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EMERGING TECHNOLOGIES FOR PRESENT AND FUTURE EDUCATION: Effects of Simulation and Animation teaching strategy on students' performance in Basic Science

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Abstract
The study examined the Effects of Simulation and Animation teaching strategy on students' performance in Basic Science in junior secondary schools in Ado Local government in Ekiti State. Nigeria. The study was a pre-test post-test quasi-experimental design. Purposive and stratified random sampling techniques was used to select a total sample of 100 JSS II Basic Science students (50 each experimental and control group respectively) from four junior secondary schools in Ado Local Government Area, Ekiti State. Two null hypotheses were formulated and tested at 0.05 level of significance. The instrument for this study was Basic Science Achievement Test (BSAT) and the treatment package used for the study was tagged: Simulation Animation Instructional Package (SAIP). The reliability of the instrument (BSAT) was 0.87. The data collected were analysed using t-test and ANCOVA statistical analysis packages. The result of the findings showed that Simulation and Animation teaching strategy significantly influenced students' Academic Achievement in Basic Science in junior secondary schools. The implications of the results on students' academic Achievement in Basic Science were discussed. Based on the findings, it was recommended that teaching Basic Science by the teachers should be encouraged through Simulation and Animation teaching Strategy to enhance better understanding and good academic achievement.
Keywords: Simulation and Animation, Basic Science, Science Education, instructional package, academic achievement.

Introduction

Science is regarded as a foundation upon which the bulk of the present technological breakthrough is built. Science education plays a vital role in the lives of individuals and development of a nation scientifically and technologically (Alebiosu & Ifamuyiwa, 2008) cited by Oludipe (2011).

The importance of Basic Science in everyday life can never be over emphasized. It serves as the bedrock which provides the required training in scientific skills to meet the growing needs of the society. It is the fundamental knowledge acquired through Basic Science at the upper basic level that leads to the transformation of the world through dramatic advances in almost all fields including Medicine, Engineering, Electronics and Aeronautics among others (Guyana, 2018).

According to Chukwuneke & Chinkwenze (2012) basic science formerly known as Integrated Science is the first form of science a child comes across at the secondary school level. Basic science is a core subject in the National curriculum at the upper basic level. All students from upper basic I-III classes must offer and study the subject. Basic Science is considered the bedrock of all science subjects at the Senior Secondary School (SSS) level. The subject prepares students at the upper basic level for the study of core science subjects (biology, chemistry and physics) at the Senior Secondary School (SSS) level (Oludipe, 2012).

The application of scientific knowledge acquired through Basic Science, as reported by Guyana (2018) has helped many countries like China and India to transform from poor feudal type economies to become economic and industrial power houses and in several ways compete effectively with developed countries. Basic Science is of great importance because early experiences in science help students to develop problem-solving skills that empower students to participate in an increasingly scientific and technological world (Guyana, 2018).

Prakash (2012) opined that basic science is the type of science which provides unique training of students in observation, reasoning and experiment in the different branches of science; it also helps students to develop a logical mind. Basic Science enables students to be systematic and enables them to form an objective judgment. Basic Science, if taught according to its philosophy, equips students with the necessary introductory scientific and technological knowledge and skills necessary to build a progressive society. This forms the bedrock on which scientific and technological studies rest (Ochu & Haruna, 2014). Basic Science is the type of science which provides unique training of students in observation, reasoning and experiment in the different branches of science; it also helps students to develop a logical mind (Prakash, 2012). Basic Science enables students to be systematic and enables them to form an objective judgment.

The teaching- learning process is as old as human being on the earth. It has been carried out by human beings and even by animals, to teach their young ones for successful adjustment to existing conditions in their environments (Owoeye, 2017). Teaching as conventionally understood by the traditional teacher, is just the act of disseminating information to learners in the classroom. An observation of the traditional classroom teaching reveals that either the teacher is delivering information, or one of the students is reading from the text book and other students are silently following him in their own text books. Conventional teaching is simply chalk-talk approach in which students remain passive as learners. Instruction is not properly organized and rote learning is heavily emphasized. Mostly, the results of the students are not satisfactory due to the use of this approach.

The term "teaching approach" refers to the general pedagogy and management style used for classroom instruction. A teacher's choice of teaching approach should not only be based on what fits/suits him or her but also putting into consideration the subject area, schools mission statement, class demography, etc. The choice of teaching approach according to Wikipedia may also depend largely on the information that the teacher or instructor intends to pass across to the students in his/her class, the skill that is to be taught, and it may be influenced by the attitude and level of enthusiasm of the students. Science lessons that are not interesting will not be able to motivate pupils to learn and subsequently will affect their scientific thinking skills and curiosity (Elvis, 2013).

The primary purpose of teaching at any level of education is to bring a fundamental change in the learner. To facilitate the process of knowledge transmission, teachers should apply appropriate teaching methods that best suit specific objectives and level exit outcomes. In the traditional epoch, many teaching practitioner widely applied teacher-centered method to impart knowledge to learners comparative to student-centered methods. Until today, questions about the effectiveness of teaching methods on students learning have consistently raised considerable interest in the thematic field of educational research. Moreover, research on teaching and learning constantly endeavor to examine the extent to which different teaching methods enhance growth in student learning (Elvis, 2013). Safdar (2010) stated that "how to learn is equally important with what to learn but how to teach (teaching strategy) is more important than what to teach". Teachers make a difference. Some teachers reliably elicit greater gains than others because of differences in how they teach (Tennyson & Volk, 2015).

Teaching methods involve different activities of the teacher and the learners such as questioning, explanation, demonstration or direction. The activities can be referred to as skills or techniques. Thus, teaching methods involve different techniques and methods among which are lectures, cooperative learning, inquiry-oriented learning or inquiry-based methods with mobile devices for learning, self-directed study, computer-assisted testing/assessment (Sung, Chang & Liu, 2015). The use of these techniques vary with different teaching methods and also on many factors such as type of learning objectives, nature of the subject, age of students, number of students in a class among others (Aniaku, 2012). Quite remarkably, regular poor academic performance by the majority students is fundamentally linked to application of ineffective teaching methods by teachers to impact knowledge to learners (Elvis, 2013). Substantial research on the effectiveness of teaching methods indicates that the quality of teaching is often reflected by the achievements of the learners.

There are various methods of teaching Basic Science but there is no single method of teaching that is absolute in meeting the learning needs of every individual learner in the classroom With the use of a variety of teaching and learning methods in classroom, it is anticipated that pupils' interest in science will be enhanced when the teaching is students' centered. Enekwechi (2016) asserted that

teaching approaches in which learners are actively involved would likely lead to meaningful learning and not rote learning.

Teaching and learning process is a mandatory part of education. Efforts are being made to enhance the quality of teaching and learning science. Similarly, efforts are being made to improve the learning of students in Basic Science through the application of variety of teaching and learning strategies (UzZaman et al, 2015).

Science as a course is abstract. Widiyatmoko (2018) cited Muller et al (2008), Stieff (2011) and Ryoo & Linn (2012) that simulation can make abstract science phenomena more accessible and visible to students. One can use Simulation and Animation teaching strategy through PowerPoint presentation to transform the abstract nature of science to vivid reality. For example, we can make student "feel" what happens in nuclear reaction chamber by animating and simulating it through PowerPoint presentation. Simulation of electron moving round an atom will be an interesting class to a student; no equipment can reveal this more than simulation through PowerPoint presentation.

A physics student will understand the teacher better in the student of gravitational acceleration if the lesson involved simulation of activities through PowerPoint presentation. A teacher can explain molecular bonds and eclipse better by simulation.

Computer Simulations are simplified versions of situations that the student would encounter in real life. Before American astronauts ever landed on the moon in April 1969, the exercise has been simulated here on earth as moon landing Simulation most delicate and risky enterprises to be undertaken by man had to be first simulated before the real exercise.

Empirical studies revealed successes in the use of animation and simulation all over the world with a lot of benefits as these strategies encourage active learning and sustains students' interest thereby enhancing their academic performances.

Simulation strategy is increasingly becoming a popular educational tool in the production of highly qualified professionals in the field of education, health, and applied sciences. Particularly, the strategy helps improve teaching practice effectiveness and student learning performance. A simulation is an imitative representation of a process or system that could exist in the real world. In this broad sense, simulation can often be used interchangeably with model.

Simulation gives learners opportunity to observe a real world experience, and they can interact with it. Through using simulations, learners can experimentally get an understanding of difficult to grasp concepts in science learning.

Simulation games provides opportunities for students to analyze problems, make decision, manage real life situations, control projects and experience the consequences of their actions. They are design to help student to learn to achieve specific objectives actively rather than passively.

Simulation-based learning not only boosts students' engagement and motivation to construct new knowledge but also improves participants' comprehension of the topics being learned at the cognitive level.

Simulations promote the use of critical and evaluative thinking. Because they are ambiguous or open-ended, they encourage students to contemplate the implications of a scenario. The situation feels real, and thus leads students to engage with the activity more enthusiastically and interactively.

Simulation training can provide realistic feedback at every point of interaction, giving the learner a large variety of information to process and integrate into their mental models, resulting in a more nuanced understanding of the learning objective.

Simulated learning allows learners to practice and even fail in a safe environment, where expensive hardware, machinery, software systems or even lives will not be at risk. Learners can 'reset' the scenario, try out alternatives and experience different outcomes, which can widen their learning and experience.

Computer simulations allow scientists to evaluate processes that they otherwise wouldn't be able to. Some real-world systems are too large or too small to investigate by other means. A process in a real-world system that scientists want to investigate might occur over very long or very short timescales.

Simulation allows you to explore 'what if' questions and scenarios without having to experiment on the system itself. It helps you to identify bottlenecks in material, information and

product flows. It helps you to gain insight into which variables are most important to system performance.

Simulators mimic the real world environment so the learner feels comfortable and can practice without any fear of causing any damage to themselves, others, or their surrounding environment. If they fail they can try as many times as needed before they succeed. It allows students to make accurate assumptions. Alenezi (2019) cited Hopwood et al (2015) that Simulation is regarded as an educational approach for learning as well as teaching applicable to different disciplines. Scientists use simulations all the time. For example, you could input the laws of gravitation into a computer, and use it to create a 3D simulation of the planets of the solar system orbiting the Sun. Then you could fire asteroids through the solar system and see what happens.

Simulations and games allow for exploration; learners don't have to just proceed through the instructional material in a linear way. And even fun, exciting games can be educational; they create engagement that helps students learn the concepts in a different manner through their simulated play.

According to Bello, Ibi & Buka (2016) Simulations are instructional scenarios where the learner is place in a "world" defined by the teacher. Bello, Ibi & Buka (2016) gave examples of Simulations as:

- When students are assigned roles as buyers and sellers of some goods and asked to strike deals to exchange the goods, they are learning about market behavior by simulating a market.
- When students take on the roles of party delegates to a political convention and run the model convention, they are learning about the election process by simulating a political convention.
- When students create an electric circuit with an online program, they are learning about physics theory by simulating an actual physical set-up.

Simulation is the realistic re-enactment of real-world scenarios for various reasons, including entertainment, education, preparing for an anticipated event, or troubleshooting a problem. They are typically conducted in a controlled environment that allows for modifications or adjusting of variables as needed. However, simulations cannot account for every variable. Developing a simulation can be a complex process. An example of a simulation is a fire drill. In this situation, a fire drill is used to prepare people for an anticipated event. During fire drills, the fire alarm is activated in the absence of a real fire, and people are instructed to react as they would if the scenario were real. The purpose of this simulation is to teach people the appropriate steps to take in the event of a real fire without their lives actually being in danger. Other examples of simulations include simulating cardiopulmonary resuscitation (CPR), science laboratory experiments, simulations used in movies, sports, and video games.

Simulation is the process of creating a model of a real world scenario for a variety of reasons including education, preparing for an anticipated event or troubleshooting a problem. The models used during a simulation might be real or dramatized.

Simulation is used in a wide number of scenarios. Most often the purpose of simulation is to prepare for an anticipated event such as with a fire drill preparing for a real fire. It is also used to teach a skill for example, in teaching how to perform cardiopulmonary resuscitation (CPR) or deliver a baby. Widiyatmoko (2018) cited Chang et al (2010) that simulations help students visualize the phenomenon that might otherwise be difficult to depict.

Simulation tools offer many advantages compared to traditional teaching methods. They are able to demonstrate abstract concepts, allow interaction between users and simulated equipment, and provide users with feedback that allow users to improve their knowledge and skills. They are also cost-effective over the long-term.

Simulation tools can transform abstract concepts into interactive visual content, making it easier for students to understand the performance and relationship between different system parts. They can become familiar with the equipment and environment, and practice necessary skills without risking accidents to themselves, the equipment, and the environment. A wide variety of scenarios are available for students to experiment in, such as emergency events, so that they are able to execute the appropriate procedures when these events occur in the real world. Students are able to reinforce theoretical knowledge with hands-on-training through simulation tools, giving a better understanding of the material.

Simulation tools can track student progress and provide standardized feedback that can aid in developing skills. They can also offer targeted skill development—students can choose which skills to improve on and receive specific training resources, and educators can also control the content. Training materials can be easily updated, developed, or modified, and training can be done regardless of time or place. Inability to access to physical training equipment is no longer a problem as simulated equipment is always accessible.

Computer simulations have greatly evolved with progress in computer science over the past few decades. With origins in a math experiment during WWII, simulation technologies now have widespread applications in various industries ranging from healthcare to manufacturing to entertainment. Simulation tools have found numerous successes and advantages in education, being used for teaching, training, and testing applications. As computer technology continues to improve, simulations will become more immersive and will continue transforming applications in education.

Bello, Ibi & Buka (2016) affirms that an effective teaching method stimulates learners' interest which therefore forms a base for achieving desired curriculum objectives in a school setting.

In the study conducted by Bello, Ibi & Buka (2016), the mean academic performance of the stimulating games group was significantly higher than that of the lecture group pupils. This implies that pupils who were taught with simulation games techniques performed better.

Widiyatmoko (2018) opines that computer simulation has an overwhelming potential for the enhancement of the teaching and learning of science concept. Similarly, in the study of Alenzi (2019) on the impact of simulation of teaching effectiveness and student learning performance confirmed that the use of social process simulation has positive and significant impact on student learning performance.

Retention is the term used to describe the remembering of a fact or an idea after a passage of time (Ayoola, 2016). It is by the demonstration of such recall that learning could be judged to have taken place. Permanent and meaningful learning is the target of our educational endeavour while understanding and retention are the products of meaningful learning when teaching is effective and meaningful to students. Meaningful learning is deemed to have taken place if after passage of time; the students can recall and apply information which he/she has been taught previously. Bennet & Rebello (2012) defined retention as having the information stored in long-term memory in such a way it can be easily retrieved. Farrant (2002) believed that increase in knowledge lies solely on the ability to remember. He further explained that if an individual could not grasp and keep hold of what was taught and learnt, it would seem like trying to fill a bucket without bottom with water. This implies that students' participation in a lesson is a basis for understanding, achievement and retention.

Ausubel compared meaningful learning to rote learning, which refers to when a student simply memorizes information without relating that information to previously learned knowledge. As a result, new information is easily forgotten and not readily applied to problem-solving situation because it was not connected with concepts already learned. Rote learning is a memorization technique based on repetition. The idea is that one will be able to quickly recall the meaning of the material by repeated practices. Some of the alternatives to rote learning include meaningful learning, associative, and active learning. In rote learning, students acquire knowledge, recall it but they are not able to use this knowledge for solving problems of the daily life (UzZaman et al, 2015).

Based on previous studies like Blair & Simon (2014) among others, researches indicated that retention over time especially in varied contexts-boots both encoding (how well knowledge is stored) and retrieval (how well knowledge can be remembered) of information. Also, by allowing students to repeatedly practice fundamental skills, and apply their knowledge to different types of problem, it maximizes students understanding and commitment of key procedures and rules to long-term memory (retention). They observed that there is growing realization that poor learning and retention of science concepts may be related to inability of students to link previous learning with present one. It is noteworthy that, without retention, there can be no transfer of knowledge to other fields of endeavours. Blair & Simon (2014) opined that when students were able to link previous learning with present one, retention has taken place.

The studies conducted by Awodun & Oyeniyi (2018) on the effects of Instructional Simulation on Students' academic performance in Basic Science in Junior Secondary Schools in Ekiti

State, Nigeria revealed that there was a significant difference in the students' achievement in basic science before and after the treatment.

Studies conducted across Africa countries including Nigeria have reported disparity in the education of girls and women in science and technology (Ogunleye & Babajide, 2019). Also, Ogunleye & Babajide (2019) reported that more girls are found in Biology and Chemistry than in Physics departments of higher learning. This accounted for females' low contribution in the areas of Engineering, Medicine, and Technology and by extension the development of nations. To this end, he proposed same institutional strategies to promote gender equity. Adelodun & Asiru (2015) reported on the relationship between self-efficacy and students' achievement in schools, finding out that there is no significant relationship between self-efficacy and academic performance however, there is a gender significant difference between boys and girls-self-efficacy is documented to be higher in boys than girls.

Okwo & Otubor as quoted by Ogunleye & Babajide (2019) observed that gender has significant influence on science achievement while Babajide (2010) found that gender has no significant influence on achievement in science. Raimi, quoted by Ogunleye & Babajide (2019), that the effect of gender on students' performance in chemistry practical skills acquisition was not significant. He also found out that there was no significant interaction effect of treatment and gender on students' acquisition of practical skills in chemistry. Female students were also reported to have performed better than their male counterparts in computational skills. Also in the work of Ogunleye & Babajide (2019), it was revealed that there was gender difference in favour of boys in relation to practical skills in science. Girls in single sex schools performed better than their male counterparts in mixed schools. The findings of the study of Taylor & Francis (2019) showed that Advance Organizer Model was also effective to teach male and female students.

However, Aguele & Agwugah, Billings Hyde and McKinley, Kolawole, etc as quoted by Oludipe (2012), in their studies found that male students performed better than female students in the cognitive, affective and psychomotor skill achievements. There is a strong association between gender and response to science education.

Samuel and John as quoted by Elvis (2013) examined how the Cooperative Class Experiment (CCE) teaching methods affect students' achievement in Chemistry. They found that there was no significant difference in gender achievement between the experimental and control groups, but girls had a slightly higher mean score than boys did. More so, the girls taught through CCE method perform better than girls taught through the conventional teaching method in the post-test scores. Similarly, boys who were taught using CCE method performed significantly better than the boys in the control groups in the post-test scores. The researcher also pointed out that there was no significant difference in achievement between boys and girls exposed to CCE method, both performed significantly better than those taught through conventional lecture method.

Ajai & Imoko (2015) found that boys performed better than girls in both cooperative and competitive learning strategies when he conducted a research on the effects of competitive and cooperative learning strategies on Nigerian students' academic performance in mathematics. Asante (2010) and Ekweme (2013) etc found in their studies at various times, that male students achieved significantly better than female students in Science Education. Dania (2014) and Atovigba, et al (2012) pointed out that there is no significant gender difference in students' academic achievement and retention in various subjects while others found significant difference with either the boys or the girls performing better.

According to Wijesundera & Ramakrishna as quoted by Oluwatelure (2015), the issue of gender differences in achievement in school science is far from being resolved, and the inconclusiveness of studies conducted to date provides no solid basis on which changes can be made in teaching and learning. In many science, technology, engineering, and mathematics disciplines, women are outperformed by men in test scores, jeopardizing their success in science-oriented courses and careers. In studies held in advanced countries, New Zealand women were frustrated in trying to get promoted even with very good Curriculum vitae Brooks (Oluwatelure, 2015).

Studies conducted in countries of the North have shown that boys performed better than girls in Mathematics; (Fennema, Kaiser-Messmer) as quoted by (Ajai & Imoko, 2015). Asante (2010) quoted studies showing that boys generally achieved higher than girls on standardized math tests.

However, an interesting body of international literature suggests that female students perform better than male students (Arnot, David & Weiner) was quoted by (Ajai & Imoko, 2015). A large scale study in the U.S.A. revealed that girls have reached parity with boys in mathematics performance, including at high school where a gap existed in earlier decades. They affirmed that girls are doing better than boys even for tasks that require complex problem solving.

In Nigeria, in spite of the enormous role that Basic Science plays in providing a solid foundation for the mastering of basic concepts in science and technology for national development, and the efforts of government and other stakeholders in improving science education, results in Basic Science in most certified examination bodies like the results of examination conducted by National Examinations Council (NECO) and Ekiti State Ministry of Education, Science and Technology have not been satisfactory. The broad aim and expectations of any teaching and learning programme is productivity and positive-evaluated end-product (achievement).

Hence, the need for Simulation and Animation teaching strategy as it will enhance their performances because it encourage interaction among them, allows students to observe, think, reason, investigate and make conclusion on their own about what they see themselves.

Research hypotheses

The following null hypotheses were formulated to guide the study:

1. There is no significant difference in the achievement mean scores of students in experimental and control groups after treatment.
2. There is no significant difference in the achievement mean scores of male and female students in each of the experimental and control groups.

Methodology

The design for this study was Pretest-Posttest Quasi-Experimental. The design afforded the researcher the opportunity to collect relevant data which helped to facilitate better understanding and evaluation of the problem under study. The pre-test was used to establish the knowledge baseline of the students as well as the academic homogeneity of the two groups before the commencement of the experiment. The post-test was used to determine the levels of academic performance of students within the two groups after the application of treatment.

The population of the study was made up of all junior secondary student class Two (JSS II) in Ado Local Government Area of Ekiti State. Purposive and stratified random sampling techniques was used to select a total sample of 100 public junior secondary class Two (JSS II) basic technology students (this sample was divided into the experimental and control groups in ratio 1:1 meaning that, 50 students from each group) from four junior secondary schools in Ado Local Government Area, Ekiti State. The instrument used for the study was thirty (30) standardized objective questions tagged: 'Basic Science Achievement Test (BSAT)' drawn from the topics (Cells, Electricity, and Friction) with four options (A-D) considered for the study.

The teaching covered three weeks with the control group taught using conventional method while the experimental group was taught using Simulation and Animation teaching strategy. The tests (Pretest and Posttest) questions were administered to students; each of the tests was marked and scored accordingly.

The two formulated null hypotheses were tested at 0.05 level of significance. The data collected were analysed using inferential statistics of t-test analysis.

Results and Discussion

Hypothesis 1

There is no significant difference in the achievement mean scores of students in experimental and control groups after treatment.

Table 1 : t-test analysis of achievement mean scores of students in experimental and control groups after treatment

GROUP	N	$\underline{X}$	SD	df	t_{cal}	t_{tab}	Result
Experimental	50	38.89	10.76	98	7.96	1.65	*
Control	50	23.45	8.53				

P < 0.05 (Result Significant at 0.05 level). * = Significant.

As shown in table 1, when the mean score of students in the control and experimental groups after the treatments (posttest) were statistically compared, a
t-value (t_{cal} = 7.96) with P < 0.05 alpha level was obtained, which was significant at 0.05 level. This implies that there exists significant difference between the control and experimental groups achievement mean scores after the treatment in favour of experimental group. Consequently, the null hypothesis which states that there is no significant difference in the achievement mean scores of students in experimental and control groups after treatment was rejected. As such, the conventional method of instruction (control group) can be said to be less effective compared with simulation and animation teaching strategy (experimental group).

Hypothesis 2

There is no significant difference in the achievement mean scores of male and female students in each of the experimental and control groups.

Table 2: Summary of ANCOVA analysis on the achievement mean scores of male and female students in each of the experimental and control groups

Source of variation	SS	Df	Ms	F_{cal}	F_{tab}	P	Result
Corrected model	1743.162[a]	4	532.261	52.33	2.42	0.000	
Covariate (pretest)	31.157	1	31.157	3.76	3.89	0.211	
Gender	.759	1	.759	0 .43	3.89	0.654	NS
Group	1776.214	1	1776.214	178.66	3.89	0.000	*
Gender *Group	14.712	1	14.712	1.65	3.75	0.198	NS
Error	1443.223	95	8.466				
Corrected Total	3124.218	99					
Total	73156.000	100					

P > 0.05 (Result Not significant at 0.05 level), NS = Not Significant, and * = Significant

Table 2 showed that the computed *F-value* ($\mathbf{F_{cal}}$ = 0.43 < $\mathbf{F_{tab}}$ =3.89) with a *P-value* (P > 0.05 alpha level) obtained from the analysis of the students' gender was not significant. Hence, the mean achievement scores of male and female students were not significantly different. The table also revealed that the compared *F-value* ($\mathbf{F_{cal}}$ = 1.65 < $\mathbf{F_{tab}}$ =3.75) with a *P-value* (P > 0.05 alpha level) obtained for the interaction of gender and group was not significant as well. The null hypothesis was thus not rejected. It, therefore, implies that there is no significant interaction between gender of students and simulation and animation teaching strategy applied. In other words, gender of students has no significant influence on either the effectiveness (or otherwise) of the approach of instruction applied.

Discussion

The result of the study revealed a relative increase in the post-test mean score of the students in the simulation and animation teaching strategy group over those taught with the conventional method. Thus confirmed that simulation and animation teaching strategies are learner-centered and capable of making remarkable impart on instructional practices. This result agrees with the findings of Bello, Ibi & Buka (2016) that students exposed to Simulation and Animation method of teaching performs better than their counterparts who were exposed to conventional teaching method. The result also agrees with the findings of Widiyatmoko (2018) that affirmed that computer simulation has an overwhelming potential for the enhancement of the teaching and learning of science concept. Similarly, the result also agrees with the findings of Awodun & Oyeniyi (2018) on the effects of Instructional Simulation on Students' academic performance in Basic Science in Junior Secondary Schools in Ekiti State, Nigeria revealed that there was a significant difference in the students' achievement in basic science before and after the treatment. This result also agree with the findings of Alenzi (2019) on the impact of simulation on teaching effectiveness and student learning performance

that confirmed that the use of social process simulation has positive and significant impact on student learning performance.

Furthermore, the findings of this study also revealed that there was no significant differences in the achievement mean scores of male and female students in each of the experimental and control groups before and after the treatment. In other words, the achievement of male and female students exposed to Simulation and Animation teaching strategy did not differ significantly as female students were found to have similar achievement in Basic Science as their male counterparts in the two groups involved in the study. The implication of this result is that gender was not a significant predictor of students' achievement in Basic Science. The finding agrees with the findings of Robinson & Daniel (2017) that there is no significant difference between the mean academic performance of male and female students exposed to Simulation and Animation method of teaching.

Conclusion

Based on the findings of this study, it can be concluded that Simulation and Animation teaching strategy is more potent in improving students' academic performance in Basic Science in secondary schools than conventional method in vogue in the nation in term of performance and retention.

The study however found no significant difference between academic performance of male and female students in basic technology when Simulation and Animation teaching was used as strategy of instruction. This simply implies that performance of students taught using different teaching strategies is not in any manner affected by either their gender.

Recommendations

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

1. Simulation and Animation teaching strategy assessment should be practically applied to classroom situations. Teachers should use Simulation and Animation strategy to arouse the interest of their students in basic technology teaching. They should be trained and encourage to use Simulation and Animation teaching strategy.
2. Principals of secondary schools should encourage their basic science and technology teachers through sponsorship to attend refresher courses and other forms of in-service training to enable them acquire the needed skill that can help them use or apply different strategies in the classroom teaching and learning. Thus help eradicate mediocrity among Basic Science teachers and expose them to a wide range of methods which can enhance their teaching in classroom situation.
3. Authors of basic technology textbooks should present the content and concepts alongside the worked examples using Simulation and Animation strategy.

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