The study's goal was to determine the mean achievement scores of children in Basic Science before and after exposure to library electronic books on pretest 1, pretest 2, posttest 1 and posttest 2.

### **Research Question**

The following research question was posed for the study.

What are the mean achievement scores of children in Basic Science before and after their exposure to the library electronic books?

### **Hypothesis**

The lone hypothesis tested at 5% probability value was formulated for the study

**H<sub>01</sub>:** There is no significant difference in the pretest 1, pretest 2, posttest 1, and posttest 2 mean achievement scores of children in Basic Science when exposed to the library electronic books.

## **Method**

### **Research Paradigm, approach, and design**

This research was rooted in the postpositivist research paradigm. This is for the fact that the research findings were derived from the test of the formulated hypothesis. Thus, a quantitative research approach was adopted since the attributes of the participants were quantitatively measured and reported. Based on this approach, a simple repeated measures research design guided the study. This design has to do with the multiple measurements of the dependent measure at different test occasions before and after the treatment. This design had been adopted by Ugwuanyi, Okeke et al. (2020), Ugwuanyi, Ede et al. (2020). Ugwuanyi et al. (2021) in similar studies.

### **Participants**

A sample of 45 class three pupils purposively sampled from three primary schools in Igbo-Eze North Local Government Education Authority participated in the study. This sample was drawn purposively from three primary schools in Igbo-Eze North Local Government Education Authority. Purposive sampling was used to ensure that primary schools that have computer and internet facilities were sampled since the exposure to the use of the library electronic books was the treatment for the study.

### **Measure**

A basic science achievement test (BSAT) developed by the researchers was used for data collection. The instrument was made up of 20 multiple-choice test items with four options A, B, C and D of which only one option is the correct option. These items were generated from primary

3 basic science concepts. Each correct option for a particular question was awarded 2 marks making a maximum score of 40 marks and a minimum score of 0.

### **Validation and reliability of the measure**

The BSAT was properly content and face validated before its trial testing. The content validation of BSAT was ensured through the use of the Table of Specification. Thereafter, the face validation was done by two physics education experts and one measurement and evaluation expert. These experts made useful comments on the BSAT in terms of the wording of the items, the appropriateness of the items to the children's ability level, the relevance of the items to the research purpose among others. Thereafter, the comments of the validators were used to modify the BSAT accordingly.

After the face validation of the instrument, the modified BSAT was trial tested on 20 primary 3 pupils who were not part of the study. The data collected were subjected to Kuder-Richardson's formula 20 reliability estimate in order to determine the internal consistency reliability of the items of the BSAT. The result of the reliability test gave an index of 0.867 indicating that the instrument was reliable before its actual use.

### **Ethical consideration statement**

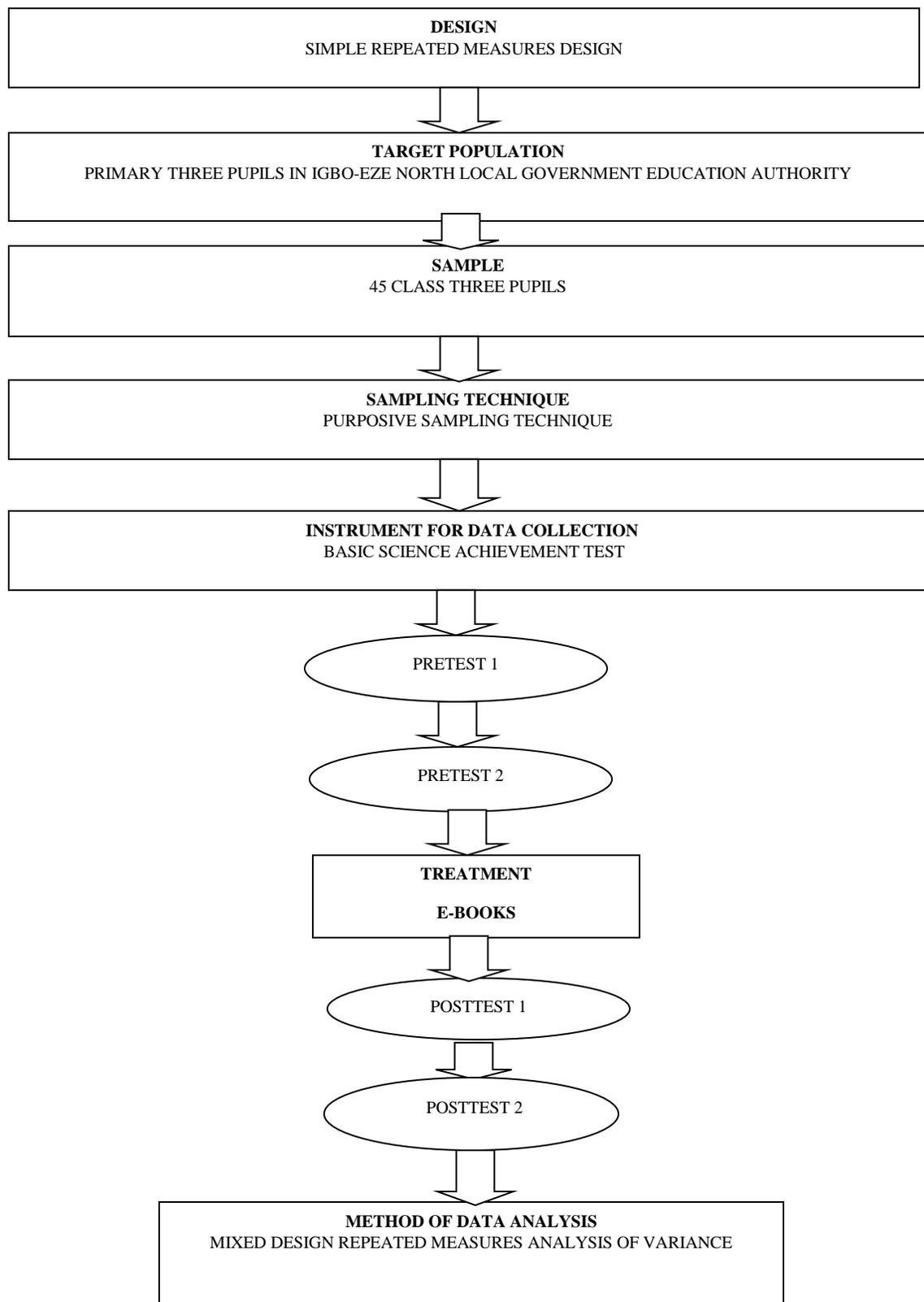
The approval for the conduct of this research was granted by the University of Nigeria committee on research ethics. Besides, informed consent forms were accordingly administered to the participants as well as their teachers before the commencement of the research. These forms were appropriately filled and signed by the concerned persons.

### **Experimental procedure**

Two sets of pretesting were carried out at an interval of one week before the commencement of the treatment. This was to enable the researchers to gather the baseline data for the study. After that, the treatment sessions started. The pupils were exposed to the use of the library electronic books during the course of teaching Basic Science concepts. The concepts learnt through the use of the library electronic books are sources of energy (light), movement of the body, and measurements. These concepts were taught to the pupils by exposing them to a different library electronic books that contain such concepts. This exposure was repeated for a period of four weeks. At each session, the pupils were encouraged to ask questions on the concepts they do not understand. At the end of the treatment, the first posttest was conducted by administering the reshuffled BSAT to the participants. At one-week interval after the administration of the first posttest, the second posttest was administered. Thereafter, the different measurement scores before and after the treatment were arranged and cleaned for data analysis.

### **Data analysis**

Data collected were analysed using mixed design repeated measures analysis of variance in order to answer the research question and test the corresponding hypothesis. Specifically, mean was used to answer the research question while the simple repeated analysis of variance was used to test the hypothesis at 5% probability levels. Figure 1 showed the summary of the research method for the study.

**Figure 1: Schematic Representation of the Research Method**

## Results

**Table 1**

*Mean analysis of the achievement scores of the children at four test occasions before and after exposure to the library electronic books*

Test occasion	n	Mean	Std. Deviation
Pretest 1	45	10.34	1.90
Pretest 2	45	10.40	2.22
Posttest 1	45	32.89	5.96
Posttest 2	45	34.69	5.53

Table 1 shows the children's mean achievement scores on pretests 1 and 2 were ( $M = 10.34$ ,  $SD = 1.90$  and  $M = 10.40$ ,  $SD = 2.2$ ) and posttests 1 and 2 were ( $M = 32.89$ ,  $SD = 5.96$  and  $M = 34.69$ ,  $SD = 5.53$ ).

**Table 2**

*Repeated measures analysis of variance of the difference in the test occasions*

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	24542.506	3	8180.835	490.796	.000	.918
	Greenhouse-Geisser	24542.506	2.118	11587.062	490.796	.000	.918
	Huynh-Feldt	24542.506	2.228	11015.320	490.796	.000	.918
	Lower-bound	24542.506	1.000	24542.506	490.796	.000	.918
Error (Time)	Sphericity Assumed	2200.244	132	16.669			
	Greenhouse-Geisser	2200.244	93.196	23.609			
	Huynh-Feldt	2200.244	98.033	22.444			
	Lower-bound	2200.244	44.000	50.006			

Table 2 shows that children's achievement in Basic Science was considerably increased by the library electronic books,  $F(3, 132) = 490.796$ ,  $p = .000$ ,  $\eta_p^2 = .918$ . Furthermore, with an effect size of .918, children's exposure to the library electronic books causes a 91.8 percent positive variation

in their Basic Science accomplishment. Furthermore, the findings of the post hoc pairwise comparison test (Table 3) revealed that the mean difference between tests 4 and 1 contributed the most to the significant difference, while the mean difference between tests 4 and 2 contributed the least.

**Table 3**

*Post-Hoc pairwise comparison test for the significant difference in the test occasions*

(I) factor1	(J) factor1	Mean Difference		
		(I-J)	Std. Error	Sig. <sup>b</sup>
1	2	-.244	.300	.962
	3	-22.311 <sup>*</sup>	.919	.000
	4	-24.533 <sup>*</sup>	.833	.000
2	1	.244	.300	.962
	3	-22.067 <sup>*</sup>	.978	.000
	4	-24.289 <sup>*</sup>	.857	.000
3	1	22.311 <sup>*</sup>	.919	.000
	2	22.067 <sup>*</sup>	.978	.000
	4	-2.222	1.061	.227
4	1	24.533 <sup>*</sup>	.833	.000
	2	24.289 <sup>*</sup>	.857	.000
	3	2.222	1.061	.227

### Discussion of the Findings

This research sought the effect of library electronic books on the achievement of children in Basic Science after exposure to four different test occasions. It was revealed that the achievement of the children in Basic Science at the baseline data was poor but significantly improved after their exposure to the use of the library electronic books. This implies that the use of the library electronic books had a significant effect on children's achievement in Basic Science. This result was not strange to the researchers in that children prefer pictorial materials in gadget forms than the hard copies.

During the experiment, the children were observed to be very interested and interactive in the learning process than the usual traditional method of teaching. Besides, library electronic books are associated with words and pictures and as well may have interactive elements like animations, games, recorded narration, music, sound effects, inbuilt dictionaries among others. Well-designed library electronic books when used educationally will enable children to develop social, listening, language, and thinking skills. This may have played in the observed effect of library electronic books. These findings are in tandem with similar empirical studies.

Kaminski (2018) found that electronic resources promote learners' engagement in areas of imagination and gaining knowledge about the world. Korat et al. (2014) found that library electronic books are very effective in the facilitation of the acquisition of word meaning at different levels of education. Miller and Warschauer (2014) revealed that most children acquire principal literacy experiences through the use of iPads, Smartphones/Android phones among other digital devices. It was revealed that educational activity with an e-book on children's language retention produced a significant effect on their vocabulary development (Shamir et al., 2018). Jones et al. (2011) found that the use of the library electronic books made children comfortable during learning and as a result, there was a significantly improved achievement in reading than their group exposed to traditional textbooks. Digital texts significantly improved students' reading achievement and motivation than the traditional or printed texts during Sustained Silent Reading condition (Snyder, 2016). The overall emergent literacy levels of children exposed to the use of the library electronic books improved significantly from pre- to postintervention (Shamir & Korat, 2008). There was a significant effect of using digital storytelling in teaching and learning scientific concepts among students (Shemy, 2020).

## Conclusion and recommendations

Based on the findings of this research, it was concluded that the use of the library electronic books proved very effective in the enhancement of children's achievement in Basic Science. Thus, the use of the library electronic books is very paramount for the scientific development of children, especially in this era of Covid-19. It was therefore recommended that:

1. primary school teachers should endeavor to expose children to the use of the library electronic books during the teaching and learning of Basic Science.
2. efforts should be made by the Local Government Education Authority to train the teachers to be proficient in the use of the library electronic books in teaching.

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