

Effect of Computer Assisted Instruction (CAI) on Students' Attitude towards Biology in Calabar South Local Government Area of Cross River State

Osomasi, Richard Aja¹; Abonyi Okechukwu Sunday (Professor)²; M. N. Anugwo (Professor)³

¹Department of Curriculum and Instructional Technology

^{2&3}Department of Science Education

¹University of Cross River State, Nigeria.

²Alex Ekwueme Federal University Ndufu Alike, Nigeria.

³Ebonyi State University, Nigeria.

¹richardosomasi518@gmail.com

DOI: <https://doi.org/10.67487/gjmret.v2i5.295>

Citation Osomasi, R. A., Sunday, A. O. & Anugwo, M. N. (2026). The Effect of Computer Assisted Instruction (CAI) on Students' Attitude towards Biology in Calabar South Local Government Area of Cross River State. *Global Journal of Modern Research and Emerging Trends*, 2(5). <https://doi.org/10.67487/gjmret.v2i5.295>

Abstract

This study investigated the effect of Computer-Assisted Instruction (CAI) on secondary school students' attitude towards biology. Two research questions and two hypotheses guided the study. A quasi-experimental pretest-posttest non-equivalent control group research design was adopted for the study. The study was conducted in Calabar South Local Government Area of Cross River State, Nigeria. The sample consisted of 320 senior secondary two (SSII) male and female biology students. The instruments: The Biology Achievement Test (BAT) was used for data collection. A reliability index of 0.81 was obtained using the Kuder-Richardson reliability technique. Data collected after the treatments were analyzed using mean, standard deviation, and Analysis of Covariance (ANCOVA). The result of the study, among others, indicated that CAI had a significant effect ($F = 6.90, p < 0.05$) on students' achievement in biology. The effect of gender and the combined effect of method and gender on students' achievement in biology were not significant. The study recommended that

biology teachers should use CAIP in teaching biology to enhance students' achievement.

Keywords: Computer-Assisted Instruction (CAI), Students' Attitude, Biology, Quasi-Experimental Design, Kuder-Richardson Technique

Introduction

Science is a systematic study of our environment. It provides a body of knowledge for us in addressing various forms of human, material, and environmental problems. It can also be viewed as composed of two major complementary modes: accumulation of knowledge through exploration and discovery efforts about the natural world and the use of such knowledge for human and material development. Science is studied and practiced in all parts of the world, including Nigeria. Nigeria is a developing nation with an increasing demand for science-based skilled manpower. The attainment of this goal could be fostered through the acquisition and application of the enabling skills inherent in the science subjects, including biology, chemistry, and physics, at the secondary school level.

Biology is one of the senior secondary school science subjects taught in Nigeria. Biology is an integral science subject that provides content in the training of students who intend to study medical and allied courses. Biology is one of the branches of science that deals with natural phenomena, and it engenders understanding of scientific concepts, attitudes, and skills. The Nigerian Educational Research and Development Council (NERDC, 2005) listed the objectives of the secondary school biology curriculum to include, enabling the learner to acquire scientific content, attitudes, and skills, inculcating the habit of critical thinking, making room for technological advancement and preparing the students for higher education and to have interest in science-based careers.

In view of these objectives, it would be observed that schools are not only to equip learners with basic knowledge of biology content but also with the practical skills needed for enhancing self-development. In order to achieve these objectives, the pedagogical approach, which is centered on the teachers' method of imparting facts and concepts, is of great essence. The implication is that biology teaching must be activity-based to be effective and meaningful. The conventional teaching methods are quite deficient towards achieving these goals, as they are teacher-centered (Adeyemi 2012). He commented that the conventional instructional method is characterized by emphasis on the instructor's behavior rather than students' behavior, minimal response of students to the instructional materials, delayed feedback on students' performance, and apathy towards the study of biology. The achievement of secondary school students in biology, as a consequence, has not been satisfactory across gender levels. Although there has not been any conclusive stand as to the way students' achievement in science and biology in particular is affected by gender,

evidence abounds to show that gender variables affect achievement in science (Anackwe, 1997; Nnaka & Anaekwe, 2003). In a study of the academic performance of students in basic science subjects like mathematics, biology, physics, and chemistry in WASSCE from 2018 to 2023 by Ajaka and Obadara (2013), it was reported that biology had the highest failure rate and recorded the lowest average academic performance, as presented in table 1.

Table 1: Academic Performance of Students in Basic Science Subjects

Subject	Percentage Pass	Failure Rate
Mathematics	47.44%	24.39%
Physics	56.01%	13.08%
Chemistry	46.30%	22.52%
Biology	37.27%	28.66%

Source: WAEC Result Statistics 2018-2023.

The same trend of poor achievement was reported in NECO/SSCE biology results from 2020 to 2024. For instance, 53.63% of the candidates that entered the examination in 2010 had credit and above. Similarly, in the years 2010-2015, the percentage of failures was reported as 20.79%, 9.07%, 25.48%, 23.92%, 28.17%, and 30.42%, respectively (NECO result analysis 2010-2015).

Again, the WAEC Chief Examiner's Report of 2023 indicated that the senior secondary school biology candidates encountered a number of problems associated with both cognitive and motor skills, which have culminated in the poor achievement of students in the Certificate Examination. Students' achievements and interest in biology are important factors that determine the extent to which a student could go in pursuing a number of science-based careers in life. Achievement, according to Ali (2004), is anything that somebody has done successfully, especially using his own efforts and skills. Underachievement is a very important phenomenon and should be given serious attention, as it goes a long way in derailing a candidate's future ambition. In practical terms, underachievement occurs when a student achieves a score lower than the mental ability test score (Onwakwe, et al., 2014). If allowed to persist, it can lead to frustrations. Academic vices and even outright dropping out of school.

Indeed, to enhance the achievement of the goals of teaching biology in the secondary schools. The recent moves of the information revolution and knowledge explosion in technology should not be swept under the carpet. Technology is utilized in enhancing instruction since it stimulates and sustains students' interest and engenders students' active participation. A Computer-Assisted Instruction Package (CAIP) is a program of instructional materials presented by means of a computer or computer systems. It is that in which the teacher uses a computer at different times and spaces according to the

characteristics of the subject matters, the students, and the available software and hardware. Computer-Assisted Instruction (CAI) is learner-centered and activity-oriented. It adds action to the information that students receive and helps students to see the unseen, test theoretical concepts, and comprehend abstract ideas. The use of CAI in biology would encourage exposure and capacity building in understanding, skills, knowledge, and access to information in the technology world. Cal has enormous potential to make education meaningful, and the utilization of it in the right direction makes education systematic and applicable in real life. The program has the potential to serve as an effective platform for enhancing students' achievement and interest in biology. It should be given serious consideration for implementation. Hence, this study sought to investigate the effect of computer-assisted instruction on biology students' academic achievement in the Calabar South Local Government Area of Cross River State, Nigeria.

Statement of the problem

In recent times, there has been a general decline in the academic achievement of students in public examinations in biology. This state of affairs has troubled the hearts of parents, teachers, administrators, governments, and even the students. This is because biology is an important subject that is required for admission for all those aspiring to be admitted into science-based courses in tertiary institutions. What has kept instigating the hearts of researchers is what would have been the causes of this problem.

The effects of these failures have been linked to many factors, of which poor utilization of computer-assisted instruction is one. The researcher has observed that, currently, Nigerian students across all levels of the educational system are not effectively enhancing their independent learning, primarily because computer-assisted instruction is lacking in schools. Hence, this study sought to investigate the extent to which computer-assisted instruction influences students' academic achievement in biology.

Purpose of the study

The study was guided by the following specific objective. This study sought to

- i. Examine the effect on the mean score of students taught Biology using computer-assisted instruction and expository method
- ii. Determine the effect on the mean achievement scores of male and female students taught Biology using computer-assisted instruction and expository method.

Research questions

The following questions were posed to guide the study:

- i. What are the mean achievement scores of students taught biology using CAI and the expository method?
- ii. What are the mean achievement scores of male and female students taught biology using CAI?

Hypotheses

To achieve the objectives of this study, the following null hypotheses were tested at a 0.05 level of significance:

- i. There is no significant difference between the mean achievement scores of students who were taught biology using CAI and their counterparts who were taught the same concept using the expository method.
- ii. There is no significant difference between the mean achievement scores of male and female students who were taught biology using CAI.

Research Methodology

The design of this study is a quasi-experimental design. Specifically, non-equivalent control and experimental group design. The experimental group was taught biology concepts using CAI, while the control group was taught using the expository teaching method.

Area of the Study

The study was conducted in Calabar South Local Government Area of Cross River State. Geographically, Calabar South is bounded in the north by Calabar Municipality, in the south by Odukpani Local Government Areas, in the east by the Calabar River, and in the west by the Great Kwa River. Its headquarters is Anantigha. It has an area of 264 km² and a population of 191,630 (2006 Census Report). The postal code of the area is 540 (Post Offices, 2012). There are eleven (11) wards in the area.

Culturally, the people of the Arca are popularly known by their language (Elik), the practice of fattening rooks (Nkuho), face and body painting, the Abang dance, masquerades (Ekpe), traditional attire, and artistic work. Educationally, Calabar South has a good number of public primary and secondary schools. Like Government Secondary School, some of the early secondary schools established in the area are Edgerley Memorial and Holy Child Secondary Schools. Calabar South Local Government Area also boasts private primary and secondary schools and tertiary institutions such as the University of Cross River State at Ekpo Abasi and the College of Health Technology. Economically, the occupations of the

people engage in farming, trading, and driving, and most of the people are civil servants (Retrieved from <https://en.m.wikipedia.org>).

Population of the Study

The population for this study is made up of Senior Secondary Two (SS II) students in ten (10) public secondary schools in the Calabar South Local Government Area who offer biology as a subject. The population of SS2 students was one thousand one hundred and ninety-six (1,196). Male students were five hundred and twenty-nine (529), and female students were six hundred and sixty-seven (667) (State Education Board, 2024).

Sampling Techniques

Purposive random sampling was used to select the schools that have facilities for CAL and up to two arms of intact classes each to facilitate the treatment and control conditions. In each school, one intact class was designated the control group and another intact class, the experimental group. The two schools used for this study were not close to each other. This was to avoid contamination of the experimental and control groups.

Sample size

The sample for this study was made up of 320 senior secondary two biology students from two government-owned secondary schools in the Calabar South Local Government Area of Cross River State.

Instrument for data collection

The instrument used for data collection in this study was the Biology Achievement Test (BAT). The BAT was constructed based on two units in the senior secondary school II curriculum, namely, Reproduction and the Nervous System. A table of specifications was used to develop a pool of twenty (20) multiple-choice objective questions.

Validity of the instrument

The Biology Achievement Test (BAT) was subjected to face and content validation. The researcher used the supervisor and department lectures in the face and content validity of the biology achievement test. The supervisor and the departmental lectures assessed the relevance of the content used in the research instrument. Feedback was obtained, and modifications were made based on their feedback.

Reliability of the instrument

A reliability index of 0.81 was established for the BAT using the Kuder-Richardson formula. Before the treatment condition, the 320 students for the study were administered

the BAT as a pre-test, after which both groups were taught ecology and evolution for a period of six weeks using a total of ten (10) lesson periods of 40 minutes each. The control group was taught using the expository method with lesson notes prepared by the researcher. The lessons for the experimental group were pre-prepared and stored on a CD-ROM by the researcher, and the students were guided by the computer instructor in their respective schools throughout the duration of the treatment. At the end of the instructional delivery sessions, a post-test was administered to all the students. The post-test items were exactly the same as the pre-test items, except that the items were, this time around, reshuffled. The results obtained from the testers were used for data analysis. The research questions were answered using means and standard deviations, while the hypothesis was tested at the 0.05 level of significance using Analysis of Covariance (ANCOVA).

Results and discussion

Results of the study were presented in line with the research questions and the corresponding hypotheses.

Research Question 1: What are the mean achievement scores of students who were taught biology using CAI and their counterparts who were taught using the expository method?

Research Question 2: What are the mean achievement scores of male and female students who were taught biology using CAIP and their counterparts who were taught using the expository method?

Table 2: Means and standard deviations of students' achievement in biology by method and gender

			Method CAI	Expository	Overall
Gender	Female	Mean	75.50	37.80	56.65
		S.D	5.35	6.53	5.94
		N	80	81	161
Gender	Male	Mean	79.20	40.70	59.95
		S.D	4.41	6.34	5.38
		n	78	81	159

Overall	Mean	77.40	38.50	57.95
	S.D	4.88	6.44	5.66
	n	158	162	320

To answer research question 1. We refer to Table 2. The post-test mean score of the 158 biology students who were taught using CAI was 77.00 with a standard deviation of 4.88. The expository (control) group consisting of 162 students had the post-test mean score of 38.50 with a standard deviation of 6.44. This result indicated that the treatment group (CAI) achieved higher than the control group (expository). To establish whether the observed difference between the two groups was significant or not, we refer to hypothesis one in Table 3 below.

To answer research question 2, we also refer to table 2. From this table, the mean achievement score of 161 female biology students was 56.65 with a standard deviation of 5.94. The mean score of their 159 male counterparts was 59.95 with a standard deviation of 5.38. This result showed that the male students recorded a higher mean score than their female counterparts. To establish whether the observed difference between the gender levels was significant or not, we refer to hypothesis two in table 3.

Test of Hypotheses

- There is no significant difference between the mean achievement scores of students who were taught biology using CAI and their counterparts who were taught the same concept using the expository method.
- There is no significant difference between the mean achievement scores of male and female students who were taught biology using CAI.

Table 3: ANCOVA of Students' Achievement by Method and Gender

Source	Source of Square	df	Mean	F	Sig	Decision
Corrected model	193.98	1	64.66	1.97	0.12	
Intercept	80905.24	1	80905.24	2461.90	0.00	
Method (main effect)	183.08	1	183.08	6.90	0.02	H01: Rejected
Gender (interaction effect)	2.32	1	2.32	5.57	0.79	H02: Not rejected
Error	10384.39	312		0.03		
Total	91573.00	320	32.86			

Corrected total 10578.37 312

R square = 0.018 (Adjusted R Square = 0.009).

From table 3, the result of ANCOVA test as it affects hypothesis one, was evident. The treatment as main effect, had significant effect on students, achievement in biology ($F = 6.90$, $p = 0.02 < 0.05$). Hypothesis one was therefore rejected. This meant that significant difference existed in the mean achievement scores of students who were taught the biology concepts using CAI and their counterparts who were taught the same concepts using the Expository method. This difference was seen to be in favour of the treatment group who had higher mean score of 77.00 as against the control group that had mean score of 38.50.

Considering hypothesis two, the same table 3 shows that there is no significant difference in the mean achievement scores of male and female students who were taught Reproduction and Nervous system using CAI and Expository method. The table shows that the calculated F-value for the effect of gender on students achievement in biology was ($F = 5.57$, $p = 0.79 > 0.05$). Thus, hypothesis two was not rejected. This means that there was no significant difference between the mean achievement scores of male and female students on the BAT. The observed effect may be attributed to chance.

Discussion

The results from this study have revealed that students taught biology using CAIP performed significantly better than their counterparts who were taught using the expository method ($F = 6.9$, $p = 0.02 < 0.05$). The trend of higher performance by the treatment group could be as a result of self-evaluation and remedial activities provided by CAI, which helped the students to master the biology concepts better than the control group. It could also be a result of the excitement over the new approach to handling personal computers. The individualized instruction produced by the computer is a unique technique that made for a better performance of the experimental group over the control group. This result is in tandem with Udeogu (2007), who stated that CAI is an asset in the classroom situation since it tends to enhance achievement, foster interest, motivation, and spirit of cooperation in a science classroom. The additional pictorial illustrations provided in CAI were considered effective in enhancing achievement as they serve as the instructional materials that are used to make illustrations about the topic (Ifeakor, 2005). It is known that Computer Assisted Instructions (CAI) ensure students' active participation in the teaching-learning process; little wonder the treatment group outperformed the control group.

The result of this study indicated that gender has no significant effect on students' achievement in biology ($F = 5.57$, $p = 0.79 > 0.05$). This implies that given equal opportunities in the study of biology using CAIP, male students achieved as high as female students. Some studies on gender influences on students' learning outcomes in science have

reported that boys are more exposed to scientific activities very easily in life than girls (Okeke, 1990; Ezeudu, 2001). Again, boys are encouraged to enter science-related careers like engineering and technology, while girls go for home economics and allied courses (Bola 2008). Furthermore, Anderson (1997) stated that this disparity originated from the fact that the basic sciences are more or less perceived as masculine subjects rather than feminine. This perceived difference could also be attributed to gender stereotyping, which ascribes some specific roles to male and female students (Maduabum, 2006). However, the result of this study has shown that given equal experiences and unlimited access to education, girls would perform as much as boys in biology. This result would, by implication, go a long way to reduce gender-related differences in students' achievement in biology. Hence, the need to encourage an activity-based learning approach in science classrooms.

Conclusion

The result of the study showed that CAI had a significant effect on students' achievement in biology. The findings also revealed that gender had no significant effect on the achievement of students in biology. This suggests the need for biology teachers to adopt CAI as an alternative or supplementary instructional technique in the classroom. Similarly, there is the need to enrich and equalize educational experiences of both males and females in biology teaching and avoid gender role stereotyping in the instructional procedure, curricular offerings, or teacher expectations.

Recommendations

The following recommendations were made:

- i. Biology teachers should be encouraged to use CAI in the teaching of biology, as it has tended to engender male and female students' achievement in schools.
- ii. Conferences, seminars, and workshops should be organized for biology teachers to acquaint them with the pedagogical skills of using CAI for instructional delivery.
- iii. The use of computers in instructional delivery should be mainstreamed in the curriculum of pre-service science teachers so as to popularize CAI among teachers.

References

Adeyemi, B. A. (2012). Effects of computer assisted instruction on students achievement in social studies (Unpublished M.Ed. thesis). Obafemi Awolowo University, Ile-Ife.

- Ajaka, A. A., & Obadara, O. E. (2013). Scholastic performance of students at WASC examinations in Nigeria. *Journal of Educational and Social Research*, 3(1), 275–285.
- Ali, I. (2004). Attitude of Nigerian secondary school students towards school and their achievement in science. *Journal of the Nigerian Education Research Association*, 3(1), 11–17.
- Anaekwe, M. C. (1997). Effect of students' interaction patterns on cognitive achievement, retention and interest in chemistry (Unpublished doctoral dissertation). University of Nigeria, Nsukka.
- Anderson, M. R. (1997). Too few women in engineering: A partial solution. In J. E. Daniels & J. B. Kalie (Eds.), *Contribution of the 4th GASAT Conference* (Vol. 3, pp. 300–325).
- Anyaeibunam, N. J. (2012). Effect of constructivist theatre instruction on students' knowledge of HIV, AIDS and sexual behaviour in Enugu State of Nigeria (Unpublished Ph.D. dissertation). Department of Science Education, University of Nigeria, Nsukka.
- Bota, L. O. (2008). The development and preliminary validation of a Biology Interest Scale (BIS) (Unpublished M.Ed. thesis). University of Jos.
- Cotton, K. (2001). Computer assisted instruction. Retrieved July 8, 2017, from <http://www.nwrel.org/scpd/sirs/5/cu/o.html>
- Ejikeme, G. G., & Ejikeme, T. U. (2013). Effect of global economic crises on Nigerians: The need for attitude change intervention by guidance counselors and social workers. *International Journal of Research in Arts and Social Sciences*, 6, 269–271.
- Ezeudu, F. O. (2000). Use of local materials in the teaching of chemistry. In *Proceedings of the 4th Annual Conference of the Science Teachers Association of Nigeria* (pp. 163–165).
- Ifeakor, A. C. (2005). Effects of commercially produced computer assisted instruction package (CPCAIP) on students' achievement and interest in secondary school chemistry (Unpublished dissertation project). University of Nigeria, Nsukka.
- Jersild, J. I. (2010). *Children's interest and what they suggest for education*. New York, NY: Bureau of Publication.



- Jurich, S. (2001). Computer drill and practice tutorials: Are they effective? Retrieved July 8, 2017, from <http://www.Techknowlogia.org>
- Maduabum, M. A. (2006). Sex differences in attitude towards science and achievements in science in Nigeria: An analysis of 12 years of research. *Journal of Technical and Science Education*, 2(1), 63–71.
- National Educational Research and Development Council. (2005). National curriculum for science and technology. Lagos, Nigeria: NERDC Press.
- Nnaka, C. V., & Anaekwe, M. C. (2003). Students' learning styles, gender and their interaction effects on achievement and retention of chemistry concepts. *International Journal of Educational Research*, 6, 7–14.
- Okeke, E. A. C. (1990). Effects of investigative laboratory approach and expository method on acquisition of science process skills in biology by students at different levels of scientific literacy. *Journal of STAN*, 41(1–2), 79–88.
- Olatunji, M. O. (2007). Research studies in education. Lagos, Nigeria: Rattel Communications Limited.
- Onwukwe, E., Akuezuiilo, E., & Ijeoma, B. (2014). Science drama: Clue to underachievement in secondary school chemistry. *Journal of the Science Teachers Association of Nigeria*, 94(1), 58–64.
- Udeogu, L. (2007). Effect of selected improvised and conventional teaching materials on students' achievement and attitude towards biology. University of Jos.
- West African Examinations Council. (2012). May/June chief examiner's report. Retrieved May 31, 2015.



BIOLOGY ACHIEVEMENT TEST (BAT)

Instruction: Answer all questions by ticking the right option from A-D.

Time Allowed: 1 ½ hour

1. Sperm production begins in the?
(a) seminiferous tubules (b) epididymis (c) vas deferens (d) ejaculatory duct
2. The cell produced by fertilization is called?
(a) Gamete (b) embryo (c) fetus (d) zygote
3. The production of testosterone in the interstitial cells is stimulated by
(a) Inhibin (b) luteinizing hormone (c) follicle-stimulating hormone (d) progesterone
4. Sperm maturation occurs in the
(a) Seminiferous tubules (b) epididymis (c) vas deferens (d) urethra
5. The layer of the uterine wall that is shed during menstruation is the
(a) Endometrium (b) myometrium (c) Cpimetrium (d) none of the above
6. The external genitalia of the female are collectively called the
(a) Labia (b) Vulva (c) clitoris (d) Mons pubis
7. The hormone that works with estrogen to prepare the endometrium for implant egg is?
(a) LH (b) FSH (c) ADH (d) Progesterone
8. The average menstrual cycle is?
(a) 14 days (b) 18 days (c) 24 days (d) 28 days
9. The structure between the uterus and the vagina is the?
(a) Uterine tube (b) cervix (c) Vulva (d) hymen
10. The hormone that stimulates uterine contractions is?
(a) Oxytocin (b) estrogen (c) granular cell carcinoma (d) Progesterone
11. The term control nervous system refers to the:
(a) Automatic and peripheral nervous systems
(b) Brain, spinal cord and cranial nerves
(c) Brain and spinal cord
12. The peripheral nervous system consists of:

- (a) spinal nerves only (b) the brain only (c) Cranial nerves only (d) the spinal and cranial nerves
- 13.** Which of these cells are not a type of neuroglia found in the CNS:
(a) Astrocytes (b) microglia (c) Schwann cells (d) ependymal cells
- 14.** The Schwann cells form a myelin sheath around the:
(a) Dendrites (b) cell body (c) nucleus (d) axon
- 15.** The neuron processes that normally receives incoming stimuli are called:
(a) axons (b) dendrites (c) neurolemmas (d) Schwann cells
- 16.** Collection of nerve cell bodies inside the FMS are called:
(a) ganglia (b) Tracts (c) Nerves (d) Tracts or ganglia
- 17.** Which of the following best describes the waxy-appearing material called myelin.
(a) An outer-membrane on a neuroglial cell
(b) a lipid-protein (lipoprotein) cell membrane on the outside of axons
(c) a mass of white lipid material that insulates the axon of a neuron
(d) a mass of white lipid material that surrounds the cell body of a neuron
- 18.** A neuron with a cell body located in the CNS whose primary function is connecting other neurons is called a(n):
(a) efferent neuron (b) afferent neuron (c) interneuron (d) satellite cell
- 19.** White matter refers to myelinated fibers in the:
(a) CNS (b) SNS (c) ANS (d) Both ANS and SNS
- 20.** Impulse conduction is fastest in neurons that are:
(a) myelinated (b) unmyelinated (c) Sensory (d) Cerebral

Answers

1. A
2. D
3. B
4. B
5. A
6. B
7. D
8. D
9. B
10. A



11. D
12. D
13. C
14. D
15. B
16. A
17. D
18. C
19. A
20. A

NOTE OF LESSON

Subject: Biology

Lesson: The cell and its environment (osmosis and diffusion)

Duration: 40 minutes

Sex: Mixed

Age: 15 and above

Learning outcomes

At the end of the lesson, the students are able to:

1. Define osmosis and diffusion
2. Explain the biological significance of osmosis in living things
3. Differentiate between osmosis and diffusion
4. Give life instances and examples of osmosis and diffusion

Instructional/learning materials

Illustration using real objects like houses diagrams, charts etc.

Reference materials

Essential Biology for Senior Secondary Schools by M. C. Michaels, Modern Biology for Senior Secondary School, Comprehensive Biology etc.

CONTENT DEVELOPMENT

Steps	Contents	Teachers activity	Students activity	
I	Definition of osmosis	The teacher defines osmosis and diffusion. (i) Osmosis is defined as the flow of water or solvent molecules from a region of dilute or a weaker solution to a region of concentrated or stronger solution through a selectively or differentially permeable membrane. (ii) Diffusion is defined as the process by which molecules or ions of a substance (i.e. gases and liquids) move from a region of high concentration to a region of low concentration until they are evenly distributed.	Students ask questions where they do not understand and take notes.	Explanation and discussion
II	Biological significance of osmosis in living things	The teacher highlights all the significance of osmosis in living things; i. Osmosis in animal cells ii. Osmosis plants cells iii. Transport across the plasma membrane	The students listen and ask questions where necessary they copy the notes given to them by the teacher	and Explanation and discussion
III	Differences between osmosis and diffusion.	The teacher leads the students through the	The students listen and ask questions	Explanation and discussion

		differences between diffusion and osmosis. i. Diffusion occurs in gases and liquid medium only. ii. Differentially permeable membrane is not required in diffuse while it is required in osmosis. iii. Diffusion occurs in living and non-living organisms while osmosis occurs naturally in living organisms.	where necessary. They copy the notes given to them by the teacher	
IV	Examples	The teacher gives examples		

Summary

Osmosis occurs both in animal cells and in plant cells/ animal cells contain mainly cytoplasm and cell organelles. Diffusion and osmosis are passive processes and do not require energy. They only depend on a concentration gradient.

Evaluation

1. Define diffusion
2. State the importance of diffusion in liquid
3. Define osmosis
4. State the importance of osmosis in living tissues
5. Differentiate between osmosis and diffusion

Assignment

1. Mention 5 different between diffusion and osmosis
2. What is osmosis?
3. State 5 importance of diffusion to plants and animals
4. State and explain four factors that affect the diffusion of substances.