

Computer Animation Learning Approach and its Effects on Retention and Interest of Pre-service Biology Teachers in Cell Division among Kwara State Colleges of Education, Nigeria

ABDULRAHMAN, Abdulgafar Opeyemi¹, YUSUF Nusirat Bolanle Ph.D², ARINDE, Odunayo Omowumi³ & MUHAMMAD-THANI, Sefinat⁴

¹Department of Integrated Science/Kwara State College of Education (Technical), P.M.B. 01 Lafiagi, Nigeria.

Email: opeyemiayinla2@gmail.com Orcid ID: 0000-0001-7447-9876

²Department of Chemistry Education, School of Science/Kwara State College of Education (Technical), P.M.B. 01, Lafiagi, Nigeria. Email: nusiratyusuf@gmail.com Orcid ID: 0000-0001-5368-5785

³Department of Biology Education/Kwara State College of Education (Technical), P.M.B. 01 Lafiagi, Nigeria.

Email: arindeodunayo99@gmail.com Orcid ID: 0000-0003-4927-1429

⁴Department of Computer Science Education/Kwara State College of Education, Ilorin, Nigeria. Email:

safinah2012@gmail.com Orcid ID: 0000-0002-1220-3951

DOI: 10.5281/zenodo.6845503

ABSTRACT

This study investigated the Effects of Computer Animation Learning Approach (CALA) on Retention and Interest of pre-service Biology teachers in Cell Division among Kwara State Colleges of Education, Nigeria. Quasi-experimental design involving pretest, posttest experimental and control group design was adopted. A total of 368 pre-service Biology teachers formed the population of this study. The sample of the study 120 pre-service Biology teachers selected from intact classes of two co-educational Colleges of Education using multi-stage sampling technique.

The experimental group of the study was selected purposively and this comprises 60 pre-service Biology teachers (32 male and 28 female) was taught through CALA while their counterparts in the control group which comprises 60 pre-service Biology teachers (29 male and 31 female) was taught using conventional lecture method.

The study answered two research questions and tested two null hypotheses. The instruments Cell Division Retention Test (CDRT) and Cell Division Interest Inventory Scale used were developed, validated and administered to the students, the reliability coefficients of CDRT and CDIIS were established at $r = 0.95$ and $r = 0.82$ respectively. Research questions were analyzed descriptively using means and standard deviations. Null hypotheses were verified at $P \leq 0.05$ levels using t-test. Results revealed significant differences in the retention of pre-service Biology teachers exposed to CALA and those taught using CLM.

The result also revealed no significant difference in the retention of males and females pre-service Biology teachers exposed to CALA. Pre-service Biology teachers in the experimental group developed high positive interest in the instructional package. From the findings of the study, it was concluded that using computer animation in cell division concepts has the potentials of enhancing pre-service Biology teachers' retention and arousing their interest.

It was recommended, that the Federal and State Ministries for Tertiary Education to provide computers and projectors for teachers to facilitate teaching with animations. The training and re-training of teachers in ICT were also recommended.

Keywords: Computer Animation, Biology, Mitosis and Meiosis, Conventional Lecture Method, Retention and Interest.

Cite as: ABDULRAHMAN Abdulgafar Opeyemi, YUSUF Nusirat Bolanle, ARINDE, Odunayo Omowumi, MUHAMMAD-THANI Sefinat. (2022). Computer Animation Learning Approach and its Effects on Retention and Interest of Pre-service Biology Teachers in Cell Division among Kwara State Colleges of Education, Nigeria. *LC International Journal of STEM (ISSN: 2708-7123)*, 3(2), 166–178. <https://doi.org/10.5281/zenodo.6845503>

INTRODUCTION

Cell division is one of the important topics in Biology. Cell division as a concept in biology is considered abstract and difficult topic to learn (NCE Minimum Standard, 2016). Cell division is also a course in biology in which theories are the main products of scientific studies. According to Lisa, Michael, Steven, Peter and Jane (2016), cell division process is a part of the cell cycle. Cell division process includes two important processes such as mitosis and meiosis. Mitosis and meiosis is a continuous process and its complex concept most difficult to understand (Murniza, Halimal & Azlina, 2010). Students find it difficult to comprehend the chromosomal movement during cell division process because the events of cell division are not conspicuous. Wekesa, Wekesa and Amadalo (2013) submitted that mitosis and meiosis serve as the basis for understanding about the molecular events of cell division and are difficult to observe through the naked eyes. However, understanding and construction of the knowledge about mitosis and meiosis concepts at molecular level depends on the ability of the students' visualization of the chromosomes movement during mitosis and meiosis. From an educational perspective, visualization helps students' understanding of complex processes because it helps in the conversion of an abstract concept into a specific visual object that can be mentally manipulated. Study of Ozcan, Yildirim and Ozgur (2012), Aziz and Ami Norliyana (2011) shows that students' poor understandings and poor mastery level for both mitosis and meiosis concepts cause difficulty in understanding of cell division concepts and make the students to have misconceptions about two important concepts of cell division. Misconceptions about Biology abstract concepts affect students' achievement. Thus, the problem of misconception should be considered in the learning process of an individual (Ozcan, *et al.*, 2012). Students have misconceptions and lack of understanding about Cell Division topic due to the use of many instructional methods that require memorization of the concepts (She & Chen, 2009). Students' misconception is difficult to replace if teachers use conventional teaching methods alone (Aziz & Ami Norliyana 2011). The teacher-centred method emphasizes learning through the teachers' guide at all times which favours passive reception of knowledge by the students hence limiting students from learning from variety of sources.

The performance of pre-service Biology teachers in (cell division) 2013-2018 is shown in Table 1

Table 1: Results of pre-service Biology teachers in (Cell-Biology) 2013 – 2018 session

Year	No. of candidate that sat for the exam	Passed at credit level (A–C) %	Passed (D–E) %	Failed (F) %
2013	850	201(23.65)	184(21.65)	465(54.47)
2014	544	111(20.40)	104(19.12)	329(60.48)
2015	343	98(28.57)	96(27.99)	149(43.44)
2016	322	75(23.29)	134(41.61)	113(35.09)
2017	216	32(14.81)	63(29.17)	121(56.02)
2018	168	21(12.5)	24(14.29)	123(73.21)

Source: Exam and Records, Kwara State College of Education (Technical), Lafiagi

The use of Information and Communication Technology (ICT) tools such as computer has made the process of teaching and learning more enjoyable and interesting. Today, such tools provide both students and teachers with more opportunities in adapting learning and teaching to individual needs and the society at large (Mikre, 2011). To make Biology more relevant, enjoyable, easy and meaningful to learners, adequate instructional materials need to be provided and properly utilized as the teaching and learning situation may demand. This is where Information and Communication Technology (ICT) comes in. Interestingly, the use of ICT in the classroom has proven to be effective in the teaching and learning of sciences (Owolabi, Babatunde & Gambari, 2019; Bamidele & Yoade, 2017). Integrating computers into the classroom will help to broaden and deepen the students' knowledge as well as to expose students' difficulties in conceptualization, and engage students actively in the learning process (Falode, Sobowale, Saliu, Usman & Falode, 2016). This is because it offers new, creative and the most engaging ways of teaching. Falode, *et al.*,(2016); Bello, (2014); Duyilemi, *et al.* (2014)and Olodu,*et al.*,(2014) in separate studies submitted that the use of computer as instructional tool in science lesson has made the process of teaching and learning not only enjoyable, interesting and more meaningful to the learner but also enables the learner acquire a wide range of skills in Information and Communication Technology.

Computer Animation is ICT based teaching and learning methods that has proven to aids students understanding of difficult concepts (Yisa & Ojiaku, 2016). Computer Animation Instruction is more effective way of teaching and learning. Computer Animation is an electronic device or object of instruction in a physical world of matter through a machine with moving objects of many characteristics (graphic, pictures,shape etc.) indicating action, reactions, skills results, product in learning process (Yisa & Ojiaku, 2016).

Computer Animations are techniques, which aim to provide the learner with a highly simplified reproducible part of a real or imaginary world. Animations are considered one of the most effective ways to promote deep conceptual understanding of the real world (Falode et al., 2016). Technology such as Computer Animation Learning Approach makes teaching effective as learning is enhanced with images, video and sound.

Computer Animations are tools that have the capacity to improve quality learning. It seeks to arouse students' interests, stimulates thinking and concretizes knowledge that could otherwise be explained in abstract terms (Bamidele & Yoade, 2017). This aspect of multimedia learning supports student-centered

strategy whereby learners take responsibility in learning process. Computer animation is a subset of computer program which literally connotes the animation of concepts that are abstract in nature. Bamidele and Yoade (2017) reported that computer animations have the potentials of increasing the probability that students will learn more, retain better and even improve students' performance of the skills students are expected to develop. Computer animation learning approach is learner-centered strategies and a learning environment in which when employed can promote interaction, interest and attentiveness etc. Yisa and Ojiaku (2016) studies shows that students who learn from computer animation have greater achievement and motivation. The studies also show that students retain information and the ability to sustain the learning process increases. These learner-centered instructional strategies can enhance a stimulating learning environment in which learners interest can increase positively and this can lead to increased attention, retention, concentration, knowledge and learning (O'Day, 2007).

Conventional lecture method is considered teacher-centered method which emphasizes learning through the teacher's guidance at all times. Students are expected to listen to lectures and learn. The teacher often talks at the students instead of encouraging students to interact, ask questions, or make students understand the lesson thoroughly (Umar, 2011). It does not promote insightful learning and long-term retention of some abstract concepts in biology (Ahmed & Abimbola, 2011 and Umar, 2011).

Retention in this study is the ability to remember tasks or reproduce the learned concepts when the need arises. Gimba, et al. (2015) defined retention as the ability to retain and recall information or knowledge gained after learning. Other researchers such as Falode, *et al.* (2016); Mangal (2010) and Obeka (2010) investigated and defined several variables that affect retention. Factors affecting retention include the content or tasks to be performed, learners' past experiences, the interval between lesson and evaluation and instructional strategies employed. Students' achievement in Biology depends on students' level of understandings and memory retention. Students' retention could be retained through the use of an appropriate instructional material like Computer Animation Learning Approach in teaching. Olorukooba, *et al.* (2016) discovered that students taught chemistry using CALA performed better than their counterparts taught using conventional lecture method and discovered that the package is gender-friendly. Interest in this study is a feeling of curiosity or concern of subject, topic (in this case, cell division concept) that makes attention towards it. It has been argued that interest is one of the factors that influence students' academic achievement. Renninger and Hiddi, (2011) put interest as a critical cognitive and affective motivational variable that guides attention, facilitates learning in different content areas, for all students of all ages, and develops through experience. In a separate study (Okoro, 2011; Yong, 2009 and Obiekwe, 2008) consistently show that interest is significantly correlated with teaching methods to enhance students' achievement in Biology. Interest is the feeling that accompanies special attention to an object or activity. Okoro (2011) ascertained that the aim of teaching is to secure the students' attention through arousing and maintaining interest in lessons of multidimensional instructions. Students' interest in learning is linked with their anxiety to learn. It consists of feelings and tendencies towards a concrete matter (Raymond, *et al.*, 2016). A characteristic feature of interest is a manifestation of a different preference toward actions, events or plans. A students' interest in academic achievement will induce him to behave and act in a certain way towards his studies (Ogbunanya & Owodunni, 2013). Besides Okoro (2011) identified a lack of interest and the use of traditional teaching methods such as lecture method as the major causes of students' poor achievement and retention in Biology.

Gender has been linked with the performance of students in several studies without any definite conclusion (Gambari, *et al.*, 2014). Several studies have shown that gender is a pertinent issue in science subjects and Biology in particular, and it is prominent among the factors identified as being responsible for learners' poor learning outcomes. Gender in science is the classification of the role of males and females (Nireti, *et al.*, 2014). Some findings indicated that significant differences existed between the performance of male

and female students while other findings showed that gender factor had no influence on students' performance (Yusuf & Afolabi 2010). For instance, Okwuduba, *et al.* (2018) reported that there was no significant difference in students' achievement due to gender. Adebayo and Oladele (2016) observed that there was no significant difference in achievement due to gender. In a like mind, Olorukooba, *et al.* (2016) discovered that computer instruction was gender-friendly. Falode, *et al.* (2014) submitted that CALA improved the achievement of both male and female students. Nireti, *et al.* (2014) observed that there is no significant difference in the academic performance of male and female students in basic science. Oludipe (2012) submitted that there is no significant difference between male and female students' academic achievement in Biology.

In a contrary view, Nasr and Asghar (2011), Okoro (2011), Opara (2011), Yong (2009) and Obiekwe (2008) submitted that a significant difference exists in the achievement and interest of male and female students in Biology. Nwagbo and Okoro (2011), Aremu and Ajanaku (2011), Akomolafe (2010), Achuonye and Olele (2009) and Njoku (2001) in separate studies submitted that there is gender disparity in favour of the males in the classroom and the society at large.

Statement of the Problem

The conventional lecture method is classroom-based and consists of lectures and direct instructions conducted by the teacher which emphasizes learning through the teacher's guidance at all times. The persistence use of this conventional lecture method makes learners passive rather than active learners (Ahmed & Abimbola, 2011). Studies in Biology indicated that many teachers prefer the lecture method of teaching and shy away from innovative methods of learning. Limited literature exists on the effects of Computer Animation Learning Approach on pre-service Biology teachers' retention and interest in Biology at Colleges of Education in the study area. It is in the light of this that the present study seeks to develop Computer Animation Learning Approach (CALA) to teach cell division to Colleges of Education pre-service Biology teachers.

Research Questions

The following research questions were raised to guide the study:

1. Is there any difference in the retention of pre-service Biology teachers taught cell division using Computer Animation Learning Approach and those taught without Computer Animation Learning Approach?
2. What is the difference in the retention of male and female pre-service Biology teachers taught cell division using Computer Animation Learning Approach?
3. What interest do pre-service Biology teachers possess after been exposed to cell division using Computer Animation Learning Approach?
4. Is there any difference in the interest of male and female pre-service Biology teachers in the Computer Animation Learning Approach?

Research Hypotheses

The following null hypotheses were tested at **0.05 levels** of significance:

HO₁: There is no significant difference in the retention of pre-service Biology teachers taught cell division using Computer Animation Learning Approach and those taught without Computer Animation Learning Approach

HO₂: There is no significant difference in the retention of male and female pre-service Biology teachers taught cell division using Computer Animation Learning Approach

HO₃: There is no significant difference in the interest of male and female pre-service Biology teachers in the Computer Animation Learning Approach.

METHODOLOGY

The research design used for this study is a quasi-experimental design involving Pre-test, Post-test experimental and control groups design. The instruments for the study were Cell Division Retention Test (CDRT) and Cell Division Interest Inventory Scale (CDIIS) which were used to determine the retention and interest of the pre-service Biology teachers respectively.

The pretest was administered using CDRT instrument to Experimental and control groups before treatment to establish equivalence in prior knowledge of the two groups respectively. The treatment for the study in experimental group was computer animation instructional package (CAIP) while the control group received conventional lecture method. This was followed by posttest after six weeks of teaching to determine the students' retention in cell division concepts. The population of this study consists of all level one pre-service Biology teachers in Kwara State Colleges of Education Nigeria, who registered for 2018/2019 academic session. There are three State Colleges of Education in Kwara State. A total of three hundred and sixty-eight (368) level one pre-service Biology teachers formed the population of this study. One hundred and twenty (120) level one pre-service Biology teachers were sampled using intact classes. The sample was in line with the central limit theorem which stressed that adequate sample should cover between 10-15% of the total population Tuckman (1975). The sample was selected using multi-stage sampling technique. The experimental group of the study was selected purposively. That is, the college with the availability of serviceable quantity of computers was selected. A College of Education was purposefully selected as experimental group because of the availability and functioning of 350 sitter equipped computer laboratory. While the control group of the research was randomly selected. The experimental group taught cell division concepts with computer animation learning approach was made up of 60 level one pre-service Biology teachers (32 male and 28 female) while the control group taught with conventional lecture method was made up of 60 (29 male and 31 female). Computer Animation Learning Approach (CALA) was validated by two Educational Technology specialists and two Colleges of Education lecturers currently teaching Biology. Also, Cell Division Retention Test (CDRT) was validated by two Biology specialists at teaching at College of Education. Based on experts' suggestions and recommendations, the instruments were modified and re-structured. The CDRT was made up of 30 multiple choice items constructed by the researcher. Each item was provided with four possible options out of which a student is expected to choose the correct answer. One mark (1mark) was awarded for every correctly answered question while no mark was awarded to each question answered wrongly. The score obtained out of 30 was later converted to percentage.

Trial testing and pilot study of CALA, CDRT and CDIIS were carried out in a College of Education within the study area but outside the Colleges selected for the main study using 25 level one pre-service Biology teachers and ICT facilities in the College computer laboratory. After a single administration of the test instruments, the test and retest method were used for the CDRT while the raw scores from CDIIS were used to determine its reliability and the reliability co-efficient of **0.95** and **0.82** was obtained using Pearson Product Moment Correlation coefficient and Cronbach Alpha respectively. After the research instruments were validated and found reliable, they were administered on pre-service Biology teachers selected for the main study in the respective Colleges using facilities in computer laboratory for pre-service Biology teachers in experimental group and lecture room for pre-service Biology teachers in the control group. The

data gathered were analyzed with descriptive and inferential statistics. The hypotheses were analyzed using t-test statistics to ascertain the significant difference between the groups using Statistical Package for Social Sciences (SPSS version 20) at 0.05 alpha level of significance.

DATA ANALYSIS AND RESULTS

Hypothesis One

HO₁: There is no significant difference in the retention of pre-service Biology teachers taught cell division using Computer Animation Learning Approach and those taught without Computer Animation Learning Approach

Table 1: t-test Analysis for Retention of the Experimental and Control Groups

Groups	N	Mean (\bar{X})	SD	t_{cal}	Df	P-value	Remarks
Experimental	60	20.52	6.09				
Control	60	16.26	5.56	21.15	119	.000*	Significant

*Significant at $p < 0.05$

Table 1 shows the t-test results of retention scores of groups taught the cell division concept using computer animation instructional package and conventional lecture method. The t-test result ($t_{cal} = 21.15(119)$ $p < 0.05$). Hence, the research hypothesis one was rejected. This indicates that there is a significant difference in the retention of pre-service Biology teachers taught cell division concepts using Computer Animation Learning Approach and those taught with Conventional lecture method.

Hypothesis Two

HO₂: There is no significant difference in the retention of male and female pre-service Biology teachers taught cell division using Computer Animation Learning Approach

Table 2: t-test Analysis for Retention of Male and Female within Experimental group only

Groups	N	Posttest		Retention Test		t_{cal}	Df	P-value	Remarks
		Mean (\bar{X})	SD	Mean (\bar{X})	SD				
Male	32	25.84	3.07	25.44	2.49	1.75	31	0.09	NS
Female	28	26.07	3.10	25.64	2.48	1.44	27	0.16	NS

NS = not Significant at $p > 0.05$

Table 2 shows the t-test analysis of mean retention scores of male and female pre-service Biology teachers exposed to Computer Animation Learning Approach in the cell division concept. The result reveals that the male in the experimental group has the t-value ($t_{cal} = 1.75(31)$ $p > 0.05$). The p-value of 0.09 is greater than the alpha value of 0.05. Likewise it is observed that the female in the experimental group has the t-value ($t_{cal} = 1.44(27)$ $p > 0.05$). The p-value of 0.16 is greater than the alpha value of 0.05. Hence, hypothesis two

was retained. This indicates that there is no significant difference in the retention of male and female pre-service Biology teachers taught cell division concepts using Computer Animation Learning Approach.

Table 3: Mean (\bar{X}) and Standard Deviation (SD) of NCE I pre-service Biology teachers interest in the Computer Animation Learning Approach

S/N	Statements	Mean (\bar{X})	SD	Remarks
1.	I like the Computer Animation Learning Approach in learning cell division concepts in Biology	4.45	0.50	Interested
2.	The cell division concepts are clearer and understandable when taught with Cell Division Computer Animation Learning Approach	4.45	0.57	Interested
3.	I like this teaching method using Computer Animation Learning Approach than when the conventional lecture method is used	4.30	0.74	Interested
4.	I don't like this teaching method using Computer Animation Learning Approach than when the conventional lecture method is used	2.02	0.75	Not Interested
5	Cell Division Computer Animation Learning Approach has changed my thinking about the difficulty of cell division concepts	3.93	1.07	Interested
6	I am curious and motivated during learning when Cell Division Computer Animation Learning Approach is used in teaching cell division than the conventional lecture method	4.33	0.77	Interested
7	Teaching cell division concepts using Computer Animation Learning Approach makes its learning process more interesting and easier	4.25	0.91	Interested
8	The use of Computer Animation Learning Approach is motivating to me in learning cell division concepts in Biology	4.08	1.08	Interested
9	The different pictures used to explain different phases of mitosis and meiosis make me lose interest in the package	1.75	0.68	Not Interested
10	Learning Cell division using Computer Animation Learning Approach has made me developed an interest in choosing Biology teaching as my future carrier	4.20	0.78	Interested
11	The use of Computer Animation Learning Approach in learning cell division is educating and simple to comprehend	3.95	0.91	Interested
12	I love to be a Biology teacher after learning cell division through Computer Animation Learning Approach	4.23	0.83	Interested
13	I will like my teacher to introduce other Biology concepts using Computer Animation Learning Approach	4.10	1.10	Interested
14	Large class size did not affect my learning of cell division concepts using Computer Animation Learning Approach	3.68	1.20	Interested
15	I did not like missing the class when Computer Animation Learning Approach is used in learning in the class	4.20	1.05	Interested

16	The use of Computer Animation Learning Approach enhanced my understanding of cell division	4.17	0.81	Interested
17	The techniques used in teaching cell division is interesting	3.95	1.09	Interested
18	Cell division is a simple and interesting topic in Biology when taught using Computer Animation Learning Approach	3.95	1.06	Interested
19	Through the use of Computer Animation Learning Approach I can study Cell Division on my own	3.95	1.19	Interested
20	The use of Computer Animation Learning Approach will be less costly in teaching cell division in our schools	3.78	1.28	Interested
Grand mean		3.89	0.92	

Table 3 shows the Mean (\bar{X}) and Standard Deviation (SD) of pre-service Biology teachers' interest in Computer Animation Learning Approach. The result reveals that the pre-service Biology teachers had the grand Mean (\bar{X}) score and Standard Deviation of 3.89 ± 0.92 respectively which is greater than the average mean (\bar{X}) of 3.0. This indicates that pre-service Biology teachers had a higher interest in learning cell division concepts using Computer Animation Learning Approach.

Hypothesis Three

HO₃: There is no significant difference in the interest of male and female pre-service Biology teachers in the Computer Animation Learning Approach

Table 4: t-test Analysis for Interest of Male and Female pre-service Biology teachers within Experimental Group

Groups	N	Mean (\bar{X})	SD	t_{cal}	Df	P-value	Remarks
Male	32	79.22	8.33				
				1.77	58	0.08 ^{ns}	Not Significant
Female	28	76.04	4.93				

NS = not significant at $p > 0.05$

Table 4 above shows the t-test analysis of interest scores of male and female pre-service Biology teachers exposed to Computer Animation Learning Approach in cell division concepts. The table reveals the ($t_{cal} = 1.77(58) p > 0.05$). Hence, hypothesis three was retained. This indicates that there is no significant difference in the interest of males and females pre-service Biology teachers taught cell division concepts using Computer Animation Learning Approach.

Summary of Findings

The Computer Animation Learning Approach enhanced pre-service Biology teachers' retained better than those using conventional lecture method. The use of Computer Animation Learning Approach to teach cell division concept has the same effect on retention of both male and female pre-service Biology teachers. Thus, indicating that the method is not gender bias. Also, the pre-service Biology teachers exposed to Computer Animation Learning Approach in cell division concept had higher level of interest towards the package and the use of Computer Animation Learning Approach to teach cell division concept had the same effect on retention of both male and female pre-service Biology teachers.

DISCUSSION OF FINDINGS

The research question one was answered by testing the corresponding hypotheses. Hypotheses one which states that there is no significant difference in the retention of pre-service Biology teachers taught cell division using Computer Animation Learning Approach and those taught without Computer Animation Learning Approach. The result revealed that there is a significant difference in the retention of pre-service Biology teachers exposed to Computer Animation Learning Approach in cell division concept and those exposed to conventional lecture method (Table 1). The significant difference is in favour of Computer Animation Learning Approach group as revealed in their mean score and the P-value. This finding is in concurrence with that of Salisu (2015), Gimba, et al., (2015), Bello, (2014), Lin, (2011), Mangal, (2010), Obeka, (2010) and O'Day (2007) who in their separate studies reveals that animations lead to greater long-term memory retention of learned materials. Studies on retention and instructional packages seem to agree that those instructional packages that are characterized by active learning such as Computer Animation Learning Approach yield permanent and meaningful learning that is readily retained and remembered at will by the learner (Mangal, 2011).

The research question two was answered by testing the corresponding hypothesis. The result revealed that there is no significant difference in the retention level of male and female pre-service Biology teachers exposed to Computer Animation Learning Approach in cell division concept as shown in Table 2. This implies that Computer Animation Learning Approach help both male and female pre-service biology teachers to retain cell division concept. This finding is in agreement with Ezeaghasi (2018), Adebayo and Oladele (2016), Salisu (2015), Gimba, et al., (2015), Bello, (2014), and O'Day (2007) who in their separate studies reveals that animations lead to greater long term memory retention of male and female in the learned materials.

The research question three was answered using mean and standard deviation. From the table, the result revealed the high-interest level of the pre-service Biology teachers in cell division concept due to exposure to Computer Animation Learning Approach. This finding is in agreement with that of Salihu and Umar (2018), Nasr (2012), Okoro (2011) Yong (2009) and Obiekwe (2008) who consistently show that interest is significantly correlated with teaching methods to enhance students' achievement in Biology. This showed that pre-service Biology teachers exposed to Computer Animation Learning Approach in cell division concept had higher mean level of interest towards the package. Tayo (2012) claimed that students' interest in agricultural science was enhanced with the use of the Computer Animation Learning Approach. Hwang, Tam, Lam and Lam (2012), further confirms that Computer Animation Learning Approach surely explains contents more explicitly to students, and make them more interested in the lesson. The difference in the interest observed can be attributed to the use of technology in teaching experimental group as stated by Neumann, Neumann, and Hood, (2011). The use of technology increases student interest and attention towards statistical concepts because it makes you see where it could be more interesting and it is a less boring way of learning.

The research question four was answered by testing the corresponding hypothesis. The result revealed that there is no significant difference in the mean interest scores of male and female pre-service Biology teachers exposed to Computer Animation Learning Approach in cell division concept (Table 4). This finding is in disagreement with Nasr and Asghar (2011), Okoro (2011), Opara (2011), Yong (2009) and Obiekwe (2008) who submitted that a significant difference exists in the achievement and interest of male and female

students in Biology. Nwagbo and Okoro (2011), Aremu and Ajanaku (2011), Akomolafe (2010), Achuonye and Olele (2009) and Njoku (2001) in their separate studies submitted that there is gender disparity in favour of the males in the classroom and the society at large.

CONCLUSION

Based on the finding of the study, the researchers concluded that: Computer Animation Learning Approach cell division concept has the potentials of enhancing pre-service Biology teachers' retention and interest.

RECOMMENDATIONS

Teacher-trainers like the Colleges of Education and Universities should incorporate Computer Animation Learning Approach into their methodology curricular at all levels. This will ensure the development of its knowledge in the teachers on training.

REFERENCES

- Adebayo, A. O. & Oladele, O. (2016). Effects of Computer Simulation Instructional Strategy on Biology Students' Academic Achievement in DNA Replication and Transcription. *Asian Journal of Educational Research*, 4(2), 16-24.
- Aderogba, K.A. (2012). Improving Teaching and Learning Aids in classes of Geography in Ogun state (Nigeria) Senior Secondary School (SSS). *International Journal of Research in Education*. 3 (2), 250 – 255.
- Ahmed, M. A. & Abimbola, I. O. (2011). Influence of Teaching Experience and School Location on Biology Teachers' Ratings of the Difficulty Levels of Nutrition Concepts in Ilorin, Nigeria. *Journal of Science, Technology, Mathematics and Education (JOSTMED)*, 7(2), 52-61.
- Awodun, A. O. & Oyeniyi, A. D. (2018). Effects of Instructional Simulation on Students' Academic Performance in Basic Science in Junior Secondary School in Ekiti State, Nigeria. *IJRAR-International Journal of Research and Analytical Reviews*, 5(2), 23–27.
- Aziz Nordin & Ami Norliyana Shamsu Kamar (2011). Tahap pemahaman pelajar terhadap konsep Pembahagian Sel dalam mata pelajaran Biologi KBSM tingkatan empat. [Online]. Tidak diterbitkan. Dipetik daripada: <http://eprints.utm.my/11220/>. (July28, 2019).
- Bamidele, E. F. & Yoade, F. B. (2017). Effects of Modes of Computer Animation Instructional Packages on Students' Achievement in Osun State Secondary Schools' Biology; *International Journal of Innovation and Research in Educational Sciences*, 4(4), 42-48.
- Bello, M. R. (2014). Effects of Computer Aided Instructional Package on Performance, Attitude and retention of Genetic Concepts among Secondary School Students in Niger State, Nigeria; *Unpublished Ph. D thesis in the Department of Science and Vocational Education. Usman Danfodio University*.
- Chattopadhyay, A. (2012). Understanding of Mitosis and Meiosis in Higher Secondary Students of Northeast India and the Implications for Genetic Education. *Scientific and Academic Publishing*, 2(3), 41-47.
- Duyilemi, A. N., Olagunju, A. M. & Olumide, O. J. (2014). Effects of Computer Simulation Package, Gender and Parental Education on Nigerian Secondary School Students' Attitude Towards Biology. *21st Century Academic Forum Conference Proceedings, Harvard*. 3(1), 114-136.
- Elangovan, T & Ismail, Z. (2014). The effects of 3D computer simulation on biology students' achievement and memory retention. *Asia-Pacific Forum on Science Learning and Teaching*. 15(2), 1-25.
- Ezeaghasi, N. E. (2018). Effect of EVACS Simulation Models on Attitude and Academic Performance in evolution among NCE 11 Students in North West, Nigeria. *International Journal of Education Development*, 21(1), 58-69.
- Falode, O. C., Sobowale, M. F., Saliu, R. M., Usman, H. & Falode, M. E. (2016). Effectiveness of Computer Animation Instructional Package on Academic Achievement of Senior Secondary School Agricultural Science Students in Animal Physiology in Minna, Nigeria. *Bulgarian Journal of Science and Education Policy (BJSEP)*, 10(1), 5-18.
- Ikwuka, O. I. & Samuel, N. N. C. (2017). Effect of Computer Animation on Chemistry Academic Achievement of Secondary School Students in Anambra State, Nigeria. *Journal of Emerging Trends in Educational Research and Policy Studies*, 8(2), 98-102.
- Kajuru, Y.K. & Ado, I.K. (2012). Effects of Constructivist Teaching Strategy on Gender in Learning of Addition and Subtraction Skills at Primary School Level. *Journal of Studies in Science and Mathematics Education, Zaria: Ahmadu Bello University*, 2(1), 82-88.

- Lisa, A. U., Michael, L. C., Steven, A. W., Peter, V. M. & Jane, B. R. (2016). Campbell Biology. (11th Edition). Published by Pearson.
- Mikre, F. (2011). The Roles of Information Communication Technologies in education. review article with emphasis to the computer and internet. *Ethiopia Journal of Education and Science*, 6(2), 1-16.
- Murniza, M., Halimal, B. Z. & Azlina, A. (2010). Visual Laboratory for learning Biology- a preliminary investigation. *Journal of World Academy of Science, Engineering and Technology*. 7(1), 572-575.
- National Commission for Colleges of Education (NCCE) Federal Republic of Nigeria (2016). Minimum Standard for Nigeria Certificate in Education Science and Mathematics.
- Nireti, D., Morenike, O. & Joyce, O. (2014). Effects of Computer Simulation Package, Gender and Perant Education on Nigerian Secondary School Students' Attiitude Towards Biology. In 21st Century Academic Forum Conference. 114–136.
- O'Day, D.H (2007). Animated Cell Biology: A Quick and Easy Method for Making Effective High Quality Teaching Animations. *CBElifesci.educ.5*. 255-263.
- Okwuduba, E. N., Offiah, F. C. & Madichie, C. J (2018). Effects of Computer Simulation on Secondary School Students' Academic Achievement in Chemistry in Anambra State. *Asian Journal of Education and Training*, 4(4), 284-289.
- Olodu, O. G., Ilabor C. S. & Isidi, P. A. (2014). Effects of Computer Assisted Instruction Package on Achievement of Pre-Service Integrated Science Teachers at Different Levels of Scientific Literacy. *Journal of Resourcefulness and Distinction*, 8(1), 1-11.
- Olorukooba, S. B., Sanda, S. & Suleiman, K. (2016). The Impact of Computer Simulations on Performance and Retention of Students in Qualitative Analysis at Senior Secondary Schools in Zaria, Kaduna State. *ATBU, Journal of Science, Technology & Education (JOSTE)*, 4(2), 169-178.
- Olubola, S. & Aladejana, F. (2013). Effect of Simulation Games and Computer Assisted Instruction on Performance in Primary Science. International Academic Conference Proceedings .Orlando USA.
- Oludipe, D. I. (2012). Developing Nigerian Integrated Science Curriculum. *Journal of Soil Science and Environmental Management*, 2(1), 93-99.
- Owolabi, O. A., Babatunde, A. E. & Gambari, A. I. (2019). Effects of Computer Animation Instructional Package on Secondary School Students' Achievement in Biology in Niger State, Nigeria, *Journal of Science, Technology, Mathematics and Education (JOSTMED)*, 15(1), 240-246.
- Ozcan, T., Yildirim, O. & Ozgur, S. (2012). Determining of the university freshmen students' misconceptions and alternative conceptions about Mitosis and Meiosis. *Procedia Social and Behavioral Sciences* [Online serial], 46, 3677-3680. Retrieve on March 18, 2019. Available: <http://dx.doi.org/10.1016/j.sbspro.2012.06.126>.
- She, H.-C. & Chen, Y.-Z. (2009). The impact of the multimedia effect on Science learning: Evidence from eye movements. *Computers & Education* [Online serial], 53(4), 1297-1307. (August 23, 2019) Available: <http://dx.doi.org/10.1016/j.compedu.2009.06.012>.
- Thomas, O.O. and Israel, O.O (2014). Effectiveness of Animation and Multimedia Teaching on Students Performance is Science Subjects. *British Journal of Education, Society and Behavioral Science*, 4 (2). Retrieved, on 29 August, 2019, from www.worldsciencedomain.org.
- Tuckman, B.W. (1975). *Measuring Educational Outcomes*. Harcourt Brace Hovawick Inc. NewYork