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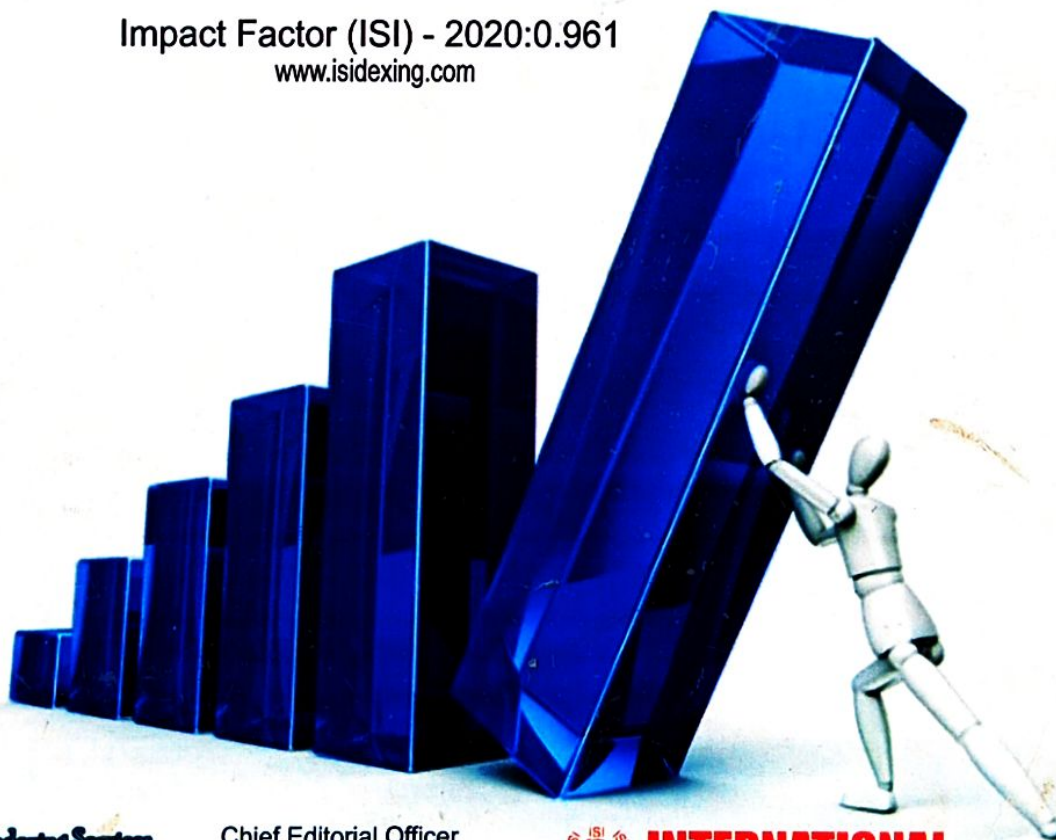
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Effects of Computer Animation Instructional Package on Senior School Biology Students' Academic Performance and Retention in Ogbomoso, Nigeria

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Abstract

This study examined the effects of Computer Animation Instructional Package (CAIP) on senior school biology students' academic performance and retention in Ogbomoso, Nigeria. The study was a Quasi-experimental research design of the posttest control group design. The population consisted of all SS2 biology students in Ogbomoso South Local Government Area of Oyo State, Nigeria. Purposive sampling technique was used in selecting two co-educational secondary schools that were assigned into one experimental and one control groups. The two schools were purposively selected based on equivalence of year of establishment, co-educational and number of arms of classes. An intact class was selected from each of the schools. Two research questions that translated to two corresponding research hypotheses were formulated and tested. The instrument known as Reproductive System in Mammal Achievement Test (RSMAT), validated by three experts with a reliability coefficient of 0.82 was used for data collection. The RSMAT was used as pretest, posttest and retention test for both experimental and control groups. The data collected were analyzed using t-test to test the hypotheses at 0.05 levels of significance. The findings of the study showed that CAIP had significant effect on biology students' academic performance. The calculated t-value was significant at 0.05 alpha level. The study also revealed that, CAIP had significant effects on the retention of the student; the calculated t-value was significant at 0.05 alpha level. It was concluded based on the findings of this study that CAIP has effects on the students' academic performance and retention. It is therefore recommended that, computer animation instructional package should be adopted by biology teachers in teaching biology as this will enhance the efficiency of teaching and learning of biology.

Key words: Effects; Computer animation; Instructional Package; Biology Students 'academic Performance; Retention.

Introduction:

Biology is derived from two Greek words: "Bio" meaning life and "logos" meaning course or study. Thus, biology is defined as the study of life and living organisms. It is a branch of natural science and it is an enormous subject, involving many other disciplines such as chemistry, physics, geology and psychology. Medicine and agriculture are really applied biology (Robert, 2005). According to Mader (2011) biology tells about human, plants, animals and the entire world around us. Biology as a subject prepares senior secondary school students that are interested in the study of medicine. Without the knowledge of biology, there won't be treatments, cures and vaccines for many diseases. Therefore, due to the advancement in the field of biology, people are presently living much more comfortably than people hundreds of years ago (Melanie, 2015).

Melanie (2015) stressed further that biology is an enormous branch of science of which it's broad filed include zoology (study of animals) and botany (study of plants). Biology also involves various disciplines through which people obtain knowledge about life and living organisms, including the origin, growth, evolution, structure, distribution and function of these organism. Biology is more than looking at a specimen under a microscope, biologists in various fields have sharpened the world with their discoveries. Therefore, biology is relevant in every facet of life and its benefits to individual as well as to the society cannot be overemphasized. Considering the relevance of biology to various fields there is need to enhance teaching and learning of the subject.

In spite of the importance and yearly increase in total enrolment in senior secondary school examinations; (WAEC and NECO), performance of students is not satisfactory in Biology compared with Physics and Chemistry. These are shown in Table 1. The percentages of students that offered Biology is greater than those of students that offered physics or chemistry in the senior school certificate examination. Percentages of Biology enrolment which was between 1,238,163 - 1,200,367 while Chemistry enrolment was between 424, 747 - 706,873 and physics enrolment is between 409,449 -705,125 for the year sampled. These indicated it is popularity among other school science subjects in most secondary schools as shown in table 1. In spite of greater interest of students in Biology many still perform poorly in external examinations as depicted also in table one below.

Table 1: Trends of Students Enrolment and Performance in Biology, Chemistry and Physics in May/June Senior School Certificate Examinations, 2007-2016

Year	Biology			Chemistry			Physics		
	Total Entry	Credit Pass(A1-C6)	% Pass	Total Entry	Credit Pass(A1-C6)	% Pass	Total Entry	Credit Pass (A1-C6)	% Pass
2007	1,238,163	413,211	33.37	424,747	196,063	46.16	409,449	180,797	44.16
2008	1,259,964	427,644	33.94	456,980	202,762	44.37	408,237	200,345	49.08
2009	1,259,964	453,928	33.87	456,980	203,365	43.49	444,236	222,722	50.14
2010	1,300,418	427,644	32.88	465,643	263,059	50.70	463,755	237,756	51.27
2011	1,505,199	479,432	38.50	565,692	280,280	49.54	563,161	360,096	63.94
2012	1,646,150	587,044	35.66	627,302	270,570	43.13	624,658	429,415	68.74
2013	1,648,363	852,717	51.73	639,296	462,517	72.34	637,023	297,988	46.77
2014	1,365,384	766,971	56.17	636,268	397,649	62.49	635,729	386,270	60.76
2015	1,390,234	798,246	57.42	680,357	412,323	60.60	684,124	410,543	60.01
2016	1,200,367	740,345	61.68	706,873	408,122	57.74	705,125	415,655	58.95

Source: The West African Examinations Council Statistics Unit, 2017

The poor performance has been blamed on teachers and government inability to effectively sponsor education of students and motivate teachers to enhance their productivity. Owolabi and Oginni (2012) posited that despite the relevance of biology and its popularity, many students still see the subject as abstract in nature and not too easy to understand, hence do not have interest in it. Other factors responsible for students' failure in biology are inadequacy of science equipment (including biology), in educational institutions and non-use of available science equipment (Ogunmade, Okediji & Bajulaye 2006). Ofoegbu (2004) revealed that poor academic performance in science generally, and in biology in particular, are caused by: poor reading habits, negative students' attitude/interest towards biology, gender inequalities, inadequate laboratory facilities, inadequate staff motivation, inadequate instructional materials and others. These therefore, called for urgent need to examine the effect of Information and Communication Technologies (ICTs) on the biology students' academic performance in Ogbomoso south Local Government, Oyo state, Nigeria.

Information technology communication technologies (ICTs) have become common place entities in all aspects of life. ICT has fundamentally changed the practices and procedures of nearly all forms of endeavor within business and governance. Education systems around the world are under increasing pressure to use new information and technologies strategy to teach students the knowledge and the skills they need in the 21st century. It is obvious therefore, that to move further into the new millennium, it becomes clear that the 21st classroom needs are different from 20th century classroom needs (Prabhakar 2014). Nigeria vision 2020 is to promote the development of local capacity to meet the needs of the electronic application on information and communication technology sector (Ogunlade, 2015). These is to develop the industrial based economy and ensure the continued development of the country. ICT application and use will prove beneficial in improving Nigeria's educational systems and giving students better education. A technologically workforce will lead to ICT growth in Nigeria, with the potential to improve the military technology and telecommunications, media communications and skilled ICT professionals that will be well equipped to solve Information Technology (IT) problems in Nigeria and other parts of the world (Garima, 2014).

Effective teaching of biology and students' academic performance have been of major concern for the teachers. Ifeakor, Njelita and Udogu, (2008) were of the opinion that the traditional methods of teaching which includes the use of lecture method, do not foster critical and creative thinking among students, neither does it encourage creative thinking and collaborative problem solving skills. Thus, the shift in teaching methodology that would make learning more meaningful. Ul-Amin (2013) stated that ICT is a potentially powerful tool for offering educational opportunities and it provides motivation to learning. Computer animation is one of the ICT tools which have been found to make teaching and learning effective. It helps visualize things that cannot be seen easily in the real world; it helps to clarify relationships through visual means and it helps student to understand the inner life and movement of an object Bamidele and Yoade (2017). Yisa (2014) submitted that computer animation instructional package enables both the cognitive and abstract information to become clearer.

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Studies have revealed that computer animation has significant effect on teaching and learning of biology among such researchers, Bamidele and Yoade (2017). Their findings on the relative effectiveness of animation combined with narration, and on-screen text instructional packages and the conventional method in improving students' achievement in biology in secondary schools in Osun State have revealed that animation has effect on the achievement of biology students. Also, Okwodu (2016) from the research conducted revealed that students taught with computer performed better than those taught using conventional method.

Bulic and Novoselic (2014) asserted that utilizing e-learning in teaching biology makes students to be more engaged in the learning process. Therefore, the use of computer animation instructional package in teaching biology will go a long way in making the teaching of biology real, clear and interesting. The theoretical basis of computer animation instructional packages is constructivism theory. Constructivism theory involves child centered system of education. Computer animation is learner-centered and it renews the learner's interest (Abdullahi, 2003). It also allows learners to learn at their own pace. Learning becomes effective if students are able to retain what they have been taught over a period of time.

Retention is the ability to preserve and later remember information or knowledge gained after learning (Barbor, 2013). It takes place when learning is coiled into memory. Thus, appropriate coding of incoming information provides the index that may be consulted so that retention takes place without an elaborate search in the memory lane (Olumorin, 2015). Nuru, Bichi, Olorukooba, & Olajide (2017) reported that for knowledge to be retained for a long time by the learner, the teacher must use effective instructional strategy in the classroom. The researcher further mentioned that students who were using activity-based method have a higher retention over time than those who receive the lecture method. The authors concluded that retention of knowledge in science depends so much on the instructional strategy employed by the teachers in the classroom.

Therefore, these researchers in this study, examined the effects of computer animation instructional package on students' academic performance and retention in other parts of Nigeria but not in Ogbomoso. Hence, this study is unique in that it was carried out to investigate the effects of computer animation instructional package on the academic performance and retention of senior school biology students in Ogbomoso Local Government, Oyo state, Nigeria.

Purpose of the Study

The main purpose of this study was to find out the effects of computer animation instructional package on senior school biology students' academic performance and retention in Ogbomosho, Oyo State, Nigeria. Specifically, the study determined the effect on CAIP on:

1. biology students' academic performance.
2. the retention of senior school biology students

Research Questions

In this study, answers were provided to the following research questions:

1. What effects does CAIP has on academic performance of senior school biology students?
2. How does CAIP affect the retention ability of senior school biology students?

Null Hypotheses

The following hypotheses were formulated and tested in this study:

- Ho₁: There is no significant difference in the academic performance of biology students taught with CAIP and those taught with traditional lecture method,
- Ho₂: There is no significant difference in the retention ability of students taught using CAIP and those taught with traditional lecture method.

Methodology

This research is a quasi-experimental research that adopts the posttest control group design. The target population consisted of all senior secondary school biology students in Ogbomosho South Local Government Area of Oyo State, Nigeria. The researchers employed purposive sampling technique to select two co-educational secondary schools within the geographical location. The school selected for the experimental group had a functional computer laboratory and all accessories like projector readily available. Hence, the students have been exposed to receiving instruction via Information and Communication Technologies. Research instruments used in this study were: lesson notes on reproductive system in mammals, Computer Animation Instructional Package on Reproductive System in mammal, Reproductive System in Mammal Achievement Test (RSMAT). The Computer Animation Instructional Package on reproductive system in mammal was downloaded online and was used by the trained regular subject teachers in the school to teach the students. The package consists of the male and female reproductive systems made easy. Also, the Reproductive System in Mammal Achievement Test (RSMAT) was constructed by the researchers. The RSMAT contained fifty items multiple choice questions. The research instrument was given to experts for validation. Thereafter, the reliability of the test instrument was obtained using Pearson's Product Moment Correlation (PPMC) with reliability coefficient value of 0.82. which was considered to be reliable and then used for the research. The experiment lasted for two weeks, the first week was used for administering the pretest so as to determine the equivalence of the two groups. Thereafter, the teaching exercise which lasted for three lessons was carried out simultaneously within both groups and at the end of the lessons, the posttest was administered on the respondents. A period of two weeks interval was then given before the retention test was administered on the respondents

Data Analysis and Results

In this study, there were two research questions with corresponding hypotheses. The hypotheses were tested with t-test at 0.05 level of significance. This analysis was done using Statistical Package for Social Sciences (SPSS) software version 21.

Table 2: The t-test comparison of pre-test mean performance scores of students in experimental and control groups

Variable	N	Mean	SD	df	t	Sig. (2-tailed)
Experimental	44	42.66	10.21	86	0.760	0.452
Control	44	40.68	11.65			

Table 2 shows the t-test comparison of pretest mean performance scores of students in both the experimental and control groups at the commencement of the study. The table reveals that the calculated t-value ($\mu = 1.977$, $t = 0.760$, $df = 86$, $p > 0.05$) was not significant at 0.05 alpha level. This indicates that there was no significant difference in the performance of the two groups at pretest. Hence, the two groups were equivalent at the commencement of the study.

Testing of the Null Hypotheses

H₀₁: There is no significant difference in the academic performance of biology students taught with CAIP and those taught with traditional lecture method.

Table 3: The t-test analysis of the Post-test Mean Scores of the experimental and control groups

Variable	N	Mean	SD	Df	t	Sig. (2-tailed)
Experimental	44	63.32	10.49	86	3.480	0.001
Control	44	54.55	13.59			

Table 3 shows the *t-test* analysis of the posttest mean scores of biology students in the experimental and control groups. The table reveals that the calculated t-value was significant at 0.05 alpha level. This indicates that students taught biology using CAIP performed significantly better than those taught using the traditional lecture method. Hence, the hypothesis was rejected

H₀₂: There is no significant difference in the retention level of the students taught using CAIP and those taught with traditional lecture method.

Table 4: The t-test comparison of retention of the academic performance of biology students in experimental and control groups

Variable	N	Mean	SD	Df	T	Sig. (2-tailed)
Experimental	44	56.77	10.07	86	2.987	0.005
Control	44	49.75	11.64			

Table 4 shows the t-test comparison of the retention of biology students in the experimental and control groups. The table reveals that the calculated t-value was significant at 0.05 alpha level. This indicates that the retention of students taught biology using CAIP performed significantly better than the retention of those taught using the traditional lecture method. Hence, the hypothesis was also rejected.

Discussion of Findings:

The findings from the study on the effects of computer animation instructional package on senior school biology students' academic performance and retention in Ogbomoso, Nigeria revealed that there was a significant difference in the academic performance of biology students taught with CAIP and those taught with conventional method. That is those taught using CAIP performed significantly better than those taught without CAIP. The implication of this is that, CAIP can be used by teachers to improve the performance of students in reproductive systems in animals and other identified hard-to-teach or hard-to-learn biology concepts. The finding of this study agrees with those of Onasanya, Daramola and Asuquo (2006); Adegbiya and Falade (2014) & Yisa and Ojiaku (2016) whose results revealed significant effect of students taught using computer instructional package and those taught without computer instructional package. The study also revealed that there was a significant difference in the retention level of the students taught using CAIP and those taught with traditional lecture method in favour of those taught using CAIP. This finding is in line with those of Sani (2017) who observed that there was a significant difference between the mean retention scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using traditional lecture method.

Conclusion

The study examined the effects of CAIP on senior school biology students' academic performance and retention in reproductive system. Based on the findings from the study, it was concluded that the use of CAIP enhanced students' academic performance and retention better than the use of the conventional lecture method

Recommendations

The following recommendations were made by the researchers for the study:

1. The use of CAIP has significant effect on the biology students' academic performance, therefore, CAIP should be used in the teaching biology.
2. CAIP has effect on the retention level of biology students. Therefore, CAIP should be used to improve the retention of the students.
3. Seminars should also be organized for teachers on the use of computer animation instructional package and its effect on teaching and learning process.

References

- Abdullahi, M. H. (2003). *Factors affecting the use of instructional material in technical schools in Niger State*. (Unpublished M. Tech Education Thesis). Federal University of Technology, Minna.
- Ahmed, M.A. (2009). Lecturers' assessment of difficulty levels of genetics concepts in Nigeria colleges of education. *Journal of Curriculum and Instruction* 7 (1&2) 132-140.

- Ahmed, M. A., & Abimbola, I.O (2011). Influence of teaching experienced and school location on Biology teachers rating of the difficult levels of nutrition concepts in Ilorin, Nigeria *Journal of Science, Technology, Mathematics and Education* 7(2), 52-61.
- Bamidele, E. F., & Yoade, F. C. (2017). Effects of modes of computer animation instructional packages on students' achievement in Osun States secondary schools' biology. *International Journal of Innovation and Research in Educational Sciences*, 4 (4), 496-501.
- Barbor, V. (2013). *Computers in educational research and development*. Springfield publishers limited.
- Bulic, M., & D. Novoselic (2014). *E-Learning in a Biology classroom*. Retrieved on September 12th, 2017
- Garima, S. (2014). 21st century classroom: responding to the needs of students of English language. In Panneerselvam S. K. (Ed.). *Virtual classroom*. New Delhi: Random publications, Pg 8. from <http://www.ictinpractice.com/e-learning-in-a-biology-classroom>.
- Ifeakor, A. C., Njelita, C. B., & Udogu, M. E. (2008). An appraisal of senior secondary school teachers' awareness and usage of innovative instructional strategies and evaluation techniques in teaching chemistry. Proceedings of the 49th Annual Conference of STAN, 116-121.
- Jegede, S. A. (2003). *The effect of the component of task analysis model of instruction on students' performance in chemistry* (Unpublished Ph. D thesis). University of Ado-Ekiti, Ekiti, Nigeria.
- Mader, S. S. (2011). *Concept of Biology*. (second edition). McGraw-Hill companies, Inc.
- Melanie, S. (2015). *The importance of biology*. Retrieved from Melbel.hub.pages.com
- Nuru, A. R., Bichi, S. S., Olorukooba, S. B. & Olajide, J. O. (2017). Impact of Concept-Mapping Strategies on Retention and Performance in Biology among Concrete and Formal Operational Secondary School Students in Zaria, Nigeria. *International Journal of Educational Benchmark*. 8(3), 24-33
- Ogunmade, T. O., Okediji, S. A. & Bajulaye, A. A. (2006). *The status of resources in secondary science teaching and learning in Lagos state, Nigeria*. Proceedings of the 47th Science Teachers Association of Nigeria annual conference. Pp. 13-15.
- Ofoegbu, G. O. (2004). Teachers' influence in motivating students to read and appreciate literature. *Nigerian Journal of Counselling and Applied Psychology*, 2(1), 202-210.
- Ogunlade, O. O. (2015). Information and Communication Technology in education. In Yusuf, M.O. & Onasanya, S. A. (Eds). *Critical issues in educational technology*. Nigeria: Department of Educational Technology, University of Ilorin.

- Olumorsin, C.O. (2015). Instructional equipment operations. In Yusuf, M.O. & Onasanya, S. A. (Eds). *Critical issues in educational technology*. Nigeria: Department of Educational Technology, University of Ilorin.
- Okwodu, N. E. (2016). *Information and Communication Technology (ICT) and Students Academic Performance in Biology in Senior Secondary Schools in Rivers State*. Scholars' world international refereed multidisciplinary journal of contemporary research. Online ISSN: 2320-3145. Retrieved online on February 28th, 2018 from www.irmjcr.scholarsworld.net.
- Owolabi, O. T., & Oginni, O. I. (2012). Improvisation of science equipment in Nigerian school. *A research paper presented at institute of science education, University of Science and Technology, Ifaki-Ekiti, Nigeria*.
- Prabhakar, C. (2014). 21st century classroom- Goals and Characteristics). In Panneerselvam S. K. (Ed.). *Virtual classroom*. New Delhi: Random publications.
- Roberts, M. B. V. (2005). *Biology, a functional approach*. (4th edition). U.K: Thomas Nelson & Sons Ltd.
- Sani, M. Y. (2017). Impact of cooperative learning enriched with analogy on retention and performance in ecology among secondary school slow learners, Kano State, Nigeria. (A published Master Thesis) Ahmadu Bello University, Zaria. Available online at <http://kubanni.abu.edu.ng/jspui/bitstream/123456789/10060/1/IMPACT%20OF%20COOPERATIVE%20LEARNING%20ENRICHED%20WITH%20ANALOGY%20ON%20RETENTION%20AND%20PERFORMANCE%20IN%20ECOLOGY%20AMONG%20SECONDARY%20SCHOOL%20SLOW%20LEARNERS%2C%20KANO%20STATE%2C%20NIGERIA.pdf>
- Ul-Amin, S. N. (2013). An Effective use of ICT for Education and Learning by Drawing on Worldwide Knowledge, Research, and Experience: ICT as a Change Agent for Education. Retrieved on September 10th, 2017 from www.nyu.edu/..amins.pdf
- West Africa examination council (2017). *Chief Examiner Report in science subjects*. WAEC, Lagos
- Yisa, N. C. (2014). *Effectiveness of computer animation on a progressive learning achievement of secondary school biology students at Niger State, Nigeria*. (Unpublished Ph.D thesis). FUT Minna, Minna, Nigeria.