

Effect of Teaching Reaming Operation with Fabricated Woodwork Mini-Lathe on Students' Achievement in Carpentry and Joinery in Technical Colleges in Rivers State Nigeria

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ABSTRACT

The aim of the study was to examine the Effect of Teaching reaming operation with Fabricated Woodwork Mini-Lathe on Students' Achievement in Carpentry and Joinery in Technical Colleges in Rivers State. One research question and one hypothesis guided the research. The hypothesis was tested at 0.05 level of significance. The study adopted quasi-experimental research design and was carried out in Rivers State of Nigeria. The population of the study was all the 50 National Technical Certificate 1 students of Technical Colleges offering carpentry and joinery craft in Rivers State (Government Technical College Port Harcourt and Ahoada), all the 50 National Technical Certificate 1 students of carpentry and joinery craft were sampled through census sampling technique, this is because the population was small and manageable. The instrument for data collection was Reaming Operations with Fabricated Woodwork Mini-Lathe Achievement Test developed by the researcher. The Reaming Operations with Fabricated Woodwork Mini-Lathe Achievement Test was used to test the students' achievement in reaming operations when carried out with a fabricated mini-lathe in carpentry and joinery. It contained 21 multiple choice items to choose from either of options A, B, C or D, to accept the highest mean gain. The null hypotheses were rejected when the calculated value, (F-cal) exceeded the critical value (F-crit), otherwise the null hypothesis was accepted.

KEYWORDS: Reaming, woodwork mini-lathe, students' achievement, carpentry and joinery, technical college

The reliability, validity and final computation of the instrument was established using the Statistical Packages for Social Sciences Version 20. The test re-test method was used to get a reliability index of 0.71, 0.75 and 0.72, 0.76 for the first and second tests respectively, therefore judging the instructional material (wood work mini-lathe) and the instrument reliable and valid for the teaching of reaming operations instead of demonstrating with a flip chart. The findings of the study revealed that reaming with fabricated woodwork mini-lathe impacted positively on students and that they get motivated when they have equipment to work with, particularly when taught reaming operations with teacher fabricated woodwork mini lathe, which is an aspect in wood processing and machining in carpentry and joinery

craft, their performance also was improved. It was concluded that, reaming operation is best taught with teacher fabricated wood work mini-lathe than flip chart, and it recommended that technical college authorities should sort out ways of training teachers in technical crafts on how to produce more functional instructional materials to boost the interest and achievement of their students.

INTRODUCTION

A lathe is a machine tool used mainly to shape metal or wood, which earned it the name two machines, one for wood, and one for metal. According to Kumar cited in Igweagbara (2021), lathe is a machine tool used to remove metals from a work piece to give a desired shape and size. He further stated that they are used in metal working, wood turning, metal spinning,

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thermal spraying, glass working and parts reclamation. The operations of a lathe is synonymous with rotation of the work piece, other tools are fixed to the receiving end (chuck) attached to the head stuck of the lathe to work on the spinning work piece to either cut, shape, sand, drill, knurl or ream. The job is done one after the other as the tools need to be changed to suit the required operation. The lathe is a capital intensive but highly needed machine in the carpentry and joinery machine.

To ream with fabricated woodwork mini-lathe, a holding device is constructed at the tail stock area to assist in holding the piece of work while the reamer is held at the head stuck with a drill chuck. A woodwork mini-lathe uses a belted motor or an electric motor to rotate the piece at various speeds, desirable features of a woodwork mini-lathe are steady, solid frame, lack of vibration, weight, variable speed and excellent machine construction. Tools for the lathe can be of carbon steel tungsten carbide, and high speed steel, (Kumar, 2021). The fabricated woodwork mini-lathe operates by rotating the work piece around a stationary cutting tool or rotating the tool around a stationary work piece as the case of reaming. The main aim is to remove unnecessary parts of the material, leaving behind a nicely formed work piece. The process of creating beautiful wide round holes on wood with a reamer in a lathe is called reaming.

wood work mini-lathe according to Saif (2014) is used to teach carpentry and joinery students of technical college lathe operations like sanding, drilling, reaming, cutting, turning and sanding. The researcher focused on using the teacher fabricated woodwork mini-lathe to teach students of carpentry and joinery in technical colleges in Rivers State reaming operations only, this is in order to satisfactorily attain the objectives of carpentry and joinery as stated in the NBTE curriculum, and to encourage students' performance and achievement of goal through provision of functional equipment for effective teaching (Igweagbara, 2021)

Achievement according to Akuda and Izu (2016) is the knowledge attained or skills developed in the school subjects, usually determined by test scores or marks assigned by the teacher. Costa and Belen (2014) also defined academic achievement as the learning outcome of students which include the knowledge, skills and ideas acquired and retained through his course of study within and outside the classroom situations. Ugwuanyi (2015) asserted that it is quantified by the measure of the students' academic standing in relation to those of other students of his age. Students' achievement is characterized by a lot of factors ranging from teacher

quality, method of teaching and availability of material and equipment. Research findings has it that, achievement is dependent on how well a student fairs in a subject, skill or a chosen career. "When the elements of achievement are not put in place, it becomes difficult to measure achievement, hence the importance of this study is that it ascertained the impact of teaching reaming with fabricated woodwork mini lathe on the students' achievement in carpentry and joinery in technical colleges in Rivers State.

Reaming with Wood Work Mini Lathe

"Reaming according to Henderson (2016) provides sizing and finishing to an already drilled hole. Its operation and tool is similar with that of drilling operations. The tool used for reaming is called a reamer, it has multiple cutting edges who cannot originate holes but leverages on the hole created by a drill. This means that it follows the hole that has been previously drilled and removes a very small amount of material. Reaming according to Sandvit (2019), is a finishing operation of high precision holes performed with a multiage tool, it has high surface finish, superb hole quality and close dimensional tolerance are achieved at high penetration rates and small depth cut."

"Most people mistake reaming, drilling and boring to be the same as their operation looks alike, Monroe (2019) differentiated between them by saying that; drilling is a cutting process that involves the use of a drill bit to cut circular-shape hole in a work piece. The drill bit used in drilling is a type of rotary cutting tool that, like other rotary tools rotates while subsequently scraping material out of work piece. To drill a work piece, you must press the drill bit against the work piece, when the drill is activated, the drill bit will dig its way into the work piece while creating a circular-shaped hole in the process. Boring, he said is a cutting process that involves the use of a single-point cutting tool or boring head to enlarge an existing hole in a work piece. This is a contrast to drilling, whose function is to create an initial hole in a work piece, and Reaming he referred to as a cutting process that involves the use of rotary cutting tool to create smooth interior walls in an existing hole in a work piece. The rotary cutting tool used in reaming is referred to as a reamer, like drill bits reamers also remove material from work piece on which they are used. However, reamers remove significantly less material than drill bits."

"The primary purpose of reaming is simply to create smooth walls, bore holes true to size in an existing hole and make conical bore holes for machine taper in joints. It is performed using a lathe or drill press.

Monroe (2019) posited that reamed holes are of two types namely; the through bore holes and blind bore holes. The through bore opens the two sides of the work piece while the blind bore does not go through, it stops at a particular diameter as is required for the job at hand. The reamer is basically of two categories namely the hand reamers and machine reamers which may be provided with straight or spiral-fluted cutting portion. The types of reaming tools are classified according to their usage, for instance;”

1. Shell reamer – this is used for large bore hole diameters, only the cutting portion consist of high-grade tool, the shank is made of ordinary steel, and various cutting parts can be put on one shank.
2. Adjustable reamers – this is used for working of worn-out bore holes as well as for making non-standardized bore holes through to size. They can be adjusted to various diameters within a small range.
3. Taper reamers – this is used in sets (roughing, semi-finishing and finishing reamer) for large machine taper joints. For smaller taper pin joints, individual reamers of various nominal diameters are used.
4. Structural reamers – these ones are used for aligning offset bore holes when making riveted joints, structural reamers are spiral-fluted, big taper reamers of strong cutting effect.

Reaming processes: Reaming processes as prescribed by Wengh (2015) are;

1. Clamp – clamp the work piece in such a way that it can be drilled, counter bored/countersunk and reamed in succession without the clamp being loosened in between.
2. Scribing/prick-punching – in this case a point is struck on the material with a punch just to indicate sitting point for the reamer.
3. Drilling – this is very important since the reaming operation is the act of removing material from the inside of the bore. The bore must be made smaller than the nominal diameter of the bore true to size indicates, the difference is called undersize. To drill a bore, N is referred to as the nominal diameter, U is the undersize and D is the diameter. Mathematically, the diameter of the drill is calculated thus; $D = N - U$. the rotational speed (n) of the drill is calculated thus; $n = \frac{V \cdot 1000}{D \cdot \pi}$ Where V = cutting speed (approximately 22m/mm) and $\pi = 3.14$.
4. Countersinking – the bore must be spot-faced by a 90° countersunk on either side, in doing so, the

diameter of the countersunk (Ds) is to be calculated with the help of the following formula; $D_s = N + 0.2m$. The rotational speed for countersinking bores up to diameter of 10mm can be approximately 350 rounds per minute (rpm). With larger bore holes it must be lower, that is $n \geq 350$ rpm.

5. Reaming – to ream through bores, hand reamers are used, while to ream bores with pockets, the reamer must be spiral-fluted (blind bores must be reamed by machine reamers only), tap wrenches are used as auxiliary means, ream in clockwise rotation.
6. Cleaning the bore – after reaming, in order to remove the chippings from wood, you don't use hand, rather, use what is called the compressed air or brush.

Checking/pinning – standardized bored holes which are made true to size are checked with the help of an internal micrometer, while pin connections are checked as to functioning after the pins are set.

Statement of Problem

It has been observed that students of carpentry and joinery can hardly boast of carrying out practical work in and out of school, yet the essence of the inculcation of the subject in the National Police on Education (FGN 2014) is to equip students with skills that will make them self-reliant and employable. The researcher is of the view that, lack of functional equipment for practical work may be one of the reasons students graduate from technical colleges without a sustainable skill. This defect is invariably the reason why graduates of technical college are found roaming about without a job. This study wishes to ascertain the effect of teaching reaming with a fabricated woodwork mini-lathe on the achievement of carpentry and joinery students of technical colleges in Rivers State. This problem of lack of equipment, have resulted to gradual extinction of carpentry and joinery in technical colleges as evidenced in the list of approved technical colleges in Rivers State and the subjects they offer (NBTE 2007). Suffice it to say that, lack of functional equipment leads to poor achievement on the part of the learner and frustration on the part of the teacher, and its resultant effect is poor performance.

Significance of the Study: This study will benefit the following: the students of carpentry and joinery, teachers of carpentry and joinery, building construction industries, and the society as a whole.

To the students of carpentry and joinery craft in technical colleges, it will help them understand the mode of operation of a lathe and how to ream ahead

of employment time, improve their practical skills in the activities of carpentry and joinery requiring a lathe, it will also boost their performance, and equip them for self-reliance. To teachers of carpentry and joinery in technical colleges, it will help facilitate their teaching, improve their self-esteem (when a student understands their lesson as teachers, they feel happy), students will love their lesson because it will be lively. It will make ease the delivery of their lessons and capture full attention of their students. The industries will benefit immensely because, they will not be spending money to train and retrain employees on the usage of lathe, and they will be having a lot of skilled people for employment instead of spending much money in the hire of expatriates. For the society as a whole, it will benefit them by improving the economy, as graduates will be self-employed thereby not depending on the government, more people will want to go into skill oriented programme and be taught practical, thereby generating income through tuition to the government.

Aim and Objective of the Study

The aim and objective of this study is to determine the effect of teaching reaming with teacher fabricated woodwork mini-lathe on students' achievement in carpentry and joinery craft in technical colleges in Rivers State.

Research Question

What was the effect of teaching reaming with woodwork mini-lathe on students' achievement in carpentry and joinery in technical colleges in Rivers State?

Hypotheses

The null hypotheses was tested at 0.5 significant level

H₀: There is no significant difference between the achievement mean scores of students taught reaming operations using teacher fabricated woodwork mini-lathe and those thought reaming with flip chart in technical colleges in Rivers State. .

Materials and Methods

Research Design: This study adopted the quasi-experimental research design, this is because Quasi-experimental design involved the use of pre-test and post-test design with experimental and control groups Ogundu (2011). The Quasi-experimental design was used since it was impossible for the researcher to randomly sample the students without disrupting the classes, hence the classes were intact.

Population for the Study: The population of the study comprised of 50 NTC 1 Carpentry and Joinery students in two out of the four Technical Colleges in Rivers State (Government Technical College Port Harcourt and Ahoada). NTC 1 students were used

here because wood processing and wood work machining (machine tools) is in their scheme of work and this has to do with lathe operations. The population for each school is as follows: (Government Technical College, Port Harcourt 45 Students; Government Technical College, Ahoada 5 Students; Government Technical College, Tombia nil, and Government Technical College Ogu, do not offer carpentry and joinery craft). The population of students available in each.

Sample and Sampling Techniques: The sample size for this study was all 50 NTC1 carpentry and joinery craft students in the two technical colleges covered, it is a census type of sample because the entire population was used due to its manageable size. However, the sampling technique was the purposive sampling technique which is described Black in Wordu (2021) as one in which the researcher relies on his or her own judgment when choosing members of population in the study. Alphabet X for Experimental Group and Y for Control Group where written on pieces of paper folded and tossed. Four students were asked to pick for each school. GTC Port Harcourt formed the experimental group having a population of 45 students while GTC Ahoada constituted the control group with a population of 5 students.

Validation of Instrument; The test items were validated by a total of three (4) lecturers, two (2) are of the department of Industrial Technical Education, one (1) from the department of mathematics/statistics and one (1) from the department of measurement and evaluation, all in Ignatius Ajuru University of Education. They checked and made some observations which the researcher used to modify and qualify the instrument for effective teaching and worthy of use.

Reliability of the instruments: The test re- test method was used to establish the reliability (the measure of stability) of the instrument items. The 25 ROTFWMAT test items were administered on 10 NTC 1 students in carpentry and joinery craft in Technical College, Sapele in Delta State. The school has two arms (A&B). Class A was used as the experimental group and taught with the teacher fabricated woodwork mini lathe, while B was the control group taught with the demonstrative instructional method with a flip-chart having drawing of a lathe as a teaching aid. At the end of the teaching exercise, the objective test was administered and the scores recorded and computed. The second test was administered after one week of the administration of the first test. The tests yielded a reliability index of 0.71, 0.75 and 0.72, 0.76 for the first and second tests respectively.

Instrument for Data Collection: The instrument for data collection was the Reaming Operations with Teacher Fabricated Woodwork Mini-Lathe Achievement Test (ROTFWMAT) developed by the researcher. The ROTFWMAT was drafted and used to test for the students' achievement in carpentry and joinery craft with wood work mini-lathe as instructional material to teach the students turning operations, it contained 25 multiple choice items, The researcher, in constructing ROTFWMAT, prepared two lesson plans (one for the control group and another for the experimental group) to guide the development of the test items.

Method of Data Collection: The researcher administered the instrument to the respondents with the help of the teachers as research assistants. The research assistants were educated on how to distribute the instrument. A total of 50 copies of the instrument was administered to the respondents and was retrieved on spot hence the 50 copies were retrieved and none was missing.

The test scores obtained from the pre-test and post-test were computed and analysed using descriptive and inferential statistics of mean and standard deviation. The mean and standard deviation were used to analyse the result of the achievement test and standard deviation values were used to determine the

homogeneity in the selected options among the respondents. Invariably, the pre-test and post-test mean gain of the control group was computed to determine the effect of reaming with woodwork mini lathe on the achievement of students in carpentry and joinery craft. The null hypothesis was tested using ANCOVA at 0.05 level of significance. Schneider, Avivi-Rreich and Mozuraitis (2015) in Igweagbara (2021) opined that the reason most researchers use ANCOVA is that it controls the effect of extraneous factors that may influence dependent measure of interest. The null hypothesis was rejected if the calculated value, (F- cal) exceeded the critical value (F- crit), if otherwise the null hypothesis was accepted, the Statistical Packages for Social Sciences Version 23 (SPSS 23) was used for final computation. The value of f-ratio at 0.05 level of significance and above was accepted while the value of f-ratio less than 0.05 level of significance was rejected.

Research Question: What is the effect of teaching reaming with teacher fabricated wood work mini-lathe on student's achievement and interest in reaming operations in technical colleges in Rivers State?

Data gathered to answer the question are in Table 1 below.

Table 1: Pretest and Post Test Means Scores on the Effect of Teaching Reaming with the Teacher Fabricated Wood Work Mini-Lathe on Students' Achievement in Reaming Operations.

Group	No	Pre-test		Post-test		Mean difference	Mean gain
		X	SD	X	SD		
Control	5	9.43	2.15	14.82	2.49	5.39	
Experimental	8.81	2.45	16.21	3.13	7.4	2.01	

Source: Field Survey 2021

“Table shows the pre-test and post-test mean score of students' achievement of both experimental and control groups on reaming operations in technical colleges in Rivers State. The results shows that the students in the experimental group had a pre-test mean score of 8.81 with a standard deviation of 2.45 and a post-test mean score of 16.21 with a standard deviation of 3.13. The difference between the pre-test and posttest mean for the experiment group was 7.40. The control group had a pre-test mean score of 9.43 with a standard deviation of 2.15 and a post-test mean score of 14.82 and a standard deviation of 2.49; giving the mean gain as 2.01. This results show that the mean score for the experimental group is higher than the control group, indicating that those taught with the teacher fabricated wood work mini-lathe performed better than those taught using flip chart.”

“**H₀:** There is no significant difference between the achievements mean scores of carpentry and joinery students taught reaming using teacher fabricated woodwork mini lathe and those taught reaming with flip chart in technical colleges in Rivers State.”

Table 2: The Analysis of Covariance (ANCOVA) Between Students Taught Reaming Operations Using Teacher Fabricated Woodwork Mini-Lathe and Those Taught Reaming With Flip Chart.

Source	Type III sum of squares	Df	Mean Square	F	Sig.
Corrected Model	4748.755 ^a	2	2374.378	5.362	.008
Intercept	111603.474	1	111603.474	252.045	.000
Postest1	267.866	1	267.866	.605	.441
Group	4085.989	1	4085.989	9.228	.004
Error	20811.245	47	442.792		
Total	5791968.000	50			
Corrected Total	25560.000	49			

a. R Squared = .186 (Adjusted R Squared = .151)

“Table 2 above is the result of the analysis of covariance on students taught reaming operations using teacher fabricated woodwork mini-lathe and those taught reaming with flip chart. The result showed that f-calculated ratio in the two groups is 9.228 at 0.004 significant level. It therefore implies that the null hypothesis is rejected since the significant value (P) is less than .05 ($P < .05$). Thus, there is a significant difference in the mean scores of students taught reaming operations using teacher fabricated woodwork mini-lathe and those taught reaming with flip chart.”

Conclusion and Recommendation

It was concluded that students of carpentry and joinery can do better if taught with teacher fabricated woodwork mini-lathe in technical colleges. Therefore, it was recommended that carpentry and joinery teachers in technical colleges be trained periodically on the usage of woodwork mini-lathe, to enable them teach the students the practical application of tools in carpentry item production.

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