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COMPUTER SIMULATION INSTRUCTION AND PUPILS' ACHIEVEMENT IN BASIC SCIENCE, AKURE TOWNSHIP, NIGERIA

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Abstract

This study was designed to determine the effect of computer simulation instructional strategy on primary school pupils' achievement in basic science in Akure township in Ondo state, Nigeria. Constructivist theory was used as the framework, while the study adopted pretest-posttest control group quasi-experimental design. Four primary schools were randomly selected from Akure township in Ondo state, Nigeria, a total of four intact classes were used. A total of 151 primary IV school pupils (71-experimental group, 80–control group) participated in the study. Instruments used were instructional guides, Pupils' Basic Science Achievement Test (r =.82) and Pupils' Basic Science Self-Efficacy Questionnaire (α=.80). The study lasted 8 weeks. Data were analysed using Analysis of covariance and Estimated marginal means. There was a significant main effect of treatment on primary pupils' achievement in basic science $F_{(1,146)}=632.99$; partial $\eta^2=.81$). The pupils exposed to computer simulation strategy had a higher basic science achievement mean score (19.60) than their counterparts in the convention strategy (12.13). Computer simulation instructional strategy enhanced primary pupils' achievement in basic science in Akure township in Ondo state, Nigeria. Primary school teachers should adopt this strategy to improve primary school pupils' knowledge of basic science.

Keywords: Computer simulation instructional strategy, pupils' achievement in basic science, pupils' self-efficacy

INTRODUCTION

Science is a search for evidence in order to answer questions or solve problems. Since solutions to problems can have more than one answer, this challenges students to solve problems by observing and collecting data and constructing inferences from those data, through this process, students also acquire knowledge and develop a rich understanding of concepts, principles, models, theories and skills. In present age of science and technology when scientific knowledge has grown exponentially, technological innovations have progressed at a rapid pace, and the effects of science and technology are clearly witnessed in all aspects of our lives, it is obvious that science and technology plays a key role for the futures of societies (Aydoğdu, 2006). The British Science Council (2009) defined science as the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence.

In Nigeria, science is taught at the three level of education, elementary, secondary and tertiary education. At the elementary education level, basic science is taught as one of the themes in basic science and technology. The study of basic science at the elementary education level is essential foundation for the nation's scientific and technological development of every nation. This is due to its crucial roles in child's survival, adjustment and adaptation to his/her immediate and wider environments dominated by scientific activities. The lack of such fundamental knowledge in science would handicap pupils to participate meaningfully in some scientific activities. According to Nweke, Abonyi, Omebe & Njoku (2014), for a child to adapt, adjust and develop maximally in an environment he/she must be scientifically literate. In recognition of the indispensability of science in national development, the Federal Government of Nigeria (FGN) made the study of science and technology compulsory at all levels of basic education. Indeed, one of the objectives of basic education in Nigeria as stated in the national policy on education (NPE) is to lay a sound basis for scientific, critical and reflective thinking and to provide opportunities for the child to develop manipulative skills that will enable the child function effectively in the society within the limits of the child capability (Federal Government of Nigeria FRN, 2014). Thus, the fundamental aim of Nigerian basic science is to develop in pupil's science-oriented skills that will make them function effectively in their immediate environment.

Basic science is taught at the primary level so as to prepare the child for the core science subjects (Physics, Chemistry, Biology, Mathematics and Geography) at the senior secondary school level. This indicates that for pupils to be able to study any science subject at the senior secondary school level successfully, such pupils had to be well grounded in basic science at elementary education level. The importance accorded Basic science in the elementary school curriculum from primary to junior secondary level reflects accurately the vital role played by the subject in contemporary society. The importance of the subject is not restricted to the development of the individual alone but for the advancement of the social, vocational and economic goals of countries all over the world.

Despite the importance accorded basic science in Nigerian education system, previous research findings indicate frustrating achievement in science and technology by pupils at the basic education level. Knowing fully well that for Nigeria as a nation that wants to develop and excel scientifically and technologically, average performance of pupils in basic science is not what should be yarning for, a 100% performance is needed. This frustrating performance in basic science raises obvious doubts on the science advancement in the country. This weak foundation at the basic education level may have affected learners' knowledge and disposition to science subjects which culminates in poor performance at the senior secondary school level (Nweke, et al, 2014). Ajagun (2006) revealed that students perform poorly in science subjects particularly in secondary education level may have been due to their weak foundation in basic sciene. Besides, research carried out by Umoren and Ogong (2007), supported the claim of a low level of performance in science subjects in Nigeria. In similar vein, Abonyi and Umeh (2014) observed that the performance of secondary school students in science and mathematics in particular is very discouraging. If secondary school students perform poorly in science and technology-based subject, it is obvious that the right foundation was not laid at the basic education level. This situation is particularly disheartening when realizing that the success of our country in science and technology depends to a great extent on the mastery of this fundamental aspect of science at the elementary level. Dajili (2001) maintained that the state of science at this level was very important. This is because the performance at this level determines the quality and quantity of intake into the secondary and tertiary levels in the country. This is why the performance in basic science examinations at this level as observed by Agbo and Mankilik (1999) and Dajili (2001) should be investigated.

This poor performance has been attributed to a number of factors, ranging from poor teaching method of basic science to so many other similar accusations, all pointing to teachers not doing their work properly (Ikwuka, 2013), neglect on the part of the government. Lack of use of ICT tools, poor teaching method and lack of competent teachers to teach the subject is reported as problem leading to poor performance (Ikwuka & Adigwe, 2017). Also, lack of practical activities and constant use of the conventional method are some of the factors contributing to this poor academic achievement. To make learning more meaningful, teachers should select suitable teaching strategies and provide instructional materials as well as adopt the teaching methods that make use of students' previous knowledge and transfer such knowledge to the publicly accepted one (Ikwuka, 2010). Several studies have been conducted to investigate the causes of students' poor academic achievement in science (Ezeugwu, 2009; Umoke & Nwafor, 2014) and the most recurring factors in all the reports were; inefficient teaching strategy employed by the teachers to impact knowledge to learners, which is the conventional teaching strategy; others are; attitudes to, inadequate instructional materials, and poor manipulation of science process skills.

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From research evidence, educators see the pressing need to reconsider the techniques and methods of instruction at elementary school level. According to Hansen and Sefton (2005) learning is an active process and pupils need to actively participate in the pedagogical process to maintain their engagement with the content. In order to address these challenges, there is need for an instructional system that supported students' active participation in the teaching and learning activity. Several science education research reports (Okoli & Egbunonu, 2012; and Okoli & Abonyi, 2014) show the discovery of innovative teaching methods and technology driven instructional strategies which could enhance pupils' learning and doing of basic science, foster their interest and promote the development of positive attitude to the learning of basic science. These innovative teaching methods and technology-driven strategies can also be applied to basic science instruction at the elementary level. Research reports also indicate that they are effective in improving students learning outcomes in sciences in general (Okoli & Abonyi, 2014).

Information and communication technology (ICT) has become an integral part of modern life, basic building blocks and learning patterns of modern society. Phenomenal advances in ICTs have greatly increased the interdependence and interconnectedness of people educationally. The role of ICT in education is becoming more and more important and this importance has been growing and developing in the 21st century (Richard, 2015). This exponential growth of information that is now available to individual, their ability to access and share this information regardless of the his/her physical location have transformed the way in which people work, organize, socialize, create, participate in public forums and use their free time (Castells, 1999, in Claro and others, 2011). Meenakshi (2013) defined ICT as a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. UNESCO (2002) aims to ensure that all countries, both developed and developing, have access to the best educational facilities necessary to prepare young people to play full roles in modern society and to contribute to a knowledge nation.

According to Sexena (2017), the objectives of ICT in education include; improvement in learning pace and achievements; increased acquisition of knowledge, skills by individuals required for better living and sustainable development; promote and facilitates the relationship between human and the environment; implement the principle of long lasting education; increase the variety of educational methods and services and literacy rate through distance education; and promote the technology literacy among citizens, and the equal importance to slow and gifted children. Appropriate use of ICT can transform the whole teaching-learning processes leading to paradigm shift in both content and teaching methodology (Anu-Sharma, Kapil & Seema, 2011). By such ICT-driven strategies, they provide teachers with tools to illustrate some points or processes as well as to support long lasting learning. While on the part of the pupils, they enable them to associate between concrete, tangible facts from the abstract ones, to help promote the pupils' retention and to facilitate the simulation and recovery phases.

Computer is a device which can be used to present instructional events that are designed, developed and produced for individualized learning situation (Onasanya, 2002). The application of computer technology in a classroom has a significant role in enhancing teaching and learning. One of the ICT driven strategies is to individualize instruction such as computer assisted instruction (CAI) and simulation wherein individual differences of the pupils with respect to their learning capacities and capabilities will be considered. Pupils will be given ample time to criticize, learn the topics and at the same time answer all their questions and queries on their point of view. Lee (1999) defined simulation in a broad sense as a computer program which temporarily creates a set of images (items, objects) and connects them through cause-and-effect relations.

Thomas & Hooper (1991) defined computer-based instructional simulation as a computer program containing a manipulatable model of a real theoretical system. This process includes choosing a model; finding a way of implementing that model in a form that can be run on a computer; calculating the output of the algorithm; and visualizing and studying the resultant data. The main advantage of this computer simulation is that it supplies the learner an immediate feedback and reinforcements from a computer. Lately, this type of instructions has made such a progressive movement that the learner can interactively use the software to help the understanding of a topic in science education. Olumide (2012 & 2019) and Sarıoğlan (2020) in their separate studies found that computer simulation-based instructions were more effective than the conventional-based instruction in students' achievement. Adebayo & Oladele (2016) and Tayo (2014) also noted the significantly greater effectiveness of computer simulation instruction as compared to traditional instruction.

A pupil's level of efficacy impacts the amount of effort applied and the degree to which he or she will persevere through a difficult task (Hibbs, 2013). Pupils with positive self-efficacy beliefs in basic science are more likely to use effective cognitive and regulatory strategies in a systematic way (Neber and SchommerAikins 2002). Self-efficacy beliefs influence achievement (Britner 2008; Yoon 2009), their choices of science related activities (Lodewyk and Winne, 2005), the effort they expend on those activities (Pajares 2008; Walker and Greene 2009), the perseverance they show when encountering difficulties (Dweck and Master 2008; Pajares 2008), and the ultimate success they experience in science (House 2008). Hence, Self-efficacy influences students' activities, effort and persistence, and it can help predict their academic performance (Lee and Mao, 2016). In light of the above, this study examined the effects of computer simulation package on primary pupils' academic achievement in basic science. The moderating effect of self-efficacy was also examined.

Theoretical Background of the Study

Constructivists theory which proposed that learning occurs through experience, provided the theoretical framework for this study. The constructivists theory states learners are active participants who gain understanding and make meaning from the surrounding environment (Driscoll, 2005). A major theme of the constructivist theory is that learning is an active process in which an individual learner must actively construct knowledge and skills (Bruner, 1990) that are based upon their past or current knowledge (Chi, 2009). Simulations is a modified form of cognitive tools, that allow students to test hypothesis and more generally "what-if" scenarios and give learners the opportunity to apply cognitive understanding of their action in a situation (Thomas and Milligan, 2004; Olumide, 2019), and encourage pupils to be actively involved in their learning by connecting prior experiences with new information (Ozmon and Craver, 2008). Thus, provided the needed support for simulation instruction.

Statement of the Problem

Basic science is one of the core subjects taught at the elementary education level in Nigeria. It laid the essential foundation for junior secondary school basic science and the basic knowledge required for biology, chemistry, physics, mathematics and geography at the secondary school level. Despite this importance, it is observed that the academic achievement of primary pupils in basic science at the elementary level is poor. This has a great on the advancement of science in the country. Previous studies have shown that this weak foundation at this level of education have effect on pupils' knowledge of science core subjects which may be one of the reasons for the poor performance of students at the senior secondary level. Several factors have been adduced to be responsible for this trend, one major cause has been attributed to the inefficient teaching strategy used by the teachers which is the conventional method. Other causes pupils' basic science self-efficacy. Different innovative intervention informs of strategies have been recommended and found to improve pupils' achievement in basic science, but this problem of poor performance still persist. Thus, the need for the introduction of strategy that is ICT oriented that would improve primary pupils' achievement in basic science. Furthermore, a review of research produced few studies that addressed the effect of computer simulation on pupils' achievement in Akure township, Ondo state Nigeria. This study was therefore embarked upon in order to investigate the effects of computer simulation package on primary pupils' academic achievement in basic science. The study further explored the extent to which the moderating effect of pupils' basic science self-efficacy on their achievement in basic science.

Research Hypotheses

The following hypotheses were formulated and tested at p<.05 level of significance.

Ho1: There is no significant main effect of treatment on primary pupils' achievement in basic science

Ho2: There is no significant main effect of self-efficacy on pupils' achievement in basic science

Ho3: There is no significant interaction effect of treatment and self-efficacy on pupils' achievement in basic science

METHODS

Research design

This study adopted the pretest-posttest control group, quasi-experimental design using a 2x3 factorial matrix with the instructional strategies as treatment at two levels (computer simulation and conventional strategies) and pupils' basic science self-efficacy at two levels (high and low). This adopted research design model presented the opportunity to evaluate interventions in a study that is structured similar to a true experiment but do not use randomisation of participants to the independent variable (strategy) that can be manipulated and a pre-existing variable (moderator variable) that cannot be manipulated. It allows the researcher to obtain pretest and posttest measurements for both the intervention and control groups, thus allowing access to the initial comparability of the groups (Bradham, Baumgarten, Zuckerman, Fink & Perencevic, 2004). The factorial matrix of the study is presented in Table 1.

Table 1. Representation of the factorial matrix

Treatment/strategies	Self-efficacy		
	High	Medium	Low
Computer simulation Strategy E_1			
Conventional Strategy C			

Within the quasi-experimental design adopted, the computer simulation strategy was implemented on the experimental group, while the conventional strategy was implemented on the control group, both groups were taken as the independent variable. Pupils self-efficacy (high and low) was taken as the moderator variable, while pupils' achievement in the three topics investigated was taken as the dependent variable.

Selection of participants

The participants consisted of primary school IV pupils. Four schools were randomly selected from Akure township of Ondo State. An intact class in each school was used making a total of four intact classes. Two school each were assigned to the computer simulation strategy and the conventional group. The teachers used in the study were the class teacher teaching primary IV pupils in each school.

Research instruments

Pupils' Basic Science Achievement Test (PBSAT): PBSAT was designed by the researcher to measure pupils' achievement in basic science. This is made up of two sections. Section A contained information on pupils personal data such as name, gender, school. Section B consisted of 21 multiple choice items with four options (A-D) from which participants selected the correct alternative. All the questions were answered by the participants. One mark is assigned to each correct answer. The maximum obtainable score is 21. To established PBSAT face and content validity, copies of the initial draft of 30 multiple choice items were given to experts in Science and Basic science Education. These experts were asked to determine its suitability for the targeted population in terms of clarity and language. 26 items survived scrutiny. They wer later trial-tested on twenty-seven (27) primary IV pupils in a school that was not selected for the main study. It was the 21 items with discrimination indices between .4-.6 and difficulty indices above .30 that were used. The data collected were analysed using Kuder-Richardson formula 20 (Kr20). The reliability coefficient of .82 was obtained.

Pupils' Basic Science Self-Efficacy Questionnaire (PBSSEQ): PBSSEQ was adapted from the self-efficacy scale developed by Lisa-Looney (2003) for the purpose of this study. This instrument was designed to measure the pupils' basic science self-efficacy. The initial instrument consists of twenty (20) items on five-point Likert scale ranging from Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. To modify the instrument for the purpose of this study, the Likert format was changed to YES and No format due to the level of the participants. In scoring of the modified instrument, the positive statements were graded Yes-2 and No-1 respectively while the negative items were reverse scored. In total, the maximum obtainable score is 40. Pupil that scored between 30-40 is rated as high self-efficacy pupil while 0-29 as low. In validating the modified instrument, it was given to experts in guidance and counselling for their expert advice in respect to the language level, suitability and over all face validity of the instrument. Their corrections were incorporated to the final draft. The final draft was later trial-tested on twenty-seven (27) primary IV pupils in a school that was not selected for the main study. The reliability coefficient was determined using Cronbach alpha which gave 0.80.

Contents of the program applied

The study was conducted on two sub-themes of the primary IV basic science and technology curriculum "Learning about Our Environment, and Living and Non-Living Things". From these sub-themes, 'changes in nature and changes in plants and animals' were the topics investigated. These topics aim to help pupils observe and describe changes taking place in their surroundings (e.g. construction of new roads; sprouting of grass in the rainy season; burning of candies, melting of ice blocks; burning pieces of wood; wetting a piece of cloth among others), differentiate and group these changes as temporary and permanent changes, observe and describe changes in the life cycle of common animals (e.g. housefly, cockroach, toad), identify and name the young ones of different animals, compare the young ones with their adults and state reasons for the observed differences, and draw the life-cycle of some insects. These contents were prepared in computer-based software for the experimental group by consulting primary school basic science and technology teachers and experts in technology education, and saved on CDs. While for the control group, these contents were presented conventionally by the teachers to the pupils.

Research Procedures

The researcher, first administered the instruments (Pupils' Basic Science Achievement Test and Pupils' Basic Science Self-Efficacy Questionnaire) as pretest to the pupils and their scores were recorded. The researcher then exposed the experimental group to the topics in Basic science using computer simulation strategy for 5 weeks. The control group was also subject to conventional strategy for the same number of weeks. The treatment procedures for the groups were presented below.

Experimental group (Computer Simulation Strategy)

The following steps guided the use of computer simulation strategy which lasted 80 minutes for lesson period.

1. The disc containing the lesson to be learnt is mounted on the computer system which is connected to the projector.

2. The teacher explains features of computer simulation classroom to the pupils and the objectives of the topic to be achieved as displayed on the screen
3. The teacher executes the lesson base on the prepared content pages while the time allotted for lesson teaching is displayed on the right down corner of the screen. This is done on unit basis as stated on the primary IV basic science curriculum.
4. Pupils watch and listen to the simulation.
5. After each unit, the next page displays the worksheet for pupils' activity
6. Pupils ask questions on part of the simulation presentation they did not understand or not clearly explained.
7. The teacher explained and clarified any misconception
8. Pupils give feedback gained after the clarification of misconception aspect by their teacher
9. Pupils write the modified summary in their note books

Control Group (Conventional Strategy)

The steps below guided the presentation of lessons in this strategy which lasted 40 minutes.

1. Teacher introduces the topic and states the objectives for the lesson
2. Teacher outlines the content of the topic on the chalkboard
3. Teacher presents the content of the topic
4. Pupils listen to the teacher explanation
5. Teacher allows pupils to ask questions on areas of the topic that are not clear to them.
6. Teacher answers the pupils' questions
7. Teacher summaries the lesson, while the pupils write down the summary
8. Teacher evaluates the pupils and give them home assignment

Methods of Data Analysis

Data obtained were analysed using inferential statistics of paired sample t-test and Analysis of Covariance (ANCOVA) of the posttest scores with the pretest scores as the covariates. Estimated marginal mean was used to determine the means of different groups in order to find the magnitude of the difference among the groups. Paired t-test was used to analyse research questions 1 to 3, while ANCOVA was used to test the null hypotheses 1 to 3.

RESULTS

1. Is there any significant difference between pupils pretest and post achievement test before the implementation of the interventions (computer simulation and conventional strategies)?

Paired sample t-test was used to answer research question 1, and the results presented in Table 2.

Table 2. Paired sample t-test showing the comparison of pre-test and post-test

Treatment	Test	N	Mean	Std. Deviation	Mean Difference	t	df	Sig. (2-tailed)	Remarks
Computer Simulation Strategy	Pretest	71	9.50	2.78	10.42	-22.39	70	.00*	Significant
	Posttest	71	19.92	3.89					
Conventional Strategy	Pretest	80	8.19	2.85	4.38	-4.31	79	.00*	Significant
	Posttest	80	12.57	3.12					

*p<.05

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Table 2 shows the comparison of pretest and posttest mean scores for both experimental and control groups. It reveals that pupils post basic science achievement test (19.92) mean score after been taught with the computer simulation strategy is higher than their pretest mean score (9.50) when they have not been introduced to the strategy. It is observed that the mean score of 9.50 obtained during the pretest increased by 10.42 to 14.04 in the posttest after the introduction of the treatment. Table 2 indicates that there is a significant difference between pupils pretest and their post achievement test after the computer simulation strategy intervention ($t=-22.39$, $df=47$; $p<.05$). The absolute t-test value of 22.39 with significance level less than 0.05 indicate that there is a significant difference between pupils pretest and post achievement test after the computer simulation strategy intervention. The results indicate that computer simulation strategy had improved pupils' achievement in basic science.

Table 2 reveals that the control group pupils who learnt basic science using conventional strategy had significantly higher mean score in the post achievement test (12.57) than pretest (8.19). Table further shows that the control group pupils' mean score have increased significantly by 4.38 in the post achievement test as compared to the pre-test. This implies that there is a significant difference between pupils pretest and their post achievement test of pupils exposed to conventional strategy ($t=-4.31$ $df=102$; $p<.05$). This means that conventional strategy had also improved pupils' achievement in basic science.

2. Is there any significant difference between pupils pretest and post achievement test after the implementation of the intervention (computer simulation and conventional strategies)?

Paired sample t-test was used to answer research question 2, and the results presented in Table 3.

Table 3. Paired sample t-test showing the comparison of experimental and control strategies

Test	Treatment	N	Mean	Std. Deviation	Mean Difference	T	Sig. (2-tailed)	Remarks
Pretest	Computer Simulation Strategy	71	9.50	2.78	1.31	-1.37	.61	Not Significant
	Conventional Strategy	80	8.19	2.85				
Posttest	Computer Simulation Strategy	71	19.92	3.89	7.35	6.67	.00*	Significant
	Conventional Strategy	80	12.57	3.12				

*p<.05

Table 3 shows the comparison of pupils' scores between the experimental and control groups. On the pupils' pretest results comparison, the mean score for experimental group is 9.50, while that of conventional strategy is 8.19 with a mean difference of 1.31. The t-value of 1.37 which is significant at .61 implies that there is no significant difference between the mean pretest scores of pupils exposed to computer simulation strategy and those taught with the conventional strategy. This means that pupils under both strategies are of equal level prior to the implementation of the interventions. While on the posttest results, it is observed that mean score of pupils in the experimental group is 19.92, while that of their counterparts in the control group is 12.57 which indicates a mean difference of 7.35. The results also reveal the t-value of 6.67 which is significant at $p<.05(.00)$, this indicates that there is a significant difference between the mean posttest score of pupils in the computer simulation strategy and those in the conventional strategy. This implies that there is an improvement in pupils' basic science achievement after the implementation of both interventions, and that there is variation in their achievement in favour of those exposed to computer simulation strategy

3. Is there any significant difference in the pre-test of low and high self-efficacy pupils before the interventions (computer simulation and conventional strategies)?

Paired sample t-test was used to answer research question 1, and the results presented in Table 4.

Table 4. Paired sample t-test showing the comparison of experimental and control pre-test by self-efficacy

Treatment	Test	Self-efficacy	N	Mean	Std. Deviation	Mean Difference	t	Sig. (2-tailed)	Remarks
Computer Simulation Strategy	Pretest	Low	42	27.11	3.73	12.23	3.41	.11	Not Significant
		High	29	39.34	4.06				
Conventional Strategy	Pretest	Low	47	28.76	3.09	10.22	2.84	.09	Not Significant
		High	33	38.98	4.33				

*p<.05

Table 4 indicates the comparison of pupils' scores between the experimental and control groups in respect to their self-efficacy. On low self-efficacy, it shows that pupils mean scores with low self-efficacy in the computer simulation and conventional strategies had 27.11 and 28.76 respectively, while their high self-efficacy counterparts had 39.34 and 38.98 respectively. Table 4 also reveals that there is no significant difference in the pre-test of pupils with low and high self-efficacy under computer simulation strategy [t=3.41; p>.05(.11)] and those exposed to conventional strategy [t=2.84; p>.05(.09)].

Note: No post-test was given for self-efficacy, it was only administered once (before the implementation of interventions, in order to have even distribution of pupils from low and high self-efficacy into the experimental and control groups).

Ho1: There is no significant main effect of treatment on primary pupils' achievement in basic science

ANCOVA was used to test null hypotheses 1 to 3 (Ho1 to Ho3) and the results presented in Table 5.

Table 5. Analysis of covariance (ANCOVA) of post-achievement by treatment and self-efficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4596.932[a]	4	1149.233	507.620	.000	.933
Intercept	888.775	1	888.775	392.575	.000	.729
PreAchievement	4517.686	1	4517.686	1995.478	.000	.932
Treatment	1433.065	1	1433.065	632.990	.000*	.813
Self-efficacy	.615	1	0.615	.272	.603	.002
Treatment x Self-efficacy	1.074	1	1.074	.474	.492	.003
Error	330.538	146	2.264			
Total	41004.000	151				
Corrected Total	4927.470	150				

R Squared = .933 (Adjusted R Squared = .931), *p<.05

Table 5 showed that there was a significant main effect of treatment on primary pupils' achievement in basic science ($F_{(1,146)} = 632.99$; $p<0.05$, partial $\eta^2 = 0.81$). The effect is 81.0%. This indicated that there was a significant difference in the pupils' post-achievement mean scores in basic science. Thus, hypothesis 1 was rejected. In order to determine the magnitude of the significant main effect across treatment groups, the estimated marginal means of the treatment groups was carried out and the result is presented in Table 6.

Table 6. Estimated marginal means for post-achievement by treatment and control group

Treatment	Mean	Std. Error
Computer Simulation Strategy (CSS)	19.60	.21
Conventional Strategy (CS)	12.13	.18

Table 6 indicated that primary pupils in Computer Simulation Strategy (CSS) treatment group had the higher adjusted post-achievement mean score in basic science ($\bar{x}$=19.60), while the Conventional Strategy (CS) control group had the least adjusted post-achievement mean score ($\bar{x}$= 12.13). This order can be represented as CSS > CS.

Ho2: There is no significant main effect of self-efficacy on pupils' achievement in basic science

Table 5 showed that there was no significant main effect of self-efficacy on pupils' achievement in basic science ($F_{(1,146)} = 0.27$ $p>.05$). Therefore, hypothesis 2 was not rejected. This implies that self-efficacy had no effect on pupils' achievement in basic science

Ho3: There is no significant interaction effect of treatment and self-efficacy on pupils' achievement in basic science

Table 5 revealed that there was no significant interaction effect of treatment and self-efficacy on pupils' achievement in basic science ($F_{(1,146)} = .47$ $p>.05$). Therefore, hypothesis 3 was not rejected. This implies that treatment and self-efficacy had no effect on pupils' achievement in basic science

DISCUSSION

The results revealed a significant main effect of treatment on primary pupils' achievement in basic science. It is observed that pupils in both the treatment and control group had gained high scores in their post-achievement compare to their pretest before the intervention is applied. These results indicate that both computer simulation and conventional strategies had improved pupils' cognitive ability, comprehension, understanding and analysis in Basic science. However, the results also indicate that there is a significant difference in pupils' achievement between the group who was exposed to computer simulation and those group taught with the conventional strategy. The magnitude of achievement scores in basic science favoured the group computer simulation groups than the conventional group. This indicates that the computer simulation strategy is more effective than the conventional strategy in improving pupils' achievement in Basic science.

The efficacy of the computer simulation strategy in terms of the higher achievement scores recorded could be due to the fact that the strategy helps pupils to learn and understand basic science through visualization. This improvement could be attributed to the opportunity students had to take initiative while learning about a given topic which is the basic traits of computer simulation, where pupils build their own mental model based on the observation to be recorded in the form of schemas in their long-term memory (Ali & Zamzuri, 2007; Zumyil, 2019). Furthermore, the efficacy of computer simulation strategy could be attributed to the "engaged exploration" offered by the simulation, as pupils were able to use the simulations to explore the topic under investigation in ways that were similar to how scientists explore such phenomena. Another factor that contributed to the success of computer simulation was the high level of interactivity with dynamic and immediate feedback to the pupils (Aoude, 2015). It encourages pupils to develop an understanding of learnt concepts and support their memory retention which improve their achievement (Kiboss, Ndirangu, & Wekesa, 2004).

The result of this study is in agreement with the findings of Sarıoğlan (2020) who found that computer-based instruction was more effective in increasing students' success compared to traditional teaching method. This also aligns with Zumyil (2019) who indicated that the use of computer simulation instructional strategy enhanced students' interest and achievement in Ecology. In the same vein with the findings of Olumide (2019) who found that computer simulation enhanced students' achievement in genetics and ecology than the conventional strategy. The findings agree with Adebayo & Oladele (2016) that there was a significant main effect of computer simulation on students' mean achievement score in DNA replication and transcription students' achievement and memory retention in biology. Also, in relation with Elangovan &Ismail (2014) revealed that realistic computer simulation based teaching method is more effective than the non-realistic simulation and it improves Biology students' achievement and memory retention. In agreement with the findings of Ezeudu and Ezinwanne (2013) that students exposed to simulation instructional strategy had their achievement improved in chemistry. The findings of this study also support the findings of Tayo (2012) who found that students exposed to developed animated agricultural package performed significantly better than those exposed to the conventional lecture method.

The findings revealed that there is no significant main effect of pupils' self-efficacy on primary pupils' achievement in basic science. The implication of this finding is that the efficacy level of pupils either high or low has nothing to do with their achievement in basic science. The finding is in line with the findings of Nwosu and Okoye (2014) who in their study revealed that self-efficacy had no relationship with students' achievement. The finding disagreed with Asaaju (2018) who found that self-efficacy had significant main effect on academic achievement in population. It is in contract to the finding of Aurah (2017) found that students' science self-efficacy is highly correlated to academic achievement. Lee & Mao (2016) and Dogan (2015) concluded in their separate study that self-efficacy could predict pupils' academic performance. The results also disagreed with the findings of Goulao (2014) and Sinan & Jongur (2016) found that there was a strong positive correlation between academic self-efficacy of students in mathematics and the performance of students in mathematics among secondary school students. In the same vein, the finding negates the findings of Loo & Cho (2013) that students' self-efficacy and academic achievement are strongly-related. Galyon, Blondin, Yaw, Nalls & Williams (2012) found a stronger relationship between academic self-efficacy and exam performance. The finding of this study is not in line with Uzuntiryaki and Çapa-Aydın (2007)'s findings that there was a significant correlation between chemistry self-efficacy beliefs in cognitive skills and chemistry achievement.

The result of the findings showed that the interaction effects of treatment and self-efficacy had no significant effect on primary pupils' achievement in basic science. The implication of this is that the treatment is suitable to both levels of pupils' self-efficacy, that is, the treatment is not self-efficacy biased. Also, the findings indicated that it is only the treatment that accounted for primary pupils' achievement in basic science. This finding of no significant interaction effects of treatment and self-efficacy is in line with the findings of Olumide (2019) who found in her study that the interaction effect of treatment and self-efficacy had no Significant Effect On Students' Achievement In Genetics And Ecology Concepts.

Conclusion

The result of this study showed that computer simulation instruction strategy improves primary pupils' achievement in basic science. This showed the effectiveness of computer simulation instruction strategy as tool for teaching abstract and difficult topics in basic science where it aids visualization of concepts thereby helping pupils required conceptual knowledge irrespective of their elf-efficacy in basic science.

Recommendations

The following recommendations are made based on the findings of this study.

i. Primary school teachers should adopt ICT-driven strategies such as computer simulation instructional strategy to enhance pupils' achievement in basic science.
ii. Computer simulation instructional strategy if adopted by primary school teachers would bring about an enriched classroom interaction which could enhance appreciable achievement in Basic science learning.
iii. Professional development programmes such as seminars, workshops, and conferences should be organized for teacher at primary school level on periodic basis to acquaint them with innovative ICT-driven strategies like the one used in this study. This would help them to effectively apply this strategy in teaching of basic science.

Limitations of the Study

The study is restricted to the topics, "Changes in Nature, and Changes in Plants and Animals, and Human Body (the mouth)" in the sub themes of Learning about Our Environment, and Living and Non-Living Things" of the basic science and technology curriculum for primary IV pupils. This research is limited to primary IV basic science pupils in Akure township of Ondo State in the 1st term of 2016/2017 academic session. The study lasted 8 week using quasi-experimental research implementation of computer simulation and conventional strategies while self-efficacy was the only moderator variable examined limited this study.

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