Effect of Constructivist Teaching Method on Students' Academic Performance in Metalwork in Technical Colleges in Yobe State, Nigeria

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ABSTRACT
This study determined the effectiveness of Constructivist teaching method on students' performance in metalwork in technical colleges in Yobe State, Nigeria. The study adopted quasi-experimental research design in which intact classes were used. Two research questions were raised to guide the study, two hypotheses were formulated and tested at 0.05 level of significance. The sample size was 58 students selected from the two technical colleges in the state. The instrument used for data collection was Metalwork Performance Test (MWPT) which was validated by three experts with a reliability coefficient of 0.82. Mean was used to answer the research questions while ANCOVA was employed to test the hypotheses at 0.05 level of significance. The study found that students in experimental group performed higher than those in control group. This implies that constructivist teaching method is more effective than lecture method in teaching measurement and marking out; and drilling process. The study therefore recommended that Metalwork teachers should be trained to use constructivist teaching method; also the National Board for Technical Education should consider reviewing its curriculum to incorporate constructivist method of teaching her programs.

Key words: Constructivist, Teaching Method, Performance, Students, Metalwork

1.0 INTRODUCTION

The ability of Nigeria to realize the vision of becoming one of the twenty largest economies in the world is largely dependent on her capacity to transform her youth into highly skilled and competent citizens capable of competing globally (Eneh, 2011). A major part of the responsibility for preparing such a workforce rests on the nation's education sector. Therefore, to realize this vision and in order to be competitive in the global economy, Nigeria needs to develop the appropriate knowledge and skills (Federal Ministry of Education, 2012). Technical education is the foundation of nations' wealth and development. It is a type of education that is meant to produce semi-skilled, skilled and technical manpower necessary to restore, re-vitalize, energize, operate and sustain the national economy and substantially reduce unemployment (Ogumbe, 2015). Technical Education is a form of education involving in addition to general education the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of the economic and social life. Technical education is an aspect of education that leads to acquisition of practical and applied skills as well as basic scientific knowledge through training.

The goals of Technical Vocational Education and Training (TVET) as contained in National Policy on Education (FRN, 2013) are as follows:

i. Provide trained manpower in applied science, technology and business particularly at craft, advanced craft and technical level;

ii. Provide technical knowledge and vocational skill necessary for agricultural, commercial and economic development; and

iii. Give training and impart the necessary skills to individual for self-reliance economically

The above stated goals of TVET are expected to be achieved after technical education recipients undergo and receive proper training. Technical colleges train craftsmen in auto-mechanic, plumbing, carpentry and joinery, cabinet making, painting and decorating, fabrication and welding, electrical installation, radio and TV repair, building construction and a few other areas. On completion of the program the recipients can obtain work in industries, further their education or establish businesses of their own (NBTE, 2011). In technical colleges many subjects are incorporated to meet the requirement of various trades' e g metalwork. The methods of delivery of these trade related courses is the major concern as it is not like any other theoretical subjects. Metalwork is a practical process of transforming metals to form various shapes and sizes, parts, assemblies, or large-scale structures. The term covers a wide range of work from large ships and bridges to precise engine parts and delicate jewelry. It therefore includes a correspondingly wide range of skills, processes, and tools. Modern metalworking processes, though diverse and specialized, can be categorized as forming, cutting, or joining processes, furthermore today's machine shop includes a number of machine tools capable of creating precise and useful work piece.

According to United Nation Education Scientific and Cultural Organization, UNESCO (2001), on completion of metalwork module in technical college, the students should be able to;

1. Understand workshop safety rules and their application in handling and using hand tools, portable power tools and machine tools.
2. Know the physical properties, manufacturing process and application of ferrous and nonferrous metals in common use.
3. Select and use common measuring, marking out, cutting and striking tools.
4. Understand the basic working principles of drilling machine and be able to use it for various types of screws treads rivets, and be able to rivet and cut screws by hand. Understand the application of various types of screw threads and rivets, and be able to rivet and cut screws by hand.
5. Understand the ISO system of tolerances and fits, and their application in engineering production.
6. Produce simple engineering components using casting process.
7. Understand the essential features and working principles of the center lathe and carry out basic operations such as turning, stepped turning facing, taper turning, knurling, chamfering and undercutting.

The success in understanding and acquiring the above mentioned themes depend on the effectiveness of instructional method. The use of varieties of teaching methods is a must for teachers if learning is to be effective and efficient, and hence there is need for a good teacher to be multi-talented in other to be conversant with the use of various teaching methods in the teaching and learning process (Dorgu, 2015). Contrary to this speculation, most of teachers in technical college are becoming addicted to use of particular teaching method particularly lecture method of teaching.

The word *lecture* comes from the latin word *lectus*, from the 14th century, which translates roughly into "to read." It wasn't until the 16th century that the word was used to describe oral instruction given by a teacher in front of an audience of learners (Paris, 2014). Lecture method according to Mele (2018) is the art of telling factual information, principles and theories to audience without minding whether the audience understands the information being or not, and that learners are expected to add flesh on the principles or the theories on their own through personal research. In other words Lecture method of teaching is the one in which the teacher, or some other knowledgeable person supplies information to students. There is little or no students' participation, students are merely required to listen and understand the information being given and that is why is also called teacher centered (Okoro, 1993). In other words it is an instructional method where an instructor who possesses the knowledge on a given topic delivers all relevant information to students verbally. During a typical lecture, an instructor stands before a class and present information for the students to learnt (Kelley, 2018).

This method of teaching according to Center for Instructional Development and Distance Education CIDDE (2014) provides an economical and efficient method for delivering substantial amounts of information to large numbers of student; it offers current information (more up to date than most texts) from many sources; and provides a summary or synthesis of information from different sources as well as creating interest in a subject as lecturers transmit enthusiasm about their discipline. In term of effectiveness, lecture method being the most widely practicing method of teaching had been found to be less effective in students' academic achievement compare to other method of instruction (Oviawe, 2010; Ameh & Dantani, 2012; Musa & Hassan, 2015). Center for Instructional Development and Distance Education (2014) proposed the following hints to be observed for a successful delivering of lecture;

i. Present an outline of the lecture (use the blackboard, overhead transparency or handout) and refer to it as you move from point to point.
ii. Repeat points in several different ways. Include examples and concrete ideas.
iii. Use short sentences.
iv. Stress important points (through your tone or explicit comments).
v. Pause to give listeners time to think and write.
vi. Use lectures to complement, not simply repeat, the text.
vii. Learn students' names and make contact with them during the lecture.
viii. Avoid racing through the last part of the lecture. This is a common error made by instructors wishing to cram too much information into the allotted time.
ix. Schedule time for discussion in the same or separate class periods as the lecture.
x. Prepare because preparation reduces stress, frustration, insecurity and consequent ineffectiveness.

Constructivist views learning as a constructive process in which the learner is building an internal illustration of knowledge, a personal interpretation of experience. This representation is flexible always open to modification and not rigid, its structure and linkages forming the ground to which other knowledge structures are attached to. Learning is then an active process in which experience has an important role to play in understanding and grasping the meaning of a particular concept (Amineh & Hanier, 2015). They further stated that this view of knowledge does not necessarily reject the existence of the real world, instead it agrees that reality places constrains on the existing concepts, and contends that all individuals' knowledge of the world is the interpretations of their experiences. According to Khalid and Azeem (2012) the constructivist teacher help the students through problem-solving and inquiry-based learning activities with which students formulate and test their ideas, draw conclusions and inferences, and pool and convey their knowledge in a collaborative learning environment. Constructivism transforms the student from a passive recipient of information to an active participant in the learning process. Always guided by the teacher, students construct their knowledge actively rather than just mechanically ingesting knowledge from the teacher or the textbook. The task of the instructor is to translate information to be learned into a format appropriate to the learner's current state of understanding.

Peter and William (1999) stated that constructivist instructional approach is applicable to teaching of technical education, where students are expected to acquire reliable knowledge and skills. The approach according them emphasize the ability of individuals to construct similar, if not identical, mental models based on similar or identical experiences, this conformed to the requirement of technology education. Olufemi (2008) opined that the constructivist pedagogy could be a better choice if some or all of the following conditions prevailed;

1. The roles of the teacher will not be that of transferring knowledge or 'pouring' in some facts to the learner but in acting as a facilitator who encourages learner by giving tasking activities, organize and set probing questions and experiments while the learner is left to interact with available resources to find meaning of the 'real' world.
2. When course contents are arranged and structured to encourage learner to be left most times alone to have deep understanding of concepts with little and intermittent input from the tutor as demanded of the course goals.

3. In the case where the Centre focus of learning emphasizes the roles of the learner in evaluation and assessment; undertaking tasks, searching knowledge in the sea of information on the net and when sieving information and ideas in order to come up with fresh insight remains the focus of learning activities.

Constructivism promotes social and communication skills by creating a classroom environment that emphasizes collaboration and exchange of ideas. Students must learn how to articulate their ideas clearly as well as to collaborate on tasks effectively by sharing in group projects. Students must therefore exchange ideas and so must learn to negotiate with others and to evaluate their contributions in a socially acceptable manner. This is essential to success in the real world, since they will always be exposed to a variety of experiences in which they will have to cooperate and navigate among the ideas of others. Abbas and Karema (2014) opined that this approach has some advantages compare to traditional approach to the sense that it:

i. Makes the learner focus of the educational process by activating the role of learner discovers and looking and performs activities.
ii. Allows the learner the opportunity to debate and dialogue with fellow learners or with the teacher in order to assist the growth of the language of dialogue and make him active.
iii. Links between science and technology, which gives learners the opportunity to see the importance of science for society and the role of science in solving the problems of society.
iv. Makes learners think in a scientific way.
v. Encourages constructivist learning model to develop a spirit of cooperation and work as a team

Constructivism promotes social and communication skills by creating a classroom environment that emphasizes collaboration and exchange of ideas. Students must learn how to articulate their ideas clearly as well as to collaborate on tasks effectively by sharing in group projects. Peter, Abiodun and Oke (2010), Akanwa and Ovute (2014) and Duyilemi and Bolajoko (2014) observed that, students perform better when taught using constructivist method of teaching than the conventional methods of teaching technical subjects. Musa and Hassan (2015), Oguguo (2015) and Ndubuisi (2016) also confirm that, constructivist method of teaching use to be more effective in terms of performance than the conventional methods of teaching.

Despite the huge investment by Nigerian government on technical colleges program aimed at improving the image and performance of technical college students, the performance of the students in metalwork has not been encouraging specifically in Yobe state. One of the technical colleges in Yobe state has the following performance in Metalwork NABTEB examination from 2014 to 2016. In 2014 only 65 students sat for the examination and 38 % passed while 62% failed; in 2015,only 38 students sat for the examination 37% passed and 63% failed; and in year 2016, only 39 students sat for the examination 30% passed and 70% failed. This indicates serious decline in academic performance in the subject.

This persistent poor performance has been partly ascribed to inadequate teaching and instructional methods adopted by technical teachers, and that is why NABTEB chief examiner in his report after May/June 2017 marking exercise suggested that technical teachers should consider other teaching methods in teaching technical subjects (NABTEB, 2017). So it is evident that the subject cannot thrive without appropriate instructional methods. As such, exploring the most effective method between constructivist teaching method and lecture method to teach the subject became a major concern.

1.1 Purpose of the Study

The main purpose of this study is to determine the effect of constructivist teaching method on the academic performance of metalwork students in technical colleges in Yobe state. Specifically, the study intended to;

1. Determine the effect of constructivist method of teaching on the academic performance of students when taught measurement and marking out in metalwork fabrication in technical colleges in Yobe State;
2. Determine the effect of constructivist method of teaching on academic performance of metalwork students when taught drilling process in metalwork fabrication in technical colleges in Yobe state.

1.2 Research Questions

1. What is the performance of metalwork students taught measurement and marking out with constructivists' teaching method and those taught with lecture method in technical colleges in Yobe State?
2. What is the performance of metalwork students taught drilling process with constructivists' teaching method and those taught with lecture method in technical colleges in Yobe State?

1.3 Research Hypotheses

$H0_1$ There is no significant difference in the mean performance of metalwork students taught measurement and marking out with constructivists' teaching approach and those taught with lecture method in technical colleges in Yobe State.

$H0_2$ There is no significant difference in the mean performance of metalwork students taught drilling process with constructivists' teaching approach and those taught with lecture method in technical colleges in Yobe State.

2.0 METHODOLOGY

The design for the study was quasi-experimental pretest, post-test non-equivalent control group. The design was chosen and considered appropriate for the study because school authorities will hardly allow the researcher to disrupt their normal school setting. Creswell (2012) stated that in such a situation researchers must have to use intact groups since they cannot artificially create groups for the experiment. The geographical area of the study is Yobe State, which is located in Northeastern part of Nigeria. The target population for the study 74 which consists of NTC II in all Government Science and Technical Colleges that are offering metalwork. This covered students from three Government Science and Technical College located in Potiskum, Damagum and Geidam. Purposive sampling technique was employed to sample out 58 NTC II students.

The instrument used for data collection was a Metal Work Performance Test (MWPT) multiple choice test items that consists two sections A and B. Each section has 20 questions making a total of forty (40) researcher-made objective questions. Section A asked questions on measurement and making out while section B on drilling process. The instrument was validated by two experts from Modibbo Adama University of Technology Yola to check the adequacy of the content, logical sequence and suitability of the technical terms used. To ensure a reliability of the instrument test-retest procedure was employed and reliability coefficient of 0.82 was obtained using product moment correlation coefficient. The scores obtained from the pre-test and post-test was analyzed using mean and standard deviation to answer the research questions, while Analysis of covariance (ANCOVA) was used for testing the null hypotheses at 0.05 level of significance. Any group with higher mean in the performance test was taken to have performed better and the method used in teaching them was equally considered better. While for the hypotheses if the p-value is less than 0.05, the null hypothesis was rejected. Alternatively if the p-value is greater than or equal to 0.05, the null hypothesis was accepted.

3.0 Results

3.1 Research Question 1

What is the academic performance of metalwork students taught measurement and marking out with constructivists' teaching method as experimental and those taught with lecture method as Control in technical colleges in Yobe State?

Table 1

Means Performance Score and Standard Deviations of Pretest and Posttest of Experimental and Control Groups on measurement and marking out

Group	Symbol	Pre-test	Post-test	Mean Gain
Experimental Group (Constructivists Method)	N	33	33	
	$\bar{X}$	5.06	13.82	8.76
	SD	1.52	2.11	
Control Group (Lecture Method)	N	25	25	
	$\bar{X}$	4.96	9.92	4.96
	SD	1.37	2.59	

N = Number of Subjects; $\bar{X}$ = Mean and SD = Standard Deviation

Table 1 shows that prior to the use of constructivist method in the teaching of measurement and marking out to metalwork students in the experimental group, the mean score was 5.06 while the standard deviation was 1.52. The control group has a pretest mean score of 4.96 and the standard deviation of 1.37. The standard deviation of 1.52 for the experimental group and 1.37 for the control group indicates that there is slight variation in test scores of experimental group than in control group. But after the treatment which was teaching the students, the posttest mean scores for the experimental students is 13.82 while for the control group is 9.92 with the standard deviation of 2.11 and 2.59 respectively. The table also shows that the mean gain difference was 8.76 for experimental group and 4.96 in lecture method. This implies that the students taught measurement and marking out with constructivist teaching method performed better in the achievement test than those taught with lecture method. The result shows that constructivist teaching method is the better method in teaching measurement and marking out compared to lecture method.

3.2 Research Question 2

What is the academic performance of metalwork students taught drilling process with constructivists' teaching method as experimental and those taught with lecture method as Control in technical colleges in Yobe State?

Table 2

Means Performance Score and Standard Deviations of Pretest and Posttest of Experimental and Control Groups on Drilling process

Group		Symbol	Pre-test	Post-test	Mean Gain
Experimental (Constructivists Method)	Group	N	33	33	
		$\bar{X}$	4.21	11.79	7.58
		SD	0.96	1.95	
Control Group (Lecture Method)		N	25	25	
		$\bar{X}$	3.96	8.88	4.92
		SD	1.43	2.15	

N = Number of Subjects; $\bar{X}$ = Mean and SD = Standard Deviation

Table 2 shows that, in drilling process section of MWAT, experimental group have a pre-test mean score of 4.21 with a standard deviation of 0.96, while the control group has a pretest mean score of 3.96 and a standard deviation of 1.43. There is closeness in the test scores in experimental group than in control group based on standard deviation of 0.96 for the experimental group as against 1.43 for the control group. In post-test, the mean scores for the experimental group was 11.79, while for the control group it was an increased to 8.88. But despite the increased it was low when compared with the mean of experimental group. The table also shows that the mean gain difference was 7.58 for experimental group and 4.92 in control group. This implies that the students taught drilling process with constructivist teaching method performed better in the achievement test than those taught with lecture method. The finding proves that constructivist teaching method is the better method in teaching drilling process compared to lecture method.

3.3 Hypothesis 1

There is no significant difference in the mean academic performance of metalwork students taught measurement and marking out with constructivists' teaching method and those taught with lecture method in technical colleges in Yobe State.

Table 3

Analysis of Covariance of the Mean Performance Scores of Students Taught Measurement and Marking out with two different teaching method

Source of Variance	Sum of Squares	DF	Mean Square	F	Sig. of F (p-value)
Corrected Model	216.15[a]	2	108.08	19.51	.00
Intercept	618.82	1	618.82	111.69	.00
Pretest (Covariate)	.004	1	.004	.001	.98
Group (Teaching Methods)	215.95	1	215.95	38.98	.00
Error	304.75	55	5.54		
Total	9066.00	58			
Corrected Total	520.90	57			

Table 3 reveals that the F value of pretest is 0.001 with significant of F at 0.98 which is greater than 0.05 indicating that there is no significant different in the covariate. The F-calculated value for teaching methods (1, 55) is 38.98 with p-value of 0.00. Since the p value of 0.00 is less than 0.05, the null hypothesis is therefore rejected. Hence, there is significant difference between the mean performance of students taught measurement and marking out with constructivist teaching method and those taught with lecture method. It means that there is a significant different in effectiveness of constructivist and lecture teaching method in teaching measurement and marking out.

3.4 Hypothesis 2

There is no significant difference in the mean academic performance of metalwork students taught drilling process with constructivists' teaching method and those taught with lecture method in technical colleges in Yobe State.

Table 4

Analysis of Covariance of the Mean Performance Scores of Students Taught Drilling Process with two different teaching methods

Source of Variance	Sum of Squares	DF	Mean Square	F	Sig. of F (p-value)
Corrected Model	124.12[a]	2	62.06	14.95	.00
Intercept	386.06	1	386.06	93.00	.00
Pretest (Covariate)	3.84	1	3.84	.93	.34
Group (Teaching Methods)	114.39	1	114.39	27.56	.00
Error	228.31	55	4.15		
Total	6789.00	58			
Corrected Total	352.43	57			

Table 4 reveals that the F-calculated value of pretest (that the covariate) is 0.93 with p-value of 0.34 which is greater than 0.05. This shows that there is no significant different in the pretest. The table also reveals that F-calculated value for teaching methods (1, 55) is 27.56 with p-value of 0.00. Since the p value of 0.00 is less than 0.05, the null hypothesis is therefore rejected. Meaning there is significant difference between the mean performance of students taught drilling process with constructivist method and those taught with lecture method. This shows that there is a significant different in effectiveness of constructivist and lecture teaching method in teaching drilling process.

4.0 Major Findings

The following are major findings emerged from the study:

1. Constructivist teaching method is better than lecture method in teaching measurement and marking in technical colleges in Yobe State.
2. Constructivist teaching method is better than lecture method in teaching drilling process in technical colleges in Yobe State.
3. There is a significant different in effectiveness of constructivist and lecture teaching method in teaching measurement and marking out.
4. There is a significant different in effectiveness of constructivist and lecture teaching method in teaching drilling process.

4.1 Discussion of Findings

The main concern of the study was to determine the effectiveness of constructivist teaching method. This was done by determining which among the two methods (constructivist and conventional lecture) of instructional delivery is better for metalwork related courses. Both research questions one and two are talking about the two methods, therefore the two questions can be discussed concurrently. The findings revealed that, the constructivist method of teaching performed better than the conventional lecture method in the two research questions. This is because the mean achievement for experimental group is higher than that of control group in all cases. This therefore agree with the findings of Petet, Abiodun and Oke (2010), Akanwa and Ovute (2014), Duyilemi and Bolajoko (2014), Musa and Hassan (2015), Oguguo (2015) and Ndubuisi (2016) who found that, constructivist method of teaching is better than the conventional method of teaching and learning practical related subjects.

This was also confirmed by the results of the hypotheses which showed that, there is significant difference in the mean performance of the students that were taught using constructivist method and that of conventional methods in the favour of constructivist method. All the studies reviewed showed that constructivist method of teaching is always better than that of conventional (lecture) method in teaching and learning technical subjects.

The implication of this finding is that constructivist teaching method, in which students are actively engaged in teaching and learning process is more effective than lecture method in enhancing students' achievement on measurement and marking out of metalwork concepts and also drilling process.

4.2 Conclusion

The study found out that, the use of constructivist teaching method is more effective compared to lecture method in improving the academic performance of metalwork students in technical colleges. Drawing from the findings of this study, it can be concluded that for metalwork students to do well, constructivist method should be employed in teaching metalwork. This will motivate and promote the interest of the students in terms of achieving good results. It will also encourage parents, and teachers would be proud of using the method as an effective means of teaching Metalwork. Moreover, base on this study, there is a dare need for metalwork teachers in the technical college to develop interest in using constructivist teaching method to teach metalwork related subjects.

4.3 Recommendations

In line with the findings of this study, the researcher proffered the following recommendations:

1. Metalwork teachers should be trained to adopt constructivist instructional teaching method for teaching technical related subjects in schools.
2. There should be training and re-training opportunities for the technical teachers through in-service training or workshops/ seminars on regular basis.
3. National Board for Technical Education (NBTE) should consider review of curriculum for National Technical Certificate in order to incorporate constructivist instructional technique as a method of teaching technical courses.

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