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# **Effects Of The Use Of Computer Simulation On Students' Interest And Performance In Upper Basic Science Concepts Katsina State, Nigeria**

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## **ABSTRACT**

This study examined the Effects of Computer Simulation on Students' Interest and performance in Upper Basic Science in Katsina State, Nigeria. The study adopts pretest, posttest control group quasi-experimental research design that utilized the non-randomized pretest posttest control group design. The target population for this study was all the 5109 Upper Basic II Students in public Upper Basic Schools in Kankia Zonal Education Quality Assurance, Katsina State. The sample of the study consists of 160 Upper Basic II Students randomly drawn from three intact classes of JS II in the study area. The study was guided by two objectives, research questions and hypotheses respectively. This study utilized two validated research instruments with reliability coefficient of 0.8 and 0.9, namely: Basic Science Performance Test (BSPT) and Basic Science Interest Questionnaire (BSIQ). Research questions were answered using descriptive statistics in form of Mean, Standard deviation, Mean Rank and Sum of Ranks. Hypotheses were tested using ANCOVA at 0.05 level of significance. Specifically findings shows that the change of interest in experimental group is more than in control group; there is significant difference between the mean academic performance scores of male and female students exposed to still images. Based on the findings of this study, it was concluded that the use of still images in teaching Basic Science prove to be effective in improving students' interest and academic performance. Based on the findings of this study, the researcher recommended among others that the Federal Government of Nigeria through its agencies such as the State Ministries of Education, Teacher Training Institutions and professional bodies such as NTI and STAN, to organize workshops, talk shops and seminars for Basic Science teachers on the use of Still Images for the teaching of Basic Science concepts.

**Keywords:** Computer Simulation, Interest, Performance, Upper Basic, Basic Science

## **INTRODUCTION**

Science is man's relentless effort to study nature. It's essential purpose is to enable man discover the mysteries of nature. Das, (2009) defined science as a host of facts, principles, laws and theories along with lots of systematized information used for interpreting the events in our environment and the universe at large. The process of scientific method involves critical thinking, logical reasoning, systematic

organization and understanding of each step of the procedure. Science is concerned with finding out things in our environment. The knowledge we gather about our environment constitutes the field of study called 'science' (National Teachers' Institute NTI, 2009). Integrated Science has reflected a new world wide dimension to the teaching into Nigeria through the Aiyetoro Basic Science in 1968 and the Nigeria Integrated Science Project of the Science Teachers Association of Nigeria (STAN). The first publication of the Nigerian Integrated Science Project (NISP) was in 1970. The project was concerned with the improving science teaching at Junior Secondary Schools level in the country through presenting science as a process of interpretation, manipulation and control of pupil's environment (Jamilu, 2017). Now called Basic Science, the subject is now taught in primary and Junior Secondary Schools (JSS) in Nigeria following the Universal Basic Education scheme (UBE) launched in 1999 due to the change in educational system; that is from 6 3 3 4 system to 9 3 4 system. The Nigeria integrated science project books have been revised and now cover the three year of Junior Secondary School in the Universal Basic Education (UBE) scheme (Isah, 2015).

The general objective of Basic Science education is to enable Students observe and explore their environment using their senses and their hands. Among the reasons that can be provided to explain why Basic Science is included among the components of primary curriculum are to: help Students to explain events in nature, enable the Students to think and reason in a logical manner, help Students to develop the physical skills like the proper handling of objects and equipment and help Students to satisfy their natural curiosity through opportunities in carrying out scientific investigations (NTI, 2009). Basic Science by conception and definition emphasizes the content as well as process of science, the development of mental skill, acquisition of appropriate motor capabilities and the evolution of positive attitudes among others (Isah, 2015).

Basic Science is composed of all embarrassing courses, it lays no emphases on traditional boundaries of various science subjects. It is a course that serves as a good foundation for scientific literacy, personal growth, social relevance, process of inquiry and general education. The Federal Republic of Nigeria (FRN, 2014) core curriculum for Basic Science from upper basic I – III emphasized the need for planned learning experience to be child centered. Olaruwaju in Shaibu (2012) defined Basic Science as the combination of physics, biology and chemistry; uniform or unified science fused together, which is also known as elaborated science. One of the objectives of Junior Secondary Education (now Upper Basic Education level) as presented in the National Policy on Education (FRN, 2014) is to equip pupils to live effectively in modern age of science and technology. In line with this objective basic education is made as the foundation upon which the rest of the education system is built. Consequently, upper Basic Science forms the foundation upon which science at higher levels of secondary and tertiary levels is built. The success or failure in primary science would more or less determine the success and failure of science education at higher level (Leghara, 2006). Furthermore, FRN, (2014) emphasizes that the teaching of Basic Science from the Junior Secondary School level is intended to achieve the following aims: inculcating in the learner the spirit of inquiry and creativity through exploring of nature and local environment; laying sound foundation for scientific innovation and reflective thinking; developing in the child the ability to adapt to the child's changing environment; give the child opportunity for developing manipulative skills that will enable the child to function effectively in the society within the limit of the child's ability and providing child with basic tools for further educational development, including trade and craft of the society among others.

Despite the importance of science to the development of any nation, in Nigeria, teaching and learning of science is facing so many hitches in schools as shown by many researchers (Isah, 2000, Okeke, 2007, NTI, 2009 & Mani, 2012). However, Jamilu (2017), observed that, poor Basic Science teaching and learning could emanate from lack of formative teaching, inability of teachers to improvise learning materials and the inability also to involve students in science activities both outside and inside the class. Other identified problems of teaching and learning of Basic Science include low morale and poor preparation of teachers, overloaded classroom, inadequacy of laboratories and workshops facilities, poor attitudes and interest of work, gross under funding and inadequacy of reward for excellence in science

teaching and learning among others (Jamilu, 2017). Furthermore, among the problems militating against Basic Science are; lack of appropriate teaching methods and resources and lack of trained and qualified teachers of Basic Science which at long run negatively affect the interest and at long run affect the performance of the students in Basic Science (Usman, 2010).

Interest is aspects of affective domain upon neglected by teachers in our schools and concentrate more on cognitive aspect. This neglect in turn results in poor performance among students; as such the studies embark on using innovative strategies to address the issue of lack of interest among students. That is the use of still images and computer simulation in teaching Basic Science at our upper Basic classes. For science and technology to be effectively taught appropriate teaching strategy has to be used (Shaibu, 2012). Teaching/learning like any other activity in life has been undergoing changes. Thus what used to be teaching/learning 20 years ago is no longer what it is today, hence, teaching in 21st century emphasizes learner friendly environment (Yakubu, 2017).

At secondary school level, some teachers adopt lecture method as one of the method of teaching science, despite several criticism that the method is not effective in enhancing academic attainment among learners. Salisu (2015) has stressed that the method encourages rote learning and is more of verbalization. Das, (2009) and Isah, (2015) opined that there are several methods of teaching Basic Science, these include Lecture, Project, Discussion, Field Trip ,Discovery, Inquiry, Process Based, Team Teaching, Scaffolding, Computer Assisted Learning, Concept Mapping, Demonstration and Activity Based methods among others. Though, certain conditions are necessary need to be fulfilled in order to make methods and technique to be learner centred for it to bring about effective and learning of science in our schools. These conditions include use of different forms of Teaching and Learning resources like still images among others which are not use by most of Basic Science Teachers (Muhammad, 2017).

Computer Simulation Instruction Strategy (CSI) is a recent development in search for more efficient training methods that will involve the integration of computer based programs. Hulya AE, Aslan, E. & Rifat, E. (2011) opined that Computer simulation Instruction strategy (CSI) is used in educational drill practices, testing, tutorials, games, accumulative records and simulations. Abdullahi (2010), Baillie and Mesly (2015) narrated that simulation serves as a guide, as well as provide an avenue for conducting activities for the students, so that they can be able to build and modify their existing mental models that can help to improve performance. Simulation is a new educational tool that fosters long-term learning by calling attention to objects during the early steps of instruction demonstrated that using simulation to communicate ideas and processes that change over time reduces the abstractions associated with the temporal transitions of the process (Bedau, 2011). According to Abdulhamid (2012), identified the different types of simulations. These are; procedural, physical, equation-based and agent-based simulation. Baillie and Mesly, (2015) further stated that, simulations of both types are used for three different general sorts of purposes (those that teach about something and those that teach how to do something). According to Mesly (2015), simulations that teach how to do something are classified either as procedural or situational simulations, those that teach about something are classified either as physical or process simulations.

Saka, Sam and Yusuf (2002) defined academic performance as what is measured regarding skill or knowledge developed through specific instruction or training with emphasis on how well instructional objectives have been attained. This means that, the measurement of academic performance represents all abilities that can be evaluated on the basis of observing the individual as he performs the task involved.

Halilu (2010) reported that, academic performance is the process of measuring the Students' auxiliary and terminal performances during and at the end of instruction. The study added that basically there are three uses that can be made with information obtained from academic performance which include: determining how well the Students have achieved the instructional objectives; determining the adequacy of entering behavior and determining the adequacy of our instructional procedures.

### **Statement of the Problem**

This research was prompted by the persistent poor performance of students in upper Basic Science Junior Secondary Certificate Examination (BSCE) in Katsina State as confirmed by Katsina State Education

Resources Centre (ERC) results analysis of 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021 and 2022 respectively indicated that over the years students' performance in Basic Science is declining. Moreover, the statistics of students' performance in junior secondary (Basic Science) examination in the state over these years indicated failure rate of over 50%. Experience over the years has shown that teachers have been depending on excessive use of words to express and convey ideas or facts in the teaching and learning process (Ishaya, 2012). Many students performed poorly over the years in their junior secondary certificate examination (JSCE) which has to do with some factors. James, Adebayo and Usman (2002) observed that lack of integrating teaching with innovations such as simulations and static images in science teaching is one of the major factors for poor academic achievement in Basic Science in Upper Basic secondary school level.

Learners' interest is very important in the study of any subject because the interest of any learner is a reflection of his/her performance. This implies that students perform better when their interest is stimulated and sustained. Abu (2012) revealed that interest positively affect performance of students in Biology as a the course of certain actions which acts as drive or motivation that propels people to act in certain ways and as the effect of an activity from which a child learn to pay attention as the lesson goes on if he or she is interested in the particular lesson and the method of learning.. However, such studies are lacking in Basic Science. In thrust of this, the researcher investigate whether the use of still images can enhance student's interest and performance in Upper Basic Science, Katsina State, Nigeria

### **Objectives of the Study**

This study was designed to achieve the following objectives, to:

1. Determine the effect of Computer Simulation on Interest in Basic Science Concepts among Upper Basic Students in Katsina State, Nigeria
2. Investigate the effects of Computer Simulation on Academic Performance in Basic Science Concepts among upper Basic Students in Katsina State.

### **Research Questions**

The following research questions were answered to guide the research:

1. What is the difference between the interest level of Students taught Basic Science concepts using Computer Simulation and those taught using lecture method?
2. What is the difference between the mean performance scores of students taught Basic Science concepts using Computer Simulation and those taught the same concepts using lecture method?

### **Null Hypotheses**

The following Null hypotheses are formulated and tested at 0.05 level of significance:

- H<sub>01</sub>: There is no significant difference in the interest ability of Upper Basic Students towards Basic Science when taught using Computer Simulation and those taught using lecture method.
- H<sub>02</sub>: There is no significant difference between the mean academic performance scores of students taught Basic Science concepts using Computer Simulation and those taught the same concepts using lecture method.

## **METHODOLOGY**

This study utilized pretest posttest quasi experimental and control group design. The target population for this study was all JSS II Students in public Junior Secondary Schools in Kankia Zonal Education Quality Assurance, Katsina State. According to Katsina State Ministry of Education (KTMOE, 2022) there are twenty one (21) schools with total number of five thousand one hundred and nine (5,109) JSS Students in this level spread into three local government areas namely Kankia, Kusada and Ingawa that constituted the zone. Out of this figures 2,897 are males and 2,212 are females. The sample of the study consists of one hundred and sixty (160) Upper Basic II Students drawn from three intact classes of JS II students in the study area. The schools in the selected areas have more than one arm of JS II, thus, the researcher sampled only one arm of JS II from each school used. In this case, twelve schools (four from each Local Government area) were pretested in selecting schools and to ensure equivalence in terms of academic performance before treatment. The result of the pretest was then subjected to ANOVA to find out if there

is any significant difference. For significant difference, Schaefer's test was used to find out the arms with no significant difference which finally help the researcher to end up with three arms one from each of the three selected schools from three Local Government Area.. In assigning schools into experimental and control conditions, simple random sampling technique were used. In each school, intact classes were used for the study.

For the purpose of this research, pretest was administered to the respondents using two validated instruments for the study. That is; Basic Science Performance Test (BSPT) and Basic Science Interest Questionnaire (BSIQ) at least three days before the commencement of the treatment for the researcher to ascertain the significant difference among the three groups in term of performance and interest. After the pretest the test were marked and recorded.

Then after the pretest the treatment commence for six weeks that is teaching using Computer Simulation for the experimental group and lecture method for the control group. After the treatment the same instruments were re administered to the same respondents to determine the effects (if any) of the independent variables (Computer Simulation and lecture method) on the dependent variables (performance and interest). The test items were marked and recorded. Thereafter the three recorded scores of three sets of tests were subjected to analysis.

## RESULTS

The result and analysis of data obtained is presented under the following: Answering Research Questions; Testing Null Hypotheses

**Research Questions 1:** *What is the difference in the interest scores of Students taught Basic Science concepts using Computer Simulation and those taught using Lecture Method?*

**Table 1: Mean Rank and Sum of Ranks of difference in the Interest of students in Experimental and Control Groups**

| Groups               | N  | Mean Rank | Sum of Rank | Mean Rank D/F |
|----------------------|----|-----------|-------------|---------------|
| Experimental group 1 | 40 | 87.62     | 3504.8      |               |
| control group        | 50 | 33.87     | 1,693.5     | 53.75 & 51.36 |

Table 1 presented Mean Rank of difference in the interest of students in Experimental and Control Groups. From the result obtained, the Mean Rank of experimental group is 87.62 while control group recorded a mean rank of 33.87. The mean difference observed between Experimental group and Control is 53.75. This mean that the change of interest in in experimental group and finally in control group.

### Null Hypothesis One:

There is no significant difference in the interest ability of Upper Basic Students towards Basic Science when taught using computer simulation and those taught using lecture method.

The data collected were analysed using Kruskalwallis (H test) and presented as follows:

**Table 2: Kruskalwallis Test for the Difference in Students' Interest in Experimental and Control Groups**

| Variable           | N  | Mean Rank | Sum of Ranks | H Value | P | Remark |
|--------------------|----|-----------|--------------|---------|---|--------|
| Experimental group | 40 | 87.62     | 3504.8       |         |   |        |
| control group      | 50 | 33.87     | 1,693.5      |         |   |        |

The result in Table 2 compared the change of interest of students in experimental and control group. The Kruskalwallis observed was 59.282.00 and the p value observed was 0.00. Since the p value of 0.00 is less than 0.05, there is a significant difference in the interest of students due to exposure to treatment. Therefore the null hypothesis that states that there is no significant difference in the interest ability of

Upper Basic Students towards Basic Science when taught using Computer Simulation and those taught using lecture method was rejected. Going by the mean rank values in the Table, the difference is in favour of experimental group.

**Research Question 2:** *What is the difference in the mean performance scores of students taught Basic Science concepts using computer simulation and those taught the same concepts using lecture method?*

**Table 3: Mean and S.D. of academic performance of students in Experimental and Control Groups**

| Groups       | N  | Mean  | Std. Deviation | Mean Difference |
|--------------|----|-------|----------------|-----------------|
| Experimental | 40 | 31.50 | 2.32           |                 |
| Control      | 50 | 10.14 | 2.44           | 21.36 & 16.47   |

Table 4.2 presented Mean and standard deviations of academic performance of students in Experimental and Control Groups. From the results obtained, experimental group1 recorded a mean of 31.50 and standard deviations of 2.32; experimental group 2 recorded a mean of 26.61 and standard deviations of 3.47; and control group recorded a mean of 10.14 and standard deviations of 2.44. Students taught using Computer Simulation performed better than those exposed to same concept using lecture method. The mean difference between experimental group and control group is 16.47.

**Null Hypothesis Two**

There is no significant difference between the mean academic performance scores of students taught Basic Science concepts using computer simulation and those taught the same concepts using lecture method.

**Table 4: Summary of ANCOVA on significant difference in academic performance of students in Experimental and control groups**

| Source              | Sum of Squares         | df  | Mean Square | F       | P Value | Remarks |
|---------------------|------------------------|-----|-------------|---------|---------|---------|
| Corrected Model     | 11541.694 <sup>a</sup> | 3   | 3847.231    | 497.133 | .000    |         |
| Intercept           | 1524.690               | 1   | 1524.690    | 197.018 | .000    |         |
| Pretest performance | 5.354                  | 1   | 5.354       | .692    | .407    |         |
| Groups              | 11529.879              | 2   | 5764.940    | 744.936 | .000    | Sig.    |
| Error               | 990.571                | 128 | 7.739       |         |         |         |
| Total               | 75587.000              | 132 |             |         |         |         |
| Corrected Total     | 12532.265              | 131 |             |         |         |         |

\*Significant at P (0.01) < 0.05

Table 4. Presented the Summary of ANCOVA on significant difference in academic performance of students taught Basic Science concepts using Computer Simulation and those taught the same concepts using lecture method. Results show that Sum of Squares observed is 11529.879; a mean square is 7.739; an F value is 744.936 and the p value observed is 0.00. The p value recorded is less than alpha value. The hypothesis is therefore rejected on the account that there is significant difference in the academic performance of students taught Basic Science concepts Computer Simulation and those taught the same concepts using lecture method. To determine the direction of disparity, the researcher further analyzed the result using Post hoc test and result is presented in Table 5.

**Table 5: Posthoc Pair wise Comparisons of performance of students by groups:**

| (I) groups   | (J) groups         | Mean Difference (I J) | Std. Error | Sig. <sup>a</sup> | Remark |
|--------------|--------------------|-----------------------|------------|-------------------|--------|
| Experimental | Experimental group | 4.894*                | .615       | .000              | Sig.   |
|              | control group      | 16.493*               | .583       | .000              | Sig.   |

Table 5 presents Posthoc Pair wise Comparisons of performance of students by groups. Results shows significant difference exist between experimental group and control group ( $p=0.00$ ) in favour of experimental group. .

## DISCUSSION

Finding number one indicated that there was significant difference in the interest ability of Upper Basic Students towards Basic Science when taught using Computer Simulation and those taught using lecture method in favour of experimental group. The interest of students in experimental group is more than control group. Several literatures (Aggarwal, 2008; Obeka, 2009; Mangal, 2010; Renninger & Hiddi, 2011) shows that students exposed to innovative strategy developed better interest than traditional method. However, the finding disagreed with that of Ling (2011), and Salisu (2015) who ascertained that improving students' interest does not depend on utilization of materials such as Computer Simulation.

There was significant difference between the mean academic performance scores of students taught Basic Science concepts using computer simulation and those taught the same concepts using lecture method in favour of experimental group. Students taught using Computer Simulation performed better than those exposed to same concept using lecture method. This finding agrees with previous study conducted by Ainsworth (2008), Riaza and Halimah (2008), and Aksoy (2013). According to Ainsworth (2008), affective account of learning with animations suggests that, learners may often report increase in satisfaction and motivation. Ling (2011), states that animation has been used in various disciplines to deliver instructional material that is hard to present alone using visuals or that contains content that is highly abstract to human eyes.

## CONCLUSION

Based on the findings of this study, it was concluded that the use of Computer Simulation in teaching Basic Science prove to be effective in improving students' interest and academic performance.

## RECOMMENDATIONS

Based on the findings of this study, the researcher recommend that:

1. The Federal Government of Nigeria through its agencies such as the State Ministries of Education, Teacher Training Institutions and professional bodies such as NTI and STAN, to organize a special re training, workshops, and seminars to Basic Science teachers on Computer Simulation.
2. The use of Computer Simulation in teaching Basic Science in school should be encouraged by stake holders in the education industries such as Federal Ministry of Education, State Ministries of Education, NERDC among others through periodic seminars and workshops to teachers on how to use innovative strategies and media in teaching.
3. Curriculum development bodies in Nigeria such as NERDC should design programme and policies that will incorporate the use of Computer Simulation in teaching and learning Basic sciences at Junior Secondary School level.

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