Perceptive Teaching Approaches and Technical College, Students Retention in Electronic Works in Akwa Ibom State

Michael Ime EFFIONG
Industrial Technical Education
University of Uyo, Uyo, Nigeria
Email: mfonobonge75@gmail.com
&
Namkere John Udoudo, PhD
Industrial Technical Education
University of Uyo, Uyo, Nigeria
Email: namkerejudodo@uniuyo.edu.ng,

Abstract
This study sought to determine the effect of perceptive teaching and technical college students' retention in electronics works in Akwa Ibom State, Nigeria. A quasi-experimental pre-test post-test control design was adopted for the study. The population of the study was 198 senior technical two students in the six public technical colleges in Akwa Ibom State, Nigeria. A random sampling technique was used for selection of two technical colleges for the study. The sample size comprised 98 students from two intact classes. The instrument used for data collection was "Perception Teaching Approaches and Students Retention Questionnaire (PTASRQ)" demonstration method was developed by the researcher for the treatment of the experimental and the control groups. The research questions were analysed using mean and standard deviation while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance. The study, among other findings, shows that there is a significant difference between the mean of students' scores in Electronics Works when exposed to perception teaching method than in demonstration teaching method, with students in the perception teaching class performing better than the students in demonstration class. It is recommended, among others, that the Electronics Works teachers should adopt the use of perception teaching for students retention in Electronic Works in the study area.

Keywords: Approaches, Demonstration, Retention, Semiconductor, Teaching

Background of the Study

Education is changing daily based on changes in technology in the present century. A lot of strategies have been developed to help teachers provide effective teaching and to help students learn with the ability to remember learnt instructions. Electronics is among the subjects that its methods of teaching by teachers should adopt the modern technology of teaching due to shift in modern method of teaching and students' needs of learning. Electronics Works is one of the trade subjects taught in technical colleges. Electronics is a branch of engineering which deals with the study of conduction of electricity in a vacuum, in gases and in semiconductors (Mehta and Mehta, 2018). It is concerned with methods of generating and controlling charge carriers such as electrons, holes and ions, for example, electron tubes and transistors, and with application of such devices (Amos & Amos, 2018).

Electronics deals with the use of emission, circuits or devices using transistors, microchips, semiconductors and other components. Electronics uses active devices to control electron flow.Oduntuyi (2017) posited that the study of electronics entails the learning of its concepts, principles, established laws, theories and also substantial activity-oriented-laboratory works. Unfortunately, electronics by its very nature is abstract. Consequently, many teachers perceive some concepts in electronics as difficult to teach and many students also find some concepts difficult to learn and understand.

Among the Electronics concepts perceived by both teachers and learners as difficult are semiconductors. This is because semiconductor materials such as silicon (Si), germanium (Ge) and gallium arsenide (GaAs) have electrical properties somewhere in the middle between a "conductor" and an "insulator" which is mostly so difficult to troubleshoot. Moreover, semiconductors are not good conductors or good insulators (hence their name "semi"-conductors). Semiconductors have very few "free electrons" because their atoms are closely grouped together in a crystalline pattern called a "crystal lattice" but electrons are still able to flow upon their characteristics, which needs special conditions for troubleshooting by the teacher with appropriate methods to be adopted for teaching to enable students' retention to be established. When troubleshooting a board to detect fault, the components have to be tested or troubleshot one after another. Moreover, changes in electronics technology keep changing the world of electronics from analogue to digital and to hybrid, this influences even the teacher's method of teaching and the students' ability to retain the instruction taught (Barnerjee, 2014). Ugwu (2014) asserted that various researchers believe that reasonable level of the difficulties in the teaching of Electronics Works and any other subject can be reduced through the use of effective teaching methods or strategies.

Teaching methods are various ways used by teachers to create learning environment and to specify the nature of the activity in which the teacher and the students will be involved during instructional delivery process (Ugwu, 2014). A teaching method comprises the principles and methods used by the teachers to enable students learn. Tebabai and Kahssay (2018) posited that teaching methods are classified into two major groups: teacher-centered and student-centered approaches. Teacher-centered approach allows students to simply obtain information from the teacher without building their engagement level with the subject being taught. This approach is less practical, more theoretical, emphasise memorizing, and does not apply activity-based learning to encourage students to learn real life problems based on applied knowledge. Student-centered approach helps to promote interest, analytical skill, critical thinking, motivates goal-oriented behaviour among students and hence would help to improve students' retention in their subject (Slavin, 2016). One of the student centred teaching method that is relevant to this study is perceptive approaches.

Perceptivemethod in teaching electronics involves a student-centreed approach that focuses on developing deep understanding, critical thinking, and practical skills. The key features are:

hands-on learning which engage in experiments, projects and simulations, inquiry-based which encourages exploration, questioning, and problem-solving, critical-thinking which developes ability to analyze, evaluate and interpret electronic concepts and real-world approach of aplications which connects theoretical knowledge to practical scenarios(Collins *et al.,* 2017). It is a teaching method by which learners learn from a more experienced person by way of cognitive and metacognitive skills and processes (Idris, 2017). Perceptive method of teaching permits group discussions which enhance higher understanding of students leading to better retention of knowledge on the concepts being learnt. This implies that students' retention of knowledge is based on team work (You, 2018).

Academic performance is the scholastic standing that could be explained as the grades obtained in a subject, course or group of courses taken (Owoyemi, 2018). According to Nwagbo(2020), academic performance in teaching and learning process has to do with attainment of a set of objectives of the instruction. It is an indication of the general ability of students concerning their offered subjects compared to a specified standard called "Pass Mark" which is relative and can be arbitrarily defined as 40 percent or 50 percent. Eze*et al.* (2016a) pointed out that academic achievement could be high, average or low/poor. They described a high academic achievement as one where the score is above the pass mark while a poor academic achievement is any performance score that falls below a desired standard or pass mark. Effective teaching methods help students to retain more information and strengthen understanding which could lead to better retention of learning.

Retention is the power of retaining and recalling past experience (Hegedorn, 2013).Retention refers to the ability to keep or retain information after learning (Paul, 2017). Retention is the ability to recall or remember what has been taught after a given time as a measure of students' progress (Eze*et al.,* 2016b). Retention is one of the inherent cognitive or perceptual powers of the mind. The factors that facilitate students' retention in technology subjects, including Electronics Works, according to Paul (2017), includes repetition of learned material, learning a material to mastery which can best be obtained when modelling instructional method is used, making a lesson meaningful and bringing it to the level of understanding of the students through effective and innovative teaching methods. Myer (2018) described retention as ability to retain knowledge gained after learning over some period of time. The more active the learner is in the learning process, the better the learner's retention of what is being taught. According to Johnson and Johnson (2014) learning through modelling teaching method enhances elaborative thinking and better understanding which leads to more meaningful learning. This has the potential of increasing depth of understanding, the quality of reasoning and the accuracy of long term retention. Retention aids remembering, which improves students' academic performance. Several scholars such as Udoudo (2011), Akpan and Caleb (2016); and Ogini*et al.* (2021) have identified instructional method as one of the major factors affecting students'

academic achievement and retention of learning in various subjects.

Poor academic performance of students in Electronics Works has been attributed to poor teaching methods by the teachers leading to poor students' interest towards the subject (Mnanwu, 2019). The values of being methodological in teaching-learning situation cannot be overemphasized. Esu and Inyang (2018) stressed that teaching and learning becomes fun instead of being drudgery when appropriate methods of teaching are used along with relevant instructional materials. The commonly used teaching methods by teachers of Electronics Works in technical colleges include demonstraionmethod.

Tebabai and Kahssay (2018) posited that demonstraion method is classified as a teacher-centered method as it only allows students to obtain information from the teacher without building their engagement level with the subject being taught. This approach is less practical, more theoretical, emphasise memorizing, and does not apply activity-based learning to encourage students to learn real life problems based on applied knowledge.

Perceptive approaches are teaching methods utilized by educators to teach students how to solve problems, understand tasks, perform specific tasks, and deal with difficult situations (Collins *et al.,* 2017). It is a teaching method by which learners learn from a more experienced person by way of perceptive and meta-perceiptive skills and processes (Idris, 2017). According to Beena and Asha (2023), perceptive methods try to enculturate students into authentic practices through activity and social interaction in a way similar to that evident in craft apprenticeship. Perceptive approaches is a method of teaching aimed primarily at teaching the processes that experts use to handle complex tasks. The focus of this learning through guided experience is on meta-perceive skills rather than on the physical skills.

Semiconductors

A semiconductor is any of a class of crystalline solids intermediate in electrical conductivity between a conductor and an insulator. Edward (2018) posited that semiconductors are employed in the manufacture of various kinds of electronic devices, including diodes, transistors, and integrated circuits. Such devices have found wide application because of their compactness, reliability, power efficiency, and low cost. As discrete components, they have found use in power devices, optical sensors, and light emitters, including solid-state lasers. They have a wide range of current and voltage-handling capabilities and more importantly, lend themselves to integration into complex but readily manufacturable microelectronics circuits.

According to Chi *et al*. (2017) semiconductors are and will be in the foreseeable future the key elements for the majority of electronics systems, serving communications, signal processing, computing, and control applications in both the consumer and industrial markets which require diverse methods of training electronics students for industrial world mostly in this century.

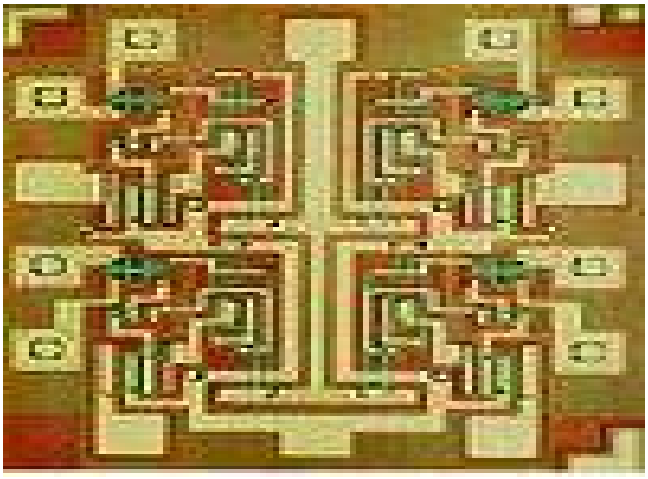

Plate 1: Metal oxide semiconductor
Source: Chi *et al.* (2017)

The metal–oxide–semiconductor field-effect transistor, (Plate 1), also known as the metal–oxide–silicon transistor, is a type of insulated-gate field-effect transistor that is fabricated by the controlled oxidation of a semiconductor, typically silicon. The voltage of the covered gate determines the electrical conductivity of the device; this ability to change conductivity with the amount of applied voltage can be used for amplifying or switching electronics signals if well designed and taught using different instructional materials can aid a student to identify not only the reaction of the circuit but also the atoms (Heller *et al.,* 2019). Furthermore, the author stressed that solid state conductivities and its corresponding resistors well explained and with a modelling technique can effectively improve students' academic performance in Electronics Works. As indicated in Plate 2.

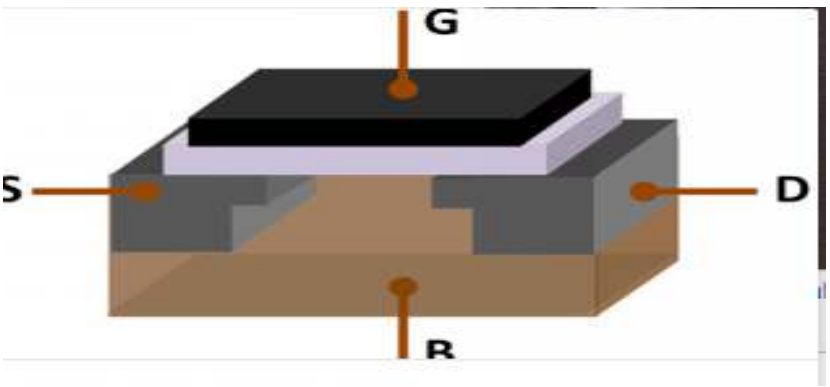

Plate 2: Solid-State (conductivities σ and the corresponding resistivities ρ = 1/σ)
Source: (Heller *et al.*, 2019).

Demonstration Method of Teaching and Students' Academic Performance

Demonstration involves the teacher talking about the mental activities that occur during the reading and writing processes. Demonstration usually involves modelling and explaining along with demonstrating the thinking that occurs while reading and writing. For instance, a teacher might compose a summary of an informational passage on an overhead projector in front of the class (Cunningham and Allington, 2017). A demonstration would occur as the teacher thinks aloud during the composing, making visible the thinking that assembles the information for the summary, puts it into words, and finally creates an evolved readable summary of the information presented. Similarly, the teacher demonstrates the complex mental processes that readers engage in while reading when he takes students through a strategy for puzzling out an unfamiliar circuit or word while using the figure. For example, "I can try a couple of things: identify a resistor to the end of the board, look at the board and see if you can know any other circuit that might help you have insightful knowledge of the board." Or, if it is in reading, one may ask, `what makes sense here?'; double-check what word makes sense against word structure; read the sentence using the word that makes sense and has the right letters. Demonstrating such thinking and how thinking shifts from incident to incident (look at the picture to get a clue, think about the word with rhyme, if it is spelt the same way; and so on) gives students the chance to see that skillful strategy use which is flexible and always requires thinking, not rote memory of rules.

Teaching Methods and Students' Retention

Retention means recalling piece of knowledge, information, process and skills that were learned earlier in time. Akinsete (2017) defined retention as the power of retaining and recalling past experience. It is the amount of material that is retained and recalled over time. Retention is the ability to retain and remember learnt concepts after learning (Hoyt, 2020). It is the process of having a large storage of information in the memory. Retention, according to Ezema *et al.,* 2017), is the ability of the working memory of an individual to retrieve and store information for long term memory.

Retention is the preservative factor of knowledge, attitudes and skills in the mind (Ibe, 2014). Knowledge gained during instruction is useful only when it is stored and retained, retrieved or produced for application in new situations. Retention, according to Nworgu (2017), is the measure of knowledge or skill that students are able to keep or retain in their memory after some time. This retentive memory differs in individuals as some students are not able to retain knowledge or recall for long time (short term memory) and others have the capacity to store knowledge that have been retained for some time or for a long time (long-term memory). Clair (2019) observed that long term memory retention is a significant goal of effective teaching methods.

Retention is the amount of materials remembered over-time (Adeoye, 2016). It involves recognition and recall. Recognition involves a process of comparison of information with memory (Oludipe, 2018). According to Oludipe

(2018), effective teaching methods used by the teacher to convey knowledge in the classroom helps to promote student's retention ability and academic performance in schools. An effective electronics teacher should be effective in the use of teaching methods depending on the subject matter and level of content development of learner to improve students' retention (Akinsete, 2017).

Ajayi (2017) asserted that one of the major obstacles that hinder students' performance and progress in Electronics Works is their inability to retain the learnt concepts. Retention, according to Yakubu (2019), is the ability to keep and constantly remember learnt material when time arises. Retention facilitates transfer of learning for problem-solving. When students cannot remember what they learnt before, they become confused. Such confusion can be the beginning of retention phobia and avoidance of the subject (Uyoata, 2016). Adeyemi (2016) stressed that the importance of retention of learnt concepts by observing that the ways students learnt and perceived are reflected in retention scores and that which is imperfectly registered cannot be perfectly retained. Taiwo (2019) agreed that poor retention ability among students is largely due to inappropriate methods used by the teacher. Karacop and Smek (2018) reported that students taught using scaffolding and demonstration retained information better than those taught using modelling method.

Many students turn out to be in confusion after discovering that they can no longer recall what they were taught. The term "retention" is used to refer to the ability to recall or recognize the concepts which has been learnt before (Gubbad, 2020). To Wyk (2018), retention is the ability to keep and consequently remember materials experienced or learnt by a person at a later time. According to Achie (2016), retention can be seen as the persistence of learned materials over a period of time which can only be reflected in an individual's ability to recall or remember. These definitions show that retention is achieved when a learner can reproduce what has been learnt at a later period which can be short or long interval. Kundu and Tutoo (2015) described the process of retention as a preservative factor of the mind.

Various factors have been responsible for students' poor retention and academic performance in Electronics Works (Hassan, 2021). These factors include lack of enough and qualified teachers, inadequate instructional materials, large class size and poor students' background, use of inappropriate and poor teaching methods. Hassan (2021) and Obioma (2019) agreed that poor retention of students in Electronics Works is largely attributed to ineffective teaching methods used by the teacher in the teaching and learning process.

To further emphasize the importance of appropriate and innovative teaching methods in enhancing retention and academic performance of students in Electronics Works, Uyoata (2016) remarked that if concepts learnt must be retained for problem-solving, then careful consideration must be given to methods by which subject matter, the learner and the teacher will interact properly. Such interaction will obviously involve all students using their senses actively. This probably made Kajuru and Popoola (2018) to conclude that an individual learner

retains 10 per cent of what he read alone, 20 per cent of what he heard, 30 per cent of what he saw and heard while the percentage increases for those who read, see and do things in a practical situation. This clearly shows the relevance of instructional methods in determining how much is retained when it is properly incorporated into teaching and learning process.

Dallmer (2017) also described effective teaching strategy for enhancement of students' retention of knowledge as teaching strategy that requires team work and cooperation, enable students to learn from each other, enable students to immensely gain interpersonal skills through group participation, enable the students to have broader understanding of the subject. This affirms that students who adopt modelling teaching strategy is able to retain more information and perform better academically compared with their counterparts who are taught through teacher-centered strategy (Robyn, 2018).

This study is, therefore, motivated by the desire to solve the problem of poor classroom interaction patterns for better academic performance among technical college students in Akwa Ibom State.

Statement of the Problem

Instructional methods play a pivotal role on students' academic performance and retention in Electronics Works. The researcher observes that the poor academic performance and retention of students in Electronics Works may be attributed partly to inappropriate instructional methods used by teachers to communicate facts and knowledge to the students culminating in students' inability to retain information taught. It may also be that students of Electronics Works do not perform enough practicals. It may as well be that consistent low performance of students in Electronics Works in technical colleges in the study area may be due to issue of teacher's use of traditional teaching strategies which might lead to poor students' interest in the subject (Nsa, 2002).

Educators over the years have developed a number of learner-friendly instructional approaches that could be used to help learners learn meaningfully. Among these are perceptive approaches. It has been established by many scholars that perceptive appraoches improve students' academic performance and retention in many science and technology subjects. Therefore the problem to which this study is addressed is to answer the question: What is the effect of perceptive method on technical college students' academic performance and retention in Electronics Works in Akwa Ibom State?

Purpose of the Study

The main purpose of this study was to determine the influence of perceptive method of education on Technical College Students' Academic Performance in Electronics Works in Akwa Ibom State. Specifically, the study sought to:

i. Determine the difference in retention of students when taught semiconductor devices in Electronics Works using perceptive and demonstration methods.
ii. Determine the difference in retention of students when taught semiconductor devices in Electronics Works using perceptive and demonstration methods based on gender.

Research Questions

The following research questions were answered.

i. What is the difference in mean academic performance of students when taught semiconductor devices in Electronics Works using perceptive mand demonstration methods in Technical Colleges in Akwa Ibom State?

ii. What is the difference in retention ability of students when taught semiconductor devices in Electronics Works using perceptive and demonstration methods?

Research Hypotheses

The following null hypotheses were formulated to guide the study and were tested at 0.05 level of significance.

$H0_1$: There is no significant difference in mean academic performance of students when taught semiconductor devices in Electronics Works using perceptive and demonstration methods in Technical Colleges in Akwa Ibom State.

$H0_2$: There is no significant difference in retention of students when taught semiconductor devices in Electronics Works using perceptive and demonstration methods.

Methodology

The study adopted a quasi-experimental pre-test post-test and non-equivilent control group design. Two intact classes of Senior Technical Two (ST2) Electronics Works students were studied. The design of the study is presented diagrammatically as follows:

O_1 x_1 O_3 O_5 (E_1)

O_2 x_2 O_4 O_6 (C)

Where: O_1 -pre-test of the experit' group

O_2 -pre-test of the control group

O_3 -post-test of experimental group

O_4 -post-test of the control group

O_5 -Retention test of the expert group

O_6 .Retention test of the control group

X_1 -experimental treatment condition

x_2 -control treatment condition

E_1 -the experimental group

C -Control group

The study was conducted in Akwa Ibom State.. Akwa Ibom State is one of the states in the South-South geopolitical zone of Nigeria, covering a land mass of about 6,900 square kilometres, with a population of over four million people

The population of the study consisted of 150 Senior Technical Two (ST11) students offering Electronics Works in Akwa Ibom State in the 2023/2024 academic session (Akwa Ibom State Technical Schools Board, STSB, 2022/2023).

A sample size of 98 Senior Technical Two Electronics Works students was used for the study. Out of the nine public technical colleges, three public technical colleges were sampled through purposive sampling technique. The use of purposive sampling technique was appropriate because only respondents who offer Electronics Works were used in both experimental and control groups. Intact class for experimental group was 50 respondents while intact class for control group was 48 respondents.

Data for the study was collected using "Electronics Works Performance Test (EWPT)". The Electronics Works Performance Test (EWPT) consisted of 50 multiple choice items on Electronics Works. It was used as pre-test post-test and delayed post-test (retention test) after being reshuffled after administration. .

The researcher handed over the instructional packages to the research assistants developed for the two groups with lesson notes relevant to the groups in their schools for the exercise. The Electronics Works Performance Test (EWPT) was administered to each of the two groups before the treatment as pre-test. The test items were reshuffled before the administration of post-test to both experimental group and control group after the treatment which lasted for 40 minutes each period for four weeks.. Two weeks after the post-test, the test items were reshuffled again and administered as delayed post-test (retention test). The test scripts were collected and handed over to the researcher by the research assistants for scoring and analysis. Each item on the instrument carried 2 marks to make a total of 100 marks which was converted to percentage.

The data collected were analysed using descriptive statistics, mean with standard deviation to answer the research questions. Analysis of Covariance (ANCOVA) was used for testing the null hypotheses with pre-test scores as covariates. The choice of ANCOVA was to ensure comparability and equality of the groups. All hypotheses were tested at .05 alpha level.

Results

Research Question 1: What is the difference in mean academic performance of students when taught semiconductor devices in Electronics Works using perceptive and demonstration methods in Technical Colleges in Akwa Ibom State?

Table 1 Summary of Mean Pre-test and Post-test scores of students in Electronics works when taught with perceptive and Demonstration methods

S/n	Group	N	Pre-test		Post-test		
			$\bar{X}$	SD	$\bar{X}$	SD	Mean Gain
1	Experimental	50	44.44	5.98	63.72	3.57	19.28
2	Control	48	44.25	4.61			
	53.46	2.09	9.21				

The data in Table 1 is a summary of the mean pre-test and post-test scores of students taught semiconductors using perceptive and demonstration instructional methods.The result shows that the mean pre-test and mean post-test scores of students in the experimental group who were taught with perceptive method are 44.44 and 63.72 respectively with standard deviations of 5.98 and 3.57. The corresponding figures for those students in the control group who were taught with demonstration method are 44.25 and 53.46 respectively with standard deviations of 4.61 and 2.09 respectively. It could be observed that students who were taught with perceptive method had a higher mean gain of 19.28 as against 9.21 obtained by those who were taught using demonstration method. This signified that teaching semiconductors with perceptive method enhances students' academic performance than using demonstration instructional method.

Research Question 2: What is the difference in retention ability of students

when taught semiconductor devices in Electronics Works using perceptive and demonstration methods?

Table 4.4 Summary of Mean Post-test and Retention test scores of students in Electronics works when taught with Perceptive Method and Demonstration methods

S/n	Group	N	Post-test		Retention test		
			$\bar{X}$	SD	$\bar{X}$SD	Mean Gain	
1	Experimental	50	63.72	3.57	68.92	4.10	5.20
2	Control	48	53.46				

The data in Table 2 is a summary of the mean post-test and retention test scores of students taught semiconductor devices using perceptive and demonstration instructional methods.The result shows that the mean post-test and retention test scores of students in the experimental group who were taught with perceptive method are 63.72 and 68.92 respectively with standard deviations of 3.57 and 4.10. The corresponding figures for those students in the control group who were taught with demonstration method are 53.46 and 56.63 respectively with standard deviations of 2.09 and 4.12 respectively. It could be observed that students who were taught with perceptive method had a higher mean gain of 5.20 as against 3.17 obtained by those who were taught using demonstration method. This signified that teaching semiconductor devices with perceptive method enhances students' retention of learning than using demonstration instructional method.

Table 3: Summary of ANCOVA Test of Significance of the Mean Post-Test Scores of students taught Semiconductor Devices in Electronics Works Perceptive Method and Demonstration Methods

Source	Sum of Squares	df	Mean Square	F	Sig	Decision
Corrected Model	2583.43[a]	2	1291.72	148.67	0.00	
Intercept	4446.13	1	4446.13	511.74	0.00	
PRETEST	4.61	1	4.61	0.53	0.47	
GROUP	2574.08	1	2574.08	296.27	0.00	S
Error	825.38	95	8.69			
Total	341016.00	98				
Corrected Total	3408.81	97				

S = Significant at 0.05 level of significance

Table 3 is a summary of Analysis of Covariance test of significance of the mean post-test scores of students taught semiconductor devices in Electronics Works using perceptive method and

demonstration methods with pre-test used as covariates. The students were divided into two groups based on teaching method, namely; perceptive method and demonstration methods. The F-value for group (teaching methods) is 296.27 with p-value (level of significance) being 0.00. Since the obtained p-value is less than the stipulated probability level of 0.05, it implies that the value of F is significant at 0.05 level of significance. On this basis, the null hypothesis is rejected implying that there is significant difference in mean academic performance of students when taught semiconductor devices in Electronics Works using perceptive method and demonstration methods in Technical Colleges in Akwa Ibom State. The difference is in favour of students in the experimental group who obtained a higher mean performance score than their counterparts in the control group as shown in Table 3.

$H0_2$: There is no significant difference in retention of students when taught semiconductor devices in Electronics Works using perceptive method and demonstration methods.

Table 4: Summary of ANCOVA Test of significance of the mean Retention score of students taught semiconductor devices in Electronics Works using Perceptive Method and demonstration methods

Source	Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	3702.07[a]	2	1851.04	108.09	0.00	
Intercept	5457.03	1	5457.03	318.65	0.00	
PRETEST	0.02	1	0.02	0.01	0.97	
GROUP	3701.18	1	3701.18	216.12	0.00	S
Error	1626.91	95	17.13			
Total	393032.00	98				
Corrected Total	5328.98	97				

S = Significant at 0.05 level of significance

Table 4 presents a summary of Analysis of Covariance test of significance of the mean retention scores of students taught semiconductor devices in Electronics Works using perceptive method and demonstration methods with pre-test used as covariates. The students were divided into two groups based on teaching method, namely; perceptive method and demonstration methods. The F-value for group (teaching methods) is 216.12 with p- value (level of significance) being 0.00. Since the obtained p- value is less than the stipulated probability level of 0.05, it implies that the value of F is significant at 0.05 level of significance. On this basis, the null hypothesis is rejected implying that there is significant difference in students' mean retention scores when taught semiconductor devices in Electronics Works using perceptive and demonstration methods in Technical Colleges in Akwa Ibom State. The difference is in favour of students in the experimental group who obtained a higher mean retention score than their counterparts in the control group as shown in Table 4.

Findings

i. Students in the experimental group who were taught with perceptive method had a higher mean gain of 19.28 as against 9.21 obtained by those who were taught using demonstration method. This signified that teaching semiconductors with perceptive method enhances students' academic performance than using demonstration instructional method.

ii. Students in the experimental group who were taught with perceptive method had a higher mean gain of 5.20 as against 3.17 obtained by those who were taught using demonstration method. This signified that teaching semiconductor devices with perceptive method enhances students' retention of learning than using demonstration instructional method.

Conclusion

Based on the findings of the study, it could be concluded that the use of perceptive instructional method enhance students' academic performance and retention in Electronics Works than using demonstration method. Also, the two teaching methods (perceptive method and demonstration methods) should be adopted to enhane academic performance and retention in Electronics Works.

Recommendations

The study recommended that:

i. Teachers and instructors of Electronics Works in all public and private Technical Colleges in Akwa Ibom State should, henceforth, adopt perceptive method alongside demonstration method in teaching topics in Electronics Works in order to improve students' academic performance in the subject.

ii. Electronics Works teachers and instructors in all public and private Technical Colleges in Akwa Ibom State should, henceforth, adopt perceptive method in teaching topics in Electronics Works in order to improve students' retention in the subject

References

Adeoye, F. A. (2016) Effects of cooperative and expository teaching method on student achievement and retention in secondary schools on Ibadan.*Journal of Achievetion and Practices,* 5(2): 66-71.

Ajayi, O. V. (2017). Effect of hands-on activity based methods on retention of senior secondary students in organic chemistry. *Scholarly Journal of Education*, 6(1):1-15.

Akinsete, A. (2017). Retention materials and individual working memory to retrieve facts.*Journal of Sciences,* 22:411-432.

Amos, S. & Amos, R. (2018). Newness Dictionary of electronics: New Delhi: Reed education and Professional Ltd., 32p.

Barnerjee, M. J. (2014). Effect of experience on retention and elimination of misconceptions about molecular structure and bonding.*Journal of Chemical Education*,76(2): 124-12

Beena, C. G. & Asha, J. V. (2023).Cognitive apprenticeship model – an experiental strategy for bolstering student achievement in Commerce.*Journal of the Asiatic Society of Mumbai,* 97 (7), 11-21

Clair, S. W. (2019). Assessment of long term effect of technology use in the engineering classroom and knowledge retention.Unpublished thesis.Georgia Institute of Technology.

Collins, A., Bown, J. S. & Newman, S. E. (2017). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L.B. Resnick (ed.) knowing, learning, and instructional essays in honor of robertglaser. Hillsdale, Erlbaum, New York.

Edward, N. (2018). Evaluation of student-centered approach to first year undergraduate engineering laboratories.*International Journal of Electrical Engineering Education*, (39): 310-319.

Eze, T. I., Ezenwafor, J. I. & Obidile, I. J. (2016a). Effects of problem-based teaching method on students' academic performance and retention in financial accounting in Technical colleges in Anambra State.*Scholars Journal of Arts, Humanities and Social Sciences* 4 (6A), 634 – 639.

Eze, T. I., Ezenwafor, J. I. and Obidile, J. I.(2016b). Effect of gender on students' academic performance in Financial accounting in Technical colleges.*British Journal of Education, Society and Behavioural Sciences* 18 (4): 1-9.

Ezema, M. A; Adejoh, M.S & Ochu, A, (2017).Effect of guided requiring intuitional method on secondary school students' retention in biology in plateau state.*Journal of Science, Technology and Education*, 5(2): 131- 138.

Gubbad, A. M. A. (2020), Effects of cooperative learning on students' academic achievement and retention of mathematics concepts at the Primary school in Holy Makkah, Journal of King Saud University. *Riyadh Education, Science and Islamic Studies,* 22(2): 13-23.

Hassan, A.A. (2021). Effects of school type on visual perception of geometry shapes and in mina meytroplis. *Journal of Stiklies in Science and Mathematics ducation*, 1(1): 2-18.

Hoyt, J. E. (2020). Understanding retention Retrieved from http;//publication.naspa.org/ nasspajournal/volume114/iss3/art/ (Retrieved on June 15, 2015).

Idris, A. M. (2017). Effect of Cognitive apprenticeship instructional method on auto mechanics students.*A U Journal of Technology,* 16(2): 89-98

Imoko, I, V. & Anyagh, I. P. (2019).Effect of Formal strategy on students' retention in algebra.*African*

Journal of Sustainable Professional Development, 2(1): 19-24.

Johnson, D. W. & Johnson, A.T (2014). Serial skills for successful group work. *Journal of Educational Leadership,* 5(2): 45-54.

Karacop, A. & Smek, K. (2018).Effects of Jigsaw Cooperative Learning and Animation Techniques on Students understanding of chemical bonding and their conception of the particulate nature of matter.*Journal of Science Education Technology,* 22(10): 156-203.

Kundu, L. & Tutoo, N. N. (2015).*Educational Psychology*. New Delhi: Sterting Publishers. 77-78.

Mehta, V. K. & Mehta, R. (2018).Principles of Electronics. New Delhi: S Chard and Company, 56p.

Mnanwu, N. V. (2019). *Conceptual Understanding of photosynthesis.* A masters dissertation of the department of mathematics. Science and technology education. University of Zulu and South Africa, retrieved from http://zspace.ac.za.oairequest?verb-listrecrdsandset=hell-10530.

Nworgu, L. N. (2017). Effect scaffolding and demonstration instructional strategy on students' retention and acquisition of secure process skills.*Journal of Education and Practice,* 15(3): 88-95.

Oduntuyi, M. (2017).The relationship between students' perception of pattern of interaction and students' learning outcomes in Secondary School Chemistry in Ondo State, Nigeria.*Journal of Education*, 9(1): 56-57.

Oludipe, D. I. (2018). Gender differences in Nigeria junior secondary school students' academic achievement in science.*International Journal of Science Education*, 2(1): 93-101.

Otuka, J. O. E. (2018). NCE/DLS course book integrated science, cycle 3, Modules 8, 9, 10. Kaduna: National Teachers Institute Perss, 164p.

Paul, H K (2017).The relation between active learning and long term retention Handbook of introductory statictics course.Ibadanbrown publishers, 21p.

Robyn, M.G (2018) Cooperative learning; Development in research, *International Journal of Educational Psychology,* 3(2): 125-140.

Slavin, R. E. (2016).Research for the future.Research on cooperative learning and achievement. What we know, what we need to know contemporary. *Educational psychology,* 3(2): 45-54.

Steyn, E. O. (2016). Cooperative learning strategies and students' retention in secondary school chemistry.*International Journal of Science Education,* 3(1): 77- 86.

Taiwo, G. O. (2019). Rebranding Nigeria by improving the teaching of mathematics through diagnosing Mathematics Learning Difficulties; A case study of senior secondary school students in Sokoto in J.S sadiku (Ed) proceeding of MAN conference, 157p.

Tebabai, J. & Kahssay, E. (2018).The role of teacher imitation in online. *Pedagogy Education training,* 54(6): 456-471.

Udo, N. M. (2015).*Effects of computer simulation and charts on biology students academic performance and retention on the concept of nervous coordination.*Unpublished M.Sc. Dissertation.Department of Science Education University of Uyo.

Ugwu, T. U. (2014). *Effect of guided-inquiry methods on students Achievement and interest in Basic Science.*Unpublished M.Sc. Thesis.Department of Science education.University of Nigeria, Nsukka.

Uyoata, U. E. (2016), Instructional strategies and retention of science concepts among primary school pupils. *Journal of Educational studies*, 12(1): 189-194.

Wyk, M. M. (2018). Effects of team game tournament on Achievement, Retention and Attitude of Students in chemistry. *Journal of Social Studies*, 20(3):185-194

Yakubu, L. (2019). Impacts of jigsaw cooperative learning strategy on academic performance and retention in menstruation among senior secondary school students in Kanu state Nigeria unpublished M.Ed. Dissertation, Department of science Education, Ahmadu Bello University Zaria.

You, L. (2018).Impact of Modelling; An effective approach to college English learning. *Journal of Theory and Practice in English Studies*, 4(9): 1948-1953.