Sub-Sahara African Academic Research Publications
March, 2022 Editions

JESTP
Journal of Educational Studies, Trends and Practice.
Vol.23, No.8, ISSN 2285-8565

EFFECT OF COMPUTER BASED SIMULATIONS TEACHING APPROACH ON ACQUISITION OF SCIENCE PROCESS SKILLS BY UPPER BASIC STUDENTS IN SOUTHERN TARABA STATE SENATORIAL DISTRICT

***CHRISTINA TANKO AUDU; & **DAVID IYAM LIGA**
**College of Education Zing, Taraba State. **University of Agriculture Makurdi Demonstration Secondary School.*

ABSTRACT
This study investigated the effect of computer based simulations teaching approach on acquisition of science process skills by Upper Basic students in southern Taraba State senatorial district. The study was guided by two objectives, two research questions and two hypotheses. Quasi-experimental research design was adopted. The population of this study was 8,342 Upper Basic III students in Southern Taraba State. A sample of 46 Upper Basic III students selected using multiple stage sampling technique. Data were collected using Science Process Skill Acquisition Test (SPSAT). Data collected were analysed using mean and standard deviation to answer the research questions. Analysis of Covariance was used to test the hypotheses at 0.05 significance level. The findings revealed that there is a significant difference between the mean acquisition of science process skills scores by Upper Basic students taught using computer based simulation approach and those taught using expository method in favour of the computer based simulation approach. Finding also indicated that there is no significant difference between the mean acquisition of science process skills scores of male and female Upper Basic students taught using computer based simulation approach. Science teachers should employ the use of computer simulation approach which enhances acquisition of science process skills by students.

Introduction
One of the most important and pervasive goals of schooling is to teach students to acquire desirable skills. All school subjects should share in accomplishing this overall goal. Science contributes its unique skills, with its emphasis on

experimenting, manipulating the physical world and reasoning from data (Chiapetta, 2006).The scientific method, scientific thinking and critical thinking have been terms used at various times to describe these science skills. Today the term "science process skills" is commonly used. Popularized by the curriculum project, Science - A Process Approach (SAPA), these skills are defined as a set of broadly transferable abilities, appropriate to many science disciplines and reflective of the behaviour of scientists. Science process skills are the underlying skills and premises which govern the scientific method. Cepni (1997) defined the science process skills as the core skills that guide in research means and methods, that enable the easy learning and persistency of sciences, and that provide the pupils to be responsible and active in their own learning. Science process skills have been described by Akinyemi and Folashade (2010) as mental and physical abilities and competencies which serve as tools needed for the effective study of science and technology as well as problem solving, individual and societal development.

The American Association for the Advancement of Science, (AAAS) (1967) categorized science process skills into basic science process skills (BSPS) and integrated science process skills (ISPS). The skills listed under BSPS are: observing, classifying, measuring and using numbers, inferring, predicting, communicating, and using space and time relations. The integrated science process skills include: evaluating information, controlling of variables, defining operationally, hypothesizing, and experimenting. According to Ango (2002) basic science process skills are vital for science learning and science concept formation at the primary and junior secondary levels. Thus, the Basic Science curriculum for Upper Basic school (Junior secondary school) emphasizes the six basic science process skills including; observation, classification, measurement, inference, prediction and communication.

Observation is one of the most basic and first used process skills of science. Padilla (2006) defines observation as noting the attributes of objects and situations through the use of the senses. That is using the five senses; seeing, hearing, touching, smelling and tasting. Observation often involves the use of instruments such as microscopes, telescopes, oscilloscopes, thermometers among others. These instruments aid scientists to carry out observations beyond the ability of the sense organs. Almost every activity of

science begins with observation**.** In fact Science begins with observations of objects and events, these observations lead to the asking of questions (Ango, 2002). Scientific observations involves taking information about all things around, using the senses as appropriate and safe, identifying similarities and differences, noticing details and sequence and ordering (Eze, 2004). In the study of Basic Science in particular observation skill is very important because it is use in studying the characteristics of living things and observing things in the environment. Lawson (2001) affirms that observational skills are crucial for effective classification. This is because before one is able to classify living things, objects or events, one has to observed their physical appearance and characteristics. Thus before students could be able to classify in science generally, they have to first of all master the skill of observation.

Classification as a science process skill is the process of sorting, grouping and arranging on the basis of similarities and differences (Mandor, 2002). Classification goes one step further by observing objects or situations and then grouping together based on shared attributes. Finding patterns is one way human beings organize their thinking. When scientists sort and classify, they separate and put things together to understand how they relate to each other (Mari, 2002). Science deals with a lot of classification of living organisms in order to understand their characteristics. Classification enables understanding, promotes sound conceptual structure and facilitate students' ability to retrieve information from a conceptual scheme.

Measurement involves expressing physical characteristics in quantitative ways. Harlen (2007) defined measurement as a process which involves comparison of an entity with a standard unit of measurement which has been arbitrarily determined. That is, using both standard and non-standard measures or estimates to describe the dimensions of an object or event. Ong and Kenneth (2002) affirmed that measurement in science is just another way to describe an object. Measurement involves observing quantitatively using instruments with standardized units. Ability to use numbers is central to the ability to measure. Often, the process skill of measurement can go hand in hand with observation. To keep things simple when explaining science process skills, allow students to measure using two attributes, length and weight. As an activity to enhance

learning, give students a list of things to measure using a ruler and a simple scale.

Communication brings the first three skills together to report to others what has been found by experimentation. When we are communicating, we find ways to share the steps we took in our process and results we have found. Sharing ideas through talking and listening, writing, drawing and labeling pictures, drawing and labeling graphs and acting things out are the various ways of communicating in science. Inference and prediction are the more sophisticated of the science process skills. Beyond simply seeing and reporting results, scientists must extract meaning from them. These skills can involve finding patterns in the results of a series of experiments, and using experience to form new hypotheses. Inference is an explanation based on an observation, it is the link between what is observed and what is already known. Predicting is an educated guess based on good observations and inferences about an observed event or prior knowledge.

Unfortunately, the acquisition of these science process skills among the Upper Basic students in Nigeria is still low (Iwuchukwu, 2000). This low acquisition of science process skills among other factors has led to poor achievement in science (Offiah, 2005; Nwagbo & Obiekwe, 2006). A major stumbling block on acquisition of science process skills is the focus on teaching science skills in isolation from their real world applications. Ndioho (2007) affirms that science process skills can best be acquired when teachers engage students in laboratory or practical activities. However, many Upper Basic schools in Taraba State do not have Basic Science laboratory. Where the laboratory is available, it is inadequately equipped (Nwangbo & Chukelu, 2011). This situation made it very difficult for Basic Science concepts to be taught in the science laboratory where students would acquire the needed science process skills. This calls for alternative teaching approaches that can help students acquire science process skills. One of such approaches is the computer based simulation approach.

Computer-Based Simulations Approach (CBSA) is able to present certain dynamic and complex scientific concepts that are extremely difficult to explain using words, equations or class experiments. CBSA with animated coloured and graphic images is capable of presenting the dynamic nature of scientific concepts through a multi-sensory approach. CBSA plays an important role in

contemporary teaching and learning of science concepts (Chang, 2009). Students are not only motivated by simulations, but learn by interacting with them in a manner similar to the way they would react in real situations. Computers can be used as a supplementary tool in order to enable students acquire science process skills. It is reported that student abilities and skills are affected positively by use of computers (Bayraktar, 2000). Students are not only motivated by simulations, but learn by interacting with them in a manner similar to the way they would react in real situations. It is therefore imperative that teachers become familiar with Computer simulations and its true potential and use it to present information with a perspective similar to that which the present generation of young people irrespective of their gender is using to develop their interest in their everyday life.

Statement of the Problem

The persistent poor performance in science especially among students makes it imperative to search for effective teaching approaches for effective teaching and learning of scientific concepts. Furthermore, students have not sufficiently demonstrated competency in the application of science process skills in examinations and in solving everyday life problems. Science process skills are important for students to succeed as future scientists and living in the contemporary society.

Despite the importance of science process skills to the students as they continue to pursue their science educational career, many teaching strategies contribute very little in the acquisition of these skills while some other methods simply do not provide opportunities to acquire these skills specially observation, classification and communication skills. Therefore the problem of this study posed as a question is what is the effect of computer based simulation approach on acquisition of science process skills by upper basic students?

Research Objectives

The major objective of this study was to investigate the effect of computer based simulations teaching approach on acquisition of science process skills by Upper Basic students in Southern Taraba senatorial district. The specific objectives were to:

1. determine the difference between the mean acquisition of science process skills scores by Upper Basic students taught using computer based simulation approach and those taught using expository method.
2. determine the difference between the mean acquisition of science process skills scores by male and female Upper Basic students taught using computer based simulation approach.

Research Questions

This study was guided by the following research questions:

1. What is the difference between the mean acquisition of science process skills scores by Upper Basic students taught using computer based simulation approach and those taught using expository method?
2. What is the difference between the mean acquisition of science process skills scores by male and female Upper Basic students taught using computer based simulation approach?

Hypotheses

The following hypotheses were formulated and tested.

1. There is no significant difference between the mean acquisition of science process skills scores by Upper Basic students taught using computer based simulation approach and those taught using expository method.
2. There is no significant difference between the mean acquisition of science process skills scores by male and female Upper Basic students taught using computer based simulation approach.

Research Methods

This study adopted quasi-experimental research design. The population of this study was 8,342 Upper Basic III students in Southern Taraba State. A sample of 46 Upper Basic III students selected using multiple stage sampling technique. Data were collected using Science Process Skill Acquisition Test (SPSAT). Data collected were analysed using mean and standard deviation to answer the research questions. Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 significance level.

Results

The results of the data analysis and interpretation are presented according to the research questions and hypotheses. Data related to each research question and hypothesis are presented on a separate table to aid comprehension of the analysis and interpretation of results.

Research Question 1

What is the difference between the mean acquisition of science process skills scores by Upper Basic students taught Basic Science using computer based simulation approach and those taught using expository method?

Table 1: Mean and standard deviation of science process skills acquisition scores of Upper Basic students taught Basic Science using CBSA and expository method

Group	N	Pre-SPSAT Mean	SD	Post-SPSAT mean	SD
CBSA	24	34.38	10.93	70.33	8.98
Expository Method	22	28.73	4.98	55.91	11.41
Mean difference		**5.65**		**14.42**	

Table 1 reveals that the mean science process skills acquisition scores of Upper Basic students taught Basic Science using CBSA was 34.38 with a standard deviation of 10.93 during pre-test and 70.33 with a standard deviation of 8.98 in post-test. The mean science process skills acquisition scores of those taught using expository method was 28.73 with a standard deviation of 4.98 during pre-test and 55.91 with a standard deviation of 11.41 in the post-test. The mean difference between the students taught Basic Science using CBSA and those taught using the expository method was 14.42 in favour of the CBSA group.

Research Question 2

What is the difference between the mean acquisition of science process skills scores of male and female Upper Basic students taught using computer based simulation approach?

Table 2: Mean and standard deviation of science process skills acquisition scores of male and female students taught Basic Science using CBSA

Gender	N	Pre-SPSAT Mean	SD	Post-SPSAT Mean	SD
Male	14	33.30	10.92	70.40	9.98
Female	10	32.63	9.90	69.48	10.27
Mean difference		**0.67**		**0.92**	

Table 2 reveals that the mean science process skills acquisition scores of male students taught Basic Science using CBSA was 33.30 with a standard deviation of 10.92 during pre-test and 70.40 with a standard deviation of 9.98 in post-test. The mean science process skills acquisition scores of female students was 32.63 with a standard deviation of 9.90 during pre-test and 69.48 with a standard deviation of 10.27 in the post-test. The mean difference between male and female students taught Basic Science using CBSA was 0.92 in favour of male students.

Hypothesis 1

There is no significant difference between the mean acquisition of science process skills scores by Upper Basic students taught using computer based simulation approach and those taught using expository method.

Table 3: ANCOVA of science process skills acquisition scores of Upper Basic students taught Basic Science using CBSA and expository method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4656.75[a]	2	2328.37	42.69	.00	.67
Intercept	4119.72	1	4119.72	75.54	.00	.64
Pre-RPT	2294.21	1	2294.21	42.07	.00	.50
Strategies	935.59	1	935.59	17.15	.00	.29
Error	2290.35	42	54.53			
Total	188716.00	45				

Corrected Total	6947.11	44				

Table 3 reveals that F(1, 42) = 17.157; p = 0.000 < 0.05. Since p-value is less than 0.05, the null hypothesis is rejected. This implies that there is significant difference between the mean acquisition of science process skills scores of Upper Basic students taught using CBSA and those taught using expository method in favour of those exposed to CBSA. The partial Eta square of 0.290 was obtained for the method. This means that 29.0% of the students' science process skills acquisition scores can be accounted for by method employed for teaching science. This implies that the CBSA was more effective in enhancing students' acquisition of science process skills.

Hypothesis 2

There is no significant difference between the mean acquisition of science process skills scores by male and female Upper Basic students taught using computer based simulation approach.

Table 3: ANCOVA of science process skills acquisition scores of male and female students taught Basic Science using CBSA.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1202.952[a]	2	601.476	19.421	.000	.649
Intercept	4963.558	1	4963.558	160.267	.000	.884
Pre CBSA	1053.441	1	1053.441	34.014	.000	.618
Gender	64.847	1	64.847	2.094	.163	.091
Error	650.382	21	30.971			
Total	120576.000	24				
Corrected Total	1853.333	23				

Table 4 reveals that F(1, 21) = 2.094; p = 0.163 > 0.05. Since p-value is greater than 0.05, the null hypothesis is not rejected. This implies that there is no significant difference between the mean acquisition of science process skills

scores by male and female Upper Basic students taught using computer based simulation approach. The partial Eta square of 0.091 was obtained for gender. This entails that only 9.1% of students' science process skills acquisition can be attributed to their gender in CBSA class.

Discussion of Findings

The finding reveals that there is a significant difference between the mean acquisition of science process skills scores by Upper Basic students taught using computer based simulation approach and those taught using expository method. The higher acquisition of science process skills by students taught using computer based simulation approach could be attributed to their exposure to practical activities in form simulations where they are required to make use of observation, communication, classification, measurement, inference, and prediction skills. Another reason for the better acquisition of science process skills by students taught using CBSA could be because students were captivated, more focused, attentive and interested in the practical exploration of the simulations which enables acquisition of science process skills.

The findings further indicated that there is no significant difference between the mean acquisition of science process skills scores by male and female Upper Basic students taught using computer based simulation approach. The success of both male and female students in the acquisition of science process skills could be attributed to the equal learning opportunities provided by the use of computer based simulation approach. In CBSA classes every student is given an opportunity to carry out practical activities which could enhance the acquisition of science process skills by all students irrespective of gender. This finding affirms that of Nwangbo and Chukelu (2011) who found no significant difference in the mean acquisition of science process skills scores of male and female students. The finding also corroborates Nwagbo and Obiekwe (2006) who found that when boys and girls were given equal opportunity, they perform equally better. This finding however, contradicts the findings of Eze (2004) who found that girls perform better than boys using inquiry method in Biology. The finding is also in disagreement with Mari (2002) who found that female students were better than their male counterpart in acquisition of science process skills.

Conclusion

The researchers concluded that the use of computer based simulation approach enhances students' acquisition of science process skills more than the expository method. There is no gender disparity in the acquisition of science process skills when taught using computer based simulation approach.

Recommendations

The researchers recommended that:

1. Science teachers should employ the use of computer simulation approach which enhances acquisition of science process skills by students.
2. Where there is gender gap in acquisition of science process skills, selection and use of computer based simulation approach should be used to narrow the gap.

REFERENCES

Akinyemi, O. A. & Folashade, A. (2010). Analysis of science process skills in West African senior secondary school certificate physics practical examinations in Nigeria. *American-Eurasian Journal of Scientific Research, 5(4), 234-240.*

American Association for the Advancement of Science. (1967). *Science: A process Approach.* Washington, D. C. AAA

Ango, M. L. (2002). Mastery of science process skills and their effective use in the teaching of science: An educology of science education in the Nigerian context. *International Journal of Educology 16*(1), 11-30.

Chiapetta, E. (2006). A review of Piagetian studies relevant to science instruction at the secondary and college level. *Science Education, 60*, 253-261.

Eze, P. U. (2004). Gender bias and achievement in science and mathematics among primary schools pupils: implication for human resource development. *Nigerian Journal of Curriculum Studies. 11(2) 30-33.*

Harlen, W. (2007). Primary science teaching for process based learning. A Report of Commonwealth/UNESCO Workshop held on 20-23 June 2007 in Adisababa.

Iwuchukwu, B. S. (2000). *Acquisition of science process skills among secondary school students in Rivers State of Nigeria.* Unpublished M. Sc Thesis, University of Nigeria Nsukka.

Lawson, A. E. (2001). Using the learning cycle to teach biology concepts and reasoning patterns. *Journal of Biological Education*, *35*(4), 165-169.

Mandor, A. K. (2002). *Effects of constructivist model on acquisition of science process skill among junior secondary students.* An unpublished M.Ed. Thesis University of Nigeria, Nsukka.

Mari, J. S. (2002). Gender related difference in acquisition of formal reasoning schemata: Pedagogic implication of teaching chemistry using process-based approach. *Journal of the Science Teachers Association of Nigeria,* 37(1&2), 76-81.

Ndioho, O. F. (2007). Developing observational and drawing skills in teachers for effective conduct of biology practical. Proceedings of the 2007 National Biology panel workshop held in Jos.

Nwagbo, C. & Obiekwe, C. (2006). Effect of constructivist instructional approach on students' achievement in basic ecological concepts in biology. *Journal of Science Teachers Association of Nigeria.45 (1&2), 32-39.*

Nwangbo, N. & Chukelu, U. C. (2011*).* Effects of biology practical activities on students' process skills acquisition. In Okechukwu (Ed.) *Journal of science teachers association of Nigeria, 46(1), 58-70.*

Offiah, F. C. (2005). *The effect of meta-cognitive learning cycle on the achievement in chemistry and critical thinking ability acquisition on secondary school students*. Unpublished Ph. D Thesis. Nnamdi Azikiwe University Awka.

Ong, E. T. & Kenneth, R. (2002). Acquisition of science process skills amongst form 3 students in Malaysian smart and mainstream schools. *Journal of Science and Mathematics Education in South East Asia 28,(1) 103-124.*

Padilla, M. J. (2006). *The science process skills*. University of Georgia, Athens, GA. Retrieved on 23/7/2013 from *http://www.nap.edu/readingroom/books/nses*.