

## **RELATIVE EFFECTIVENESS OF CONSTRUCTIVISM AND META-LEARNING TEACHING METHODS ON STUDENTS' ACADEMIC ACHIEVEMENT AND RETENTION IN BASIC ELECTRICITY IN TECHNICAL COLLEGES**

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**ABSTRACT:** *The study determined the relative effectiveness of constructivism and meta-learning teaching methods on academic achievement and retention of basic electricity among Technical College students. A quasi-experimental research design was adopted. Purposive sampling technique was used to select 108 students from four technical colleges in Anambra State. Two technical colleges each were randomly selected to experimental group one and other two technical colleges to experimental group two. Experimental group one used constructivism teaching method while the experimental group two used meta-learning teaching method. The instrument for data collection was Basic Electricity Achievement Test (BEAT). BEAT was developed by the researchers and validated by three experts in the Faculty of Education, Nnamdi Azikiwe University, Awka. Kuder Richardson 20 formula was used to determine the reliability of the instrument which yielded reliability co-efficient of 0.87. Data collected for the study were analyzed using mean for research questions and ANCOVA for null hypotheses at 0.05 level of significance. The result of the study revealed that constructivism teaching method had a significant effect on students' achievement when compared to meta-learning teaching method. Also the study showed that meta-learning teaching method had a significant effect on students' retention ability. Based on the findings, it was recommended among others that teachers of basic electricity should adopt the teaching methods that incorporate constructivism teaching method and meta-learning teaching method in teaching and learning of basic electricity in order to enhance knowledge mastery and retention among students.*

**KEYWORDS:** *Constructivism, Meta-learning, Academic achievement, Retention, Basic Electricity, Technical colleges*

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### **INTRODUCTION**

Basic electricity is a trade-related module of the technical college syllabus taught in year I, II and III as stipulated by Federal Republic of Nigeria, FRN, (2014). It was designed to provide the trainees with basic knowledge and practical skills in electrical and electronics technology. Being the only module that cuts across the entire engineering and related technical subjects, it ought to be taught well to ensure that students acquire the necessary knowledge and skills for employment after graduation. Lucas, Spencer and Claxton (2012) affirmed that the effectiveness of any skill-oriented educational process depends largely on the quality of teaching and learning in the classroom, workshop or, laboratory.

The current teaching methods used in technical colleges are mainly lecture and demonstration which is teacher- centered. Lecture and demonstration method are conventional teaching methods that combine oral explanation with handling or manipulation of real things, equipment or materials. It is particularly effective in teaching a skill that can be observed (Egedegbe, 2016). Ogwo and Oranu (2006) affirmed that demonstration method is the most widely used instructional method for acquisition of practical skills as it involves verbal and practical illustration of a given procedure. Demonstration method has the advantage of being a good way of motivating students to learn, providing direct experience and reinforcing learning. However demonstration method does not seem to aid critical and creative thinking as well as collaborative problem solving. Igboko and Ibeneme (2006) agreed that the use of lecture and demonstration alone has proved incapable of providing the effect required for coping with the challenges of globalization and rapid technological development. . In the same vein Omeje (2011) noted that use of teacher-centered approach to instruction by technology teachers do not actively involve students and could lead to inadequate practical skills acquisition and poor performance. It is therefore necessary to engage students' creative thinking, knowledge synthesis in order to develop problem-solving skills by adopting a learner –centered approach like constructivism and meta-learning.

Constructivism teaching method is a learner-centered approach to instruction based on constructivism learning theory that says that all knowledge is constructed from a base of prior knowledge. Dougiamans and Papert in Cey (2011) saw constructivism as a teaching method with an approach that seeks opportunities for students to analyze, investigate, collaborate, share, build and generate ideas based on what they already know rather than facts, skills and processes they can parrot. In other words, students construct their own understanding through the interactions of their existing experiences with whatever they come in contact. This makes learning a social activity which engages learners to question, challenge and formulate their own ideas and conclusions (Ultanir, 2012). Research findings carried out by Oludipe and Oludipe (2010) on effects of constructivism–based teaching strategy on academic performance of students in integrated science at the junior secondary school level revealed that there was improvement in academic performance of students in integrated science in constructivism group than their counterpart in the conventional lecture group. It is not clear that such findings apply to technical subjects like Basic Electricity.

Meta-learning teaching method on the other hand is another learner-centered approach to teaching and learning that trains the learner's consciousness on the use of meta- cognitive processes for learning (Ogwo & Oranu, (2006). It is a concept that describes the process of becoming aware of oneself as a learner and applying this knowledge towards becoming a more effective learner. This knowledge is used to monitor and regulate cognitive processes, reasoning, comprehension, problem-solving learning. In other words, in a meta-learning classroom, basic electricity students can plan, execute, monitor and evaluate the learning activities. A teacher can encourage students to go “meta” in their learning by informing the students what the learning contents/experiences are all about, what the specific objectives are, what tools are to be used to motivate them and help to achieve the objectives. Bransford, Brown and Cockry (2001) opined that effective teaching and learning in the classroom endorses active learning where students take control of their learning by recognizing when they understand and when they need more information. Amaechi (2012) observed that learners in meta-learning classroom are the most successful students in Arts and Science subjects because they set goals for their performance, plan how to use their time, focus their attention on the tasks and keep

them motivated. A study carried out by Eze, Ezenwafor and Molokwu (2015) on the effect of meta-learning teaching method on academic performance of building trade students indicated that academic performance of those taught with meta-learning improved significantly better than those taught with conventional teaching method. Also research carried out by Offiah and Akusoba (2001) on effects of meta-cognitive learning cycle on academic achievement of secondary school chemistry students showed that the achievement mean score of students taught with meta-learning is significantly higher than those taught with conventional method. This is an indication that when students are actively involved in the teaching and learning, it tends to facilitate mastery and retention which in turn improves their academic achievement.

Academic achievement refers to the successful result of interaction between a teacher and a student (Igbo and Ihejiene, (2014). It is designed to measure an individual's level of skill accomplishment or knowledge in a specific area. Academic achievement is appropriate in determining the efficacy of instruction and also useful in testing retention of information or skill. Obodo in Iji (2010) asserted that achievement is in collaboration with retention.

Retention helps in knowledge development (Eze, Ezenwafor and Obidile, 2016) and knowledge development can be guaranteed when students are actively involved in the teaching and learning processes. The major problem faced by most students is inability to remember what they have learnt which could result to students performing poorly in achievement test. Retention in basic electricity is not acquired by observing the teacher demonstrate and mere memorization rather through students' participation rooted in appropriate teaching method. Kirschner, Sweller and Clark (2006) opined that students learn and retains more when they develop their own knowledge and meaning from their own experience.

If research studies carried out by Oludipe and Oludipe (2010), Offiah and Akusoba (2001), Eze, Ezenwafor and Molokwu (2015) among others revealed that constructivism and meta-learning teaching method could improve students' academic achievement in some subjects, there is need to examine the relative effectiveness of constructivism and meta-learning teaching method on students' academic achievement and retention of basic electricity in Technical Colleges.

### **Problem Statement**

The end result of all instructional learning situation is based on the students ability to do something well or to perform in specific and broad situations. Federal Republic of Nigeria (2014) in its National Policy on Education points out that the goals of technical education is to produce graduates who could be self reliant. Regrettably, in technical colleges in Anambra state, NABTEB Chief Examiners report (2017) has unveiled that student's academic achievement in Basic electricity for National Technical Certificate Examination 2013-2017 have been dwindling. Many documented studies like that of Adunola (2011) and Ganyampfu (2013) among others have shown that students' poor academic achievement is as a result of teaching method employed by the teacher which is mainly teacher-centered. The declining academic performance of basic electricity students in Anambra State as reported by NABTEB Chief Examiner's report (2017) is of great concern to students, leaders, vocational educators considering the relevance of basic electricity in the present world of work. Hence the need for teachers to explore the teaching method(s) that would guide and motivate learners to deeply learn information and concepts in order to construct new ideas, identify new relationships and create new model of thinking and behaviour.

However, in spite of the research findings on the effects of constructivism and meta-learning teaching methods on some subjects, studies are yet to be found for the relative effectiveness of constructivism and meta-learning teaching methods in the teaching of Basic electricity. It is not known how such teaching methods (constructivism and meta-learning) would influence students' academic achievement and retention in Basic Electricity. Hence the need to ascertain the effectiveness of constructivism and meta-learning teaching methods on students' academic achievement and retention in basic electricity in technical colleges.

### **Purpose of the study**

The main purpose of this study is to determine the relative effectiveness of constructivism and meta-learning teaching methods on students' academic achievement and retention in Basic electricity in Technical Colleges in Anambra State. Specifically, the study seeks to determine:

1. The academic achievement mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method.
2. The retention mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method.

### **Research Questions**

The study was guided by the following research questions.

1. What is the academic achievement mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method
2. What is the retention mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method.

### **Null Hypotheses.**

The following null hypotheses were tested at 0.05 level of significance.

1. There is no significance difference in the academic achievement mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method.
2. Significant difference does not exist between the retention mean scores of technical college students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method

### **METHOD**

The study adopted quasi-experimental design. Specifically, the pre-test, post-test non-equivalent treatment group design was adopted for the study. This design was adopted because it was not possible for the researchers to randomly sample the subject and assign them to groups without disrupting the academic programme and the time table of the technical colleges involved in the study. The study was carried out in Anambra State of the South-Eastern zone of Nigeria. The population of the study comprised the entire 560 National Technical Certificate (NTC) year II basic electricity students in all the 12 technical colleges in Anambra State in the 2018/2019 academic year. A purposive sampling technique was used to select four schools

from the 12 technical colleges in the state. A total number of 108 students were selected for the study. The sample was grouped into four intact classes. Two intact classes were randomly assigned experimental group one while the remaining two intact classes were also randomly assigned experimental group two. The experimental group one has 44 males and 13 females while the experimental group two has 35 males and 16 females. The instrument for data collection was Basic Electricity Achievement Test (BEAT) for measuring achievement and retention of Technical College Students in Basic Electricity. The instrument consists of 40 multiple - choice questions based on the NABTEB curriculum contents on Basic Electricity for National Technical Certificates for (NTC) level. BEAT was designed to cover the following contents- resistors, capacitors and inductors which were taught during the study. The instrument (BEAT) was validated by three experts, two from department of Technology and Vocational Education and one from measurement and evaluation unit of educational foundation, Faculty of Education, Nnamdi Azikiwe University Awka. The reliability of the instrument was determined by administering the instrument to a trial group of intact class of 30 NTC II Basic electricity students of government Technical College Ofagbe, Delta State. Reliability co-efficient of the score was established using Kuder-Richardson 20 formula which yielded 0.87.

Permission was obtained from the Head of Department of electricity and the principals in the four technical colleges to allow the study to be carried out in their schools. The basic electricity teachers were trained on how to conduct the experimental treatment and were given prepared lesson plans. Pre-test was administered to the two experimental groups after which proper teaching commenced by using the prepared lesson plans. Each lesson lasted for 40 minutes and the treatment lasted for 4 weeks. At the end of the treatment, a post-test was administered on both groups with the BEAT and after two weeks interval, delay post-test was administered to both groups. Data collected for the study were analysed using mean scores and standard deviation to answer research questions and the null hypothesis were tested using Analysis of Covariance (ANCOVA) at 0.5 level of significance.

## RESULTS

**Research Question 1:** What is the academic achievement mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method.

**Table 1: Mean and standard deviation of students' academic achievement mean scores in basic electricity for constructivism and meta-learning teaching groups**

Group	N	Pre-test		Post-test		Mean gain/loss $\bar{x}$
		$\bar{x}$	SD	$\bar{x}$	SD	
Constructivism	57	24.64	6.00	77.56	6.44	52.92
Meta-learning	51	25.32	7.84	75.47	8.65	50.15

Table 1 shows that pre-test, post-test achievement mean scores of constructivism group are 24.64 and 77.56 with the standard deviation of 6.00 and 6.44 for pre-test and post-test

respectively. The mean gain is 52.92. The meta-learning group had a pre-test and post-test achievement mean scores of 25.32 and 75.47 with the standard deviation of 7.84 and 8.65 for pre-test and post-test respectively. The mean gain is 50.15. However, for each of the groups, the post-test achievement mean score was higher than the pre-test achievement mean score with constructivism group having a higher mean gain. The result indicates that constructivism teaching method improved students' achievement better than meta-learning teaching method.

**Research Question 2:** What is the retention mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method

**Table 2: Mean and standard deviation of students' retention mean scores in basic electricity for constructivism and meat-learning teaching group**

Group	N	Post-test		Delay Post-test		Mean gain/loss $\bar{x}$
		$\bar{x}$	SD	$\bar{x}$	SD	
Constructivism	57	77.56	6.44	76.95	5.53	0.61
Meta-learning	51	75.47	8.65	76.98	9.06	1.51

Data in table 2 show that the post-test, delay post-test retention mean scores of constructivism group are 77.56 and 76.95 with standard deviation of 6.44 and 5.53. The mean loss is 0.61. The meta-learning group had a post-test and delay post-test retention means scores of 75.47 and 76.98 with standard deviation of 8.65 and 9.06. The mean gain of meta-learning group is 1.51. This shows that students taught using constructivism teaching method had retention mean loss and those taught using meta-learning had retention mean gain. This indicates that students taught with meta-learning teaching method retained knowledge more than students taught with constructivism teaching method.

**Hypothesis 1:** There is no significance difference in the academic achievement mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method.

**Table 3: ANCOVA Summary of teaching methods on students' academic achievement mean scores in basic electricity.**

Source	Sum Squares	of df	Means squares	of F-cal	Sig	Remark
Teaching methods.	544.118	1	544.118	12.298	0.001	Rejected
Error	4557.167	103	44.244			
Total	639448.000	108				

The data presented in table 3 shows that the p-value of 0.001 was obtained for teaching methods on students' academic achievement mean scores in basic electricity. Since the p-value of .001 is less than 0.05 level of significance. This shows that there was a significant difference between the academic achievements means scores of technical college students taught basic

electricity using constructivism teaching method and those taught using meta-learning teaching method. The null hypothesis was therefore rejected.

**Hypothesis 2:** Significant difference does not exist between the retention mean scores of technical college students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method.

**Table 4: ANCOVA Summary of teaching methods on students' retention mean scores in basic electricity.**

Source	Sum of Squares	df	Means squares	f-cal	Sig	Remark
Teaching methods	491.722	1	491.722	10.945	0.001	Rejected
Error	4627.481	103	44.927			
Total	630038.000	108				

In table 4, the data shows that the p-value of 0.001 was obtained for teaching methods on students' retention mean scores in basic electricity since the p-value of 0.001 is less than 0.05 level of significance. This shows that significant difference exists between the retention mean scores of technical college students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method. The null hypothesis was therefore rejected.

## DISCUSSION

The data presented in table 1 provide answer to research question one, findings revealed that students taught basic electricity using constructivism teaching method performed better with a mean gain of 53.56 than the group taught using meta-learning method with the mean gain of 43.22. However, result in table 3 indicates that the difference in the mean gain is significant. With F-ratio of 12.298 and p-value of 0.001 which is less than 0.05 level of significance. The null hypothesis which stated that there is no significant difference between the academic achievement mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method was rejected. This implies that there was significant difference between the academic achievement mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method. The finding is in line with the finding of Oludipe and Oludipe (2010) who reported that there is improvement in the academic performance of students in constructivism group than their counterparts in conventional teaching group, The result obtained for research question two showed that students exposed to meta-learning teaching method had a lower retention mean loss of- 0.49 than the students exposed to constructivism teaching method with the retention mean loss of - 0.61. The result in table 4 indicates that the difference in the mean loss was significant. With F-ratio of 10.945 and p-value of .001 which is less than the 0.05 level of significance. The null hypothesis which stated the significant difference does not exist between the retention mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method was rejected. This implies that significant difference exist between the retention mean scores of students taught basic electricity using constructivism teaching method and those taught using meta-learning teaching method. The finding appears to support Amaechi (2012) who observed

that learners in meta-learning classroom are the most successful learners because they set goal for their performance, plan how to use their time and focus their attention on the learning tasks.

## CONCLUSION

Based on the findings of this study, which revealed that constructivism teaching method and meta-learning teaching method had positive effect on students' academic achievement in Basic Electricity, it was concluded that constructivism teaching method is more effective than meta-learning teaching method in improving academic achievement of technical college students in Basic Electricity due to the fact that the result from the data analyzed revealed that technical college students taught Basic Electricity using constructivism teaching method had a higher post-test mean gain than their counterparts taught using meta-learning teaching method.

In addition, meta-learning teaching method was more effective for enhancing retention ability of technical college students in Basic Electricity than constructivism teaching method because technical college students taught Basic Electricity using meta-learning teaching method had retention mean gain while their counterparts taught using constructivism teaching method had retention mean loss.

## Recommendations

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

1. Teachers of basic electricity should adopt constructivism and meta-learning teaching methods in the teaching of basic electricity in order to enhance knowledge mastery and retention among students.
2. Teachers of basic electricity should train, encourage and motivate students on how to apply constructivism and meta-learning strategies in basic electricity so as to improve their achievement and retention ability.
3. Government and other stakeholders in technical colleges should sensitize technical education teachers on the efficacy of meta-learning and constructivism teaching methods through conference, seminars and workshops.
4. Curriculum planners of technical college programme should collaborate with Basic electricity experts to develop a workable basic electricity curriculum that will accommodate teachers' integration of constructivism and meta-learning approaches in the instructional delivery.

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