EFFECT OFINSTRUCTIONAL GUIDE FOR TEACHING PRACTICAL SKILLS IN FACING AND DRILLING OPERATIONS ON THE LATHE MACHINE IN TECHNICAL COLLEGES

By

DANIEL M. DANGANA, PhD
DEPARTMENT OF EDUCATION (TECHNICAL)
COLLEGE OF SCIENCE AND TECHNOLOGY
KADUNA POLYTECHNIC
KADUNA – NIGERIA

Abstract

The purpose of the study was to determine the effect of an instructional guide developed by the researcher on the performance of students in facing and drilling operations on the lathe machine. Two purposes, two research questions and two hypotheses were formulated to guide the study. The instrument for data collection was a Practical Exercise Performance Test (PEPT) designed to test students in the major competencies to be acquired in facing and drilling operations. Quasi – Experimental group design was adopted for the study. The mean statistic was used to answer the two research questions while the t-test was used to test the hypotheses. Results showed that students who were taught with the instructional guides performed better than those taught with the conventional lesson plan. There was significant difference ($P< 0.05$) in the mean performance scores of students taught with the instructional guide and those taught with conventional lesson plans in facing and drilling operations on the lathe machine. The major conclusion of the study is that practical skill acquisition by beginners is enhanced by the use of an instructional guide. It is therefore recommended that the relevant authorities particularly the National Board for Technical Education should include the Practical Skills Instructional Guide as a mandatory instructional material for the teaching of skills in lathe machine operations in technical colleges in the country.

Introduction

Technical Colleges are institutions charged with the responsibility of training skilled technical manpower for technological and economic development of the country. To achieve this objective, technical colleges were established to run programmes leading to the award of National Technical Certificate (NTC). Accordingly, the National Board for Technical Education (NBTE) (2003) reported that there are 125 Technical Colleges established by both Federal and State governments in all the states of the Federation and the Federal Capital Territory (FCT) Abuja, with female and male enrolment figure of 3,750 and 19,750 respectively.

The Technical College programme is aimed at making the Technical College graduates achieve among other things the following:

i. Secure employment either at the end of the whole course or after completing one or more modules of employable skills.
ii. Set up their own businesses and become self employed and also be able to create employment for others.
iii. Pursue further education in advance craft/technology programme in post secondary technical institutions such as Colleges of Technology, Polytechnics, Colleges of Education (Technical) or Universities (Federal Government of Nigeria, 2004).

Based on the objectives of Technical Colleges, the National Technical Certificate (NTC) programme was designed to include a multi-dimensional and multi-disciplinary curriculum, which contains various programmes in which learners acquire various technical skills. One of such programmes is the Mechanical Engineering Craft Practice (MECP). As stipulated in the National Board for Technical Education (NBTE, 2003) minimum standards, the NTC curriculum in MECP is designed in modules. These modules are allocated a total of 360hours of theory and 924hours of practical to be covered in three years. Allocation of more time for practical work underscores the importance attached to the acquisition of practical skills during training. This is in line with Okoro's (2006) assertion that a cardinal principle of vocational education requires adequate repetitive training in practical work from the occupation, this will force right habits of doing and thinking to the degree necessary for employment.

The NTC curriculum in MECP requires demonstration of competence in lathe machine operations to the degree required in the industry. The Lathe Machine is the most fundamental of all metalwork machine tools. This is because the basic operation skills necessary for lathe machine operations apply to the operation of other machine tools, most of which are modifications or adaptation of the lathe machine. Therefore, competence in manipulating the lathe machine is advantageous in carrying out other machine processes as well. According to Bralla (1997), the process of machining is the forcing of a cutting tool through the excess material of a work piece and producing metal chips in the process. This excess material is progressively separated from the work piece, thereby reducing the work piece to the desired shape and size. The operations carried out on the lathe machine include among others:

i. Facing. This is the removal of material from the end of a bar to give it a flat and smooth surface finish
ii. Drilling. Drilling is the process of cutting cylindrical holes into or through material with a rotating tool called a drill.

An instructional guide provides a planned and logical organization of practical content and instructional process is based on 'how to perform a standard operation', and consists of certain distinct elements which include:

i. List of the tools, equipment and materials needed to perform the operation.
ii. Steps of procedure. A list of the steps of procedure with pictorial illustrations and brief written explanations of how to perform each step including notes on safety.
iii. Performance checks or standards to let the student know how he/she is progressing.
iv. Questions to direct the students attention to key points and basic concepts behind specific procedure.

Instruction guides are described as written information provided for the guidance of the student. They form part of the essential teaching materials required for teaching practical skills in technical and vocational education programmes.

One of the most important contributions of instructional guide is the specification of how the elements of practical content is to be taught and the order in which they are to be taught. Therefore, for its value in trainingfor skills acquisition it should be available for use by instructors.

However, preliminary investigation reveals that instructional guides in practical skills on the lathe machine which are consistent with the practical content required for skill acquisition and tested for effectiveness are not available for use by instructors in technical colleges in North West and North Central political zones of Nigeria.The present practice of teaching practical skills in mechanical engineering craft practice is done with information sheets with little guide for the learners and is without recourse to any standards for instructional guides. This practice leaves the technical teachers to teach according to their dictates resulting in students graduating without pre-requisite skills in machine operations.The implication of the lack of a reliable instructional guide for the use of technical teachers is that teachers will teach according to their dictates which will likely yield undesirable results.

Statement of the Problem

Practical activities in Mechanical Engineering Craft Practice (MECP) are geared towards providing students with opportunities for acquiring practical skills in machining operations so that they can graduate with the skills necessary for employment. However, Olorunshelu (2011) is of the opinion that there is inadequate mastery of practical skills among Technical College graduates. Earlier, the non-mastery of practical skills by Technical College graduates was asserted by NABTEB (2004), and Danjuma (2004). Furthermore, these experts contend that students tend to learn only theory in school hoping to learn practical work skills while at the work place. For example, Danjuma (2004) observed that the consequence of the lack of adequate instructional materials in technical colleges is the graduates' inadequate knowledge, skill and attitude resulting in high failure rate in NABTEB examinations. In the same vein, Osagie (1997)revealed the following problems of teaching vocational/technical education in Nigeria among many others: dearth of teaching aids and materials in schools compounded by teacher's laziness in improvising; lack of required textbooks by pupils and teachers' guide by the teachers; emphasis on theory because of lack of facilities for practical work. In support, NABTEB (2004) reported that from 2000 – 2003, 45% of those who sat for the NABTEB practical examinations in mechanical engineering craft practice failed and this is attributable to lack of adequate, appropriate and effective instructional guides required for teaching practical skills. The recommendation emanating from these observations is that teacher's guide should be provided in schools to enhance the quality of teaching.

Therefore, for effective teaching of practical contents in facing and drilling machining as contained in the National Technical Certificate curriculum for mechanical engineering craft practice, the provision of a valid and reliable instructional guide that is tested and has positive effect on student's performance has become necessary. This will provide a solution to the observed inadequacies of teaching practical skills in lathe

machining operations.Therefore, the study is to determine the effect of an instructional guide developed by the researcher on the performance of students in mechanical engineering craft practice.

Purpose of the Study

The purpose of the study was to determine the effect of a developed instructional guide on the performance of students in facing and drilling practical skills on the lathe machine.Specifically, the study determined:

1. The mean performance scores of students taught with the practical skills instructional guide and those taught using the ordinary lesson plan in facing operation.
2. The mean performance scores of students taught with the practical skills instructional guide and those taught with the ordinary lesson plan in drilling operation.

Research Questions

The following research questions guided the study.

1. What are the mean performance scores of students taught with the practical skills instructional guide and those taught with the ordinary lesson plan in facing operation?
2. What are the mean performance scores of students taught with the practical skills instructional guide and those taught with the ordinary lesson plan in drilling operation?

Hypotheses

The following null hypotheses formulated for the study were tested at 0.05 level of significance.

Ho_1: There is no significant difference in the mean performance of students taughtfacing operation with the instructional guide and those taught with conventional lesson plan.

Ho_2: There is no significant difference in the mean performance of students taughtdrilling operation with the instructional guide and those taught without.

Methodology

The design adopted for the study was Quasi – Experimental design. Specifically, the Randomized Posttest-Only Control Group involving one treatment group and one control group was employed for the study. The major characteristic of this design is the use of two or more already existing or intact groups randomly assigned for the study (Fraenkel&Wallen, 2000).

Area of the Study

The study was carried out in North West and North Central geo-political zones of Nigeria comprising of 13 states and the Federal Capital Territory (FCT). The zones have a total number of 15 Technical Colleges offering Mechanical Engineering Craft Practice (MECP). The reason for the choice of the geopolitical zones is because of the high failure rate recorded in National Technical Certificate (NTC) practical examinations in Mechanical Engineering Craft Practice in the past years as reported by NABTEB (2013).

Population

The population for the study consists of all the 484 year II students of mechanical engineering craft practice in all the 15 Technical Colleges in the zones. The choice of the population is informed by the fact that Lathe Machine operation being the focus of the study, is offered only at the beginning of first term through third term of year II hence, the context in which this study was carried out, justified the population. The data regarding the number of technical colleges and students for the study were obtained from NBTE (2007), and school records.

Sample and Sampling Technique

To determine the sample for the study, a two stage random sampling technique was used. The first stage involved the random selection of four technical colleges from the list of nine colleges offering mechanical engineering craft practice at the NTC level and having current NBTE accreditation. Thereafter, one arm of year II from each of the four colleges was randomly selected. The choice of the Year II students was based on the fact that the NBTE (2003) syllabus for Mechanical Engineering Craft Practice prescribes that the aspect of Lathe machining operations which is the focus of this study is taught in the second year in technical colleges.

Finally, of the four arms sselected two were randomly assigned to experimental group and two to control group. The experimental group had 33 students while the control group had 36 students respectively; hence the total sample size for the study was 69. The schools and sample for the study are as follows:

Experimental Group

- Government Technical College, Kaduna 16
- Government Technical College, Bukuru 17

Control Group

- Government Technical College, Kano 19
- Government Technical College, Orozo 17

(Source: NBTE, 2007; School records, 2013)

Development of the Instructional Guide

In order to develop a valid and reliable Practical Skills Instructional Guide (PSIG), the following steps were taken: first after carrying out a critical analysis of the National Technical Certificate (NTC) approved curriculum for Mechanical Engineering Craft Practice (MECP) and several other related literature, a lathe machining operations task specification table was assembled. From this table, seven major instructional elements for each machining operation were generated. The requirement of each of these elements was specified based on the practical content of the NTC in MECP. All the information that learners must know as well as procedures, techniques and tasks which they must be able to perform were assembled into the draft instructional guide.

The outcome of the exercise are the instructional guide as follows:

INSTRUCTIONAL GUIDE FOR TEACHING PRACTICAL

SKILLS IN FACING AND DRILLING OPERATIONS ON THE LATHE MACHINE

FACING OPERATION

General Objective: To guide student in carrying out facing

operation using the lathe machine

Specific Instructional Objective At the end of the lesson the student should be able to:

1. Check lathe alignment and adjust if necessary.
2. Mount lathe chuck accurately and securely
3. Mount cutting tool properly and securely
4. Carry out facing operation to specification

Entry Behaviour. Students should already know:

1. Safety rules in the machine shop
2. Parts and functions of the lathe machine
3. Lathe accessories and cutting tools
4. How to calculate and determine lathe speed and rate of feed

Instructional Materials/Tools

1. 3-jaw self centering chuck
2. Chuck key
3. Cutting tools
4. Tool post/holder
5. Work piece
6. Vernier calipers
7. Screw driver
8. Instructional Guide
9. Block of wood 9" wide (to cover and protect bed ways)
10. Dead centers

Presentation/Instructional Procedure

SN	STEPS OF PROCEDURE	TEACHERS COMMENTS/ACTIVITIES	STUDENTS ACTIVITY

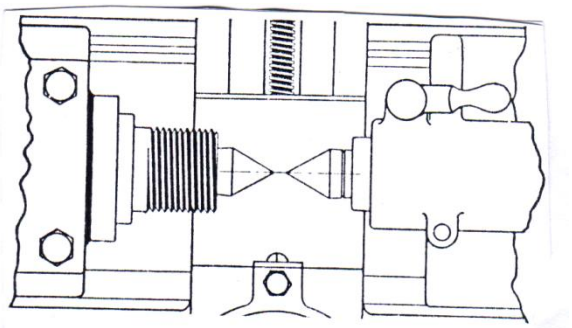
1.	Check the lathe alignment and adjust if not in alignment (see fig. 1 and 2).	Carry out visual inspection of lathe alignment, and adjusts if necessary	Students watch teacher as inspection/adjustment is done.
2.	Use the block of wood to protect the bed ways, and install the 3-jaw chuck securely.	Teacher emphasize safety	To watch and listen
3.	Securely mount the work piece in the 3-jaw chuck.	Work piece over hang not more than 50mm.	To watch and listen
4.	Set the tip of the cutting tool to be in line with the center of the work piece, while the cutting edge of the cutting tool is set at an angle of 80 degrees to the face of the work piece. Then securely mount the cutting tool in the tool post.	Teacher carries out this procedure, ensuring students can clearly see how to do it.	Students should watch and note that the cutting tool is in line with the work piece.
5.	Set the lathe speed to the correct rpm.	Teacher calculates the rpm to the nearest whole number and sets it on the lathe.	Students should observe how the rpm is set on the lathe.
6.	Start the lathe and slowly advance the tool by turning the compound rest knob for a cut that will give the desired surface finish (see fig. 3).	The teacher directs the student's attention to the surface finish.	Students observe and notes the smoothness of the finish.
7.	Stop the lathe and remove the work piece.	Teacher passes round the work piece to students for inspection. Directs students attention to the smooth surface finish.	Students should take note pf the quality of work produced.

Assignment

Students assigned to a lathe machine each; and were required to-obtain the required tools and work piece from the store and carry out a facing operation following the instructional guide.

Evaluation

The teacher should go round to inspect and observe what the students are doing. Encouragement given and correction made with good efforts of the students commended.



Testing lathe centers for alignment.

fig.1

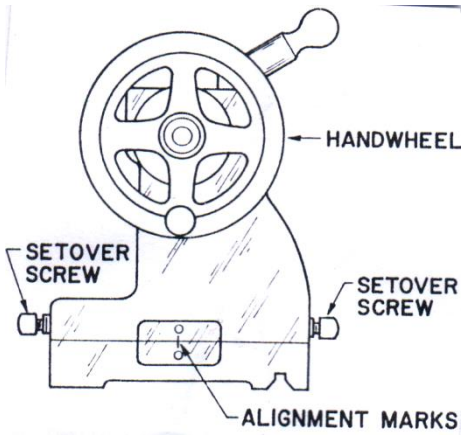
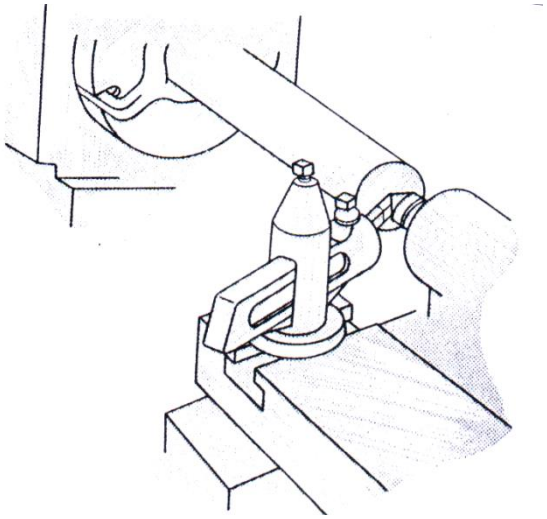


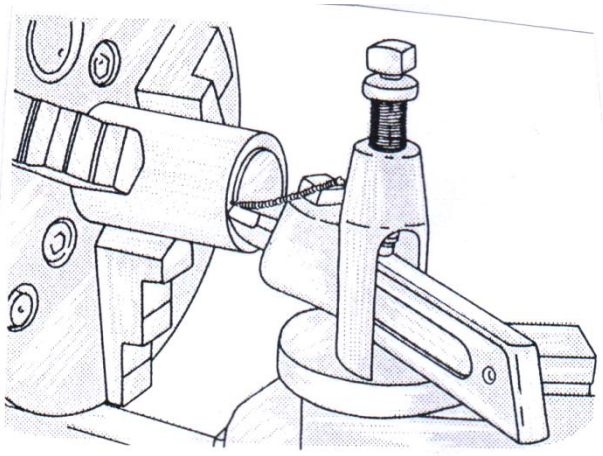
fig. 2



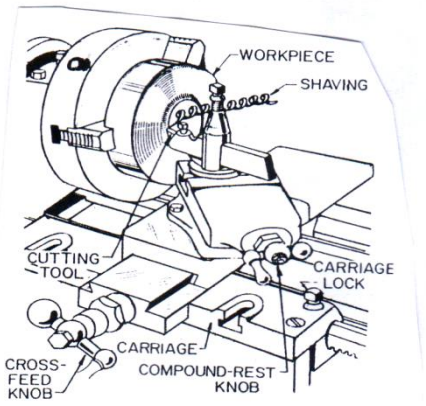
Facing work mounted between centers

Fig.3

Fig.4



Facing stock mounted in a chuck.



UNIT2: DRILLING OPERATION

General Objective : To guide the student in carrying out a drilling operation on the lathe.

Specific Instructional Objectives:

At the end of the lesson the student should be able to

1. set up the lathe machine for center drilling and drilling operation

2. Center drill a hole to specification

3. Drill a hole to specification

Entry Behaviour

Students already know

1. Safety rules in machine shop
2. How to check and adjust lathe alignment
3. Parts and functions of lathe machine and accessories
4. How to calculate and set lathe speeds

Instructional Materials/Tools

1. 3-jaw self centering chuck
2. Center drill
3. Drill bit of the correct size
4. Drill chuck/key
5. Work piece
6. Verniercallipers
7. Instructional guide

Presentation/Instructional Procedure

SN	STEPS OF PROCEDURE	TEACHER ACTIVITY	STUDENT ACTIVITY
1	Check the tail stock alignment. Adjust if necessary		
2	Securely mount the work piece and center it accurately	Emphasis on	Watch and listen
3	Install the drill chuck in the tailstock	Correctly installs the drill chuck safely and rigid.	Watch and listen to explanations
4	Install the center drill in the drill chuck	Carefully show how much over hang is good	Students take note of over hang.
5	Set the lathe speed on a suitable revolutions per minute (rpm)	Calculate the speed and set it on the lathe machine.	Students note how to set the speed on the lathe
6	Advance the tailstock until the tool is about 5mm from the work piece, then clamp the tailstock to the lathe bed.	Gently carry out the procedure, ensuring safety points are stressed.	Students to watch
7	Start the lathe and slowly advance the center drill by turning the tail stock hand wheel until the hole is the correct depth. Stop the lathe (see fig. 4 and 6).		Students watch
8	Remove the center drill and install a straight/tapered shank drill of the appropriate diameter (see fig. 5).		Students inspect and note how deep the center drilled hole should be.
9	Start the lathe and slowly advance the drill by turning the tailstock hand wheel until the hole is the correct depth, using the tail stock graduations/vernier to determine the depth of drilling.		Students watch and note the quality of finish of the drilled hole.

Assignment

Students are assigned to a lathe machine each; and should be required to obtain the required tools and work piece from the store and carry out center drilling and a drilling operation following the instructional guide.

Evaluation

The teacher should go round to inspect and observe what the students are doing. Encouragement given and correction made with good efforts of the students commended.

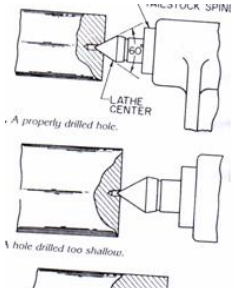


Fig 6

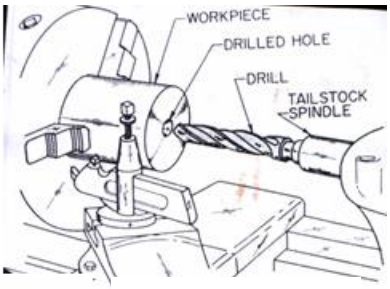


Fig 7

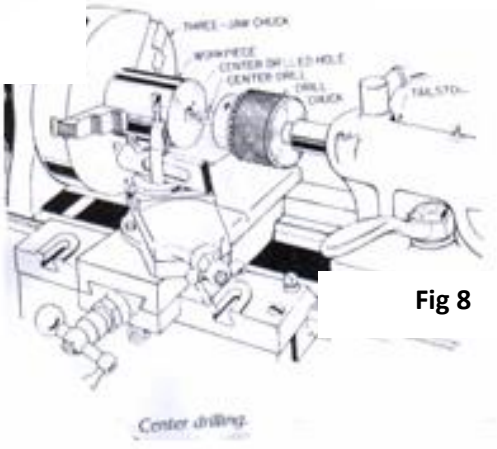


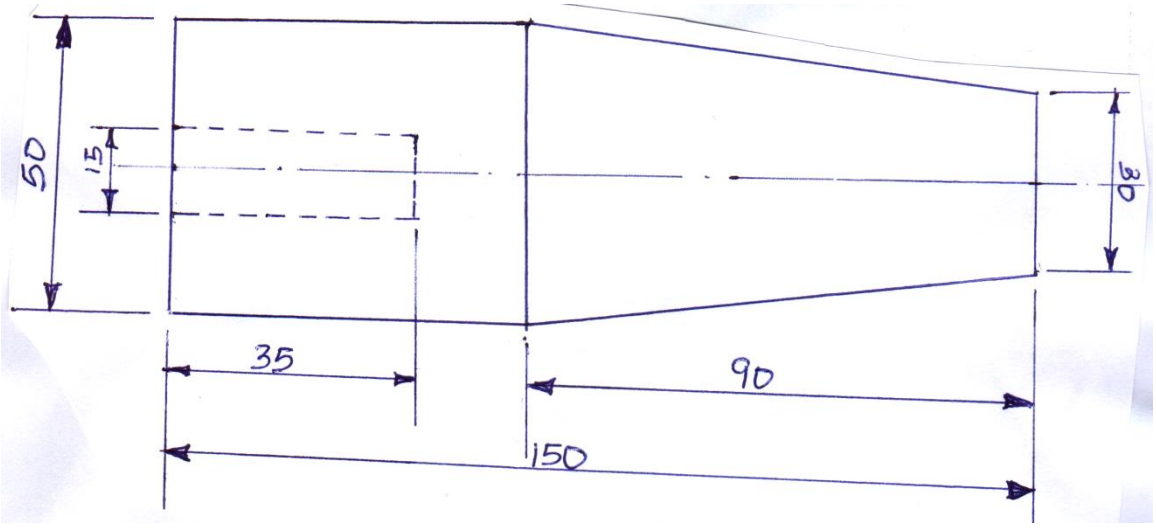
Fig 8

Instrument for Data Collection

The instrument for data collection (a mild steel bar of 30mm diameter by 100mm length) was a Practical Exercise Performance Test (PEPT) designed by the researcher. The PEPT covered facing and drilling operations practical skills expected to be acquired by year II students of mechanical engineering craft practice in technical colleges. The practical testwas designed to assess student's performance in facing and drillingoperations on the lathe machine.

PRACTICAL TEST (FACING & DRILLING OPERATION)

MATERIAL: Carbon Steel
TIME: 3hrs
INSTRUCTION: Using the instructional guide, produce a flat surface and the drilled hold as below.
All dimm.in mm
Tolerance + 0.30mm



Validation of Instrument

The instrument comprising of the practical exercise performance test (PEPT), was subjected to face and content validation by three vocational educators drawn from the Universities and Polytechnics. For this purpose, one was from the Federal University of Technology, Minna and two from Kaduna Polytechnic respectively. Specifically, the experts were requested to examine the practical tests and marking scheme, and advice on its appropriateness to student level, adequate timing, comprehensiveness of marking

scheme, fairness of marks distribution, appropriateness for achieving objectives and clarity of assignment. Observations made by these experts were used in modifying the practical tests and marking scheme.

Reliability of the Instrument (PEPT)

The test re-test method was used to establish the measure of stability of the practical exercise performance test (PEPT). The practical test was administered on 12 year II students of mechanical engineering craft practice in Government Technical College Kajuru in Kaduna State who were not part of the experiment. The second practical test was administered three weeks after the administration of the first test. The tests yielded a reliability index of 0.69 and 0.71 for the first and second tests respectively.

Experimental Procedure

Of the four schools selected for the experiment, two were assigned to the experimental group while the other two were assigned to the control group. The experimental group had a total of 33 students while the control group had 36 students.

The researcher made several visits to the four schools for briefing training and monitoring and to collect the score sheets for the administered test. As a pre – condition for using the instructional guide to teach practical skills and the administration of the test to both control and experimental groups, theory lessons specified in the syllabus for Year II MECP were taught by the teachers. This was done following the school's schedule.

The control group consisting of two classes of year II students in MECP in two different schools were taught using the conventional lesson plan. At the end of each administration of the practical exercise performance test, the projects were assessed by the teachers and the score sheet containing their scores collected by the researcher.

For the experimental group, the procedure for conducting instruction was as follows:

1. A demonstration on how to carry out a facing and drillingoperations for the students was done by the teacher using the lesson guide following the normal school time table (during the 5^{th} 6^{th} 13^{th} 14^{th} 25^{th} and 26^{th} week of the session).
2. Each student was given a copy of the instructional guide as the teacher takes 15 minutes to go over the procedures with the students.
3. Each student was given material needed for carrying out facing, drilling, straight turning, taper turning, knurling, and screw cutting practical exercise on the lathe machine.
4. Using the instructional guide, each student checked out tools required, and followed the guide in setting up for the operation.
5. The teacher went round to assist them and to ensure that the students followed the guide strictly.

6. After each session of work shop activities, the practical test was administered to the students. Each operation is assessed by the teacher before the student proceeds to the next operation. A combination of process and product assessment was adopted as this is the recommendation by technical education experts. To do this, marks were allocated to selection of tools, set up, precision in adjustments, dexterity/competence in carrying out the operation, safety consciousness, and time management.
7. The students submitted their work at the end of the test period.
8. At the end of the exercise, the researcher collected the score sheets and sample of practical tests.

Method of Data Collection

The method for data collection was the Practical Exercise Performance Test (PEPT) designed by the researcher and administered to the students by the teachers. Using the marking scheme as a guide for assessing the practical work done by the students on each of the lathe machining operations, performance scores were generated by the teachers.

Method of Data Analysis

The data for the two research questions of this study were analyzed using mean and standard deviation. The group means were compared and analyzed to indicate the effectiveness of the instructional guide in teaching practical skills in facing and drilling operations on the lathe machine. To make a decision, the group means of both experimental and control groups were compared. If the group mean of the experimental group is higher, then the instructional guide is effective; if however the group mean of the experimental group is lower, then the instructional guide is not effective. The t-test was used to test the two hypotheses at 0.05 level of significance. If t-calculated is found to be greater than the table - t, then there is significant difference, otherwise there is no significant difference.

Presentation and Analysis of Data

The data collected is presented and analyzed as follows:

Research Question 1

What are the mean performance scores of students taught with the instructional guide and those taught using the conventional lesson plan in Facing Operation?

Table 1 answers the research question.

Table 1: Mean performance scores of students taught with the developed practical skills instructional guide and students taught using the conventional lesson plan in Facing Operation.

Group	School	N	Mean	SD	Group Mean	Group SD
Experimental	GTC Kaduna	16	85.00	6.30	81.21	8.57
	GTC Bukuru	17	77.65	9.01		
Control	GTC Kano	19	56.84	3.33	52.50	10.52
	GTC Orozo	17	47.65	3.13		

Table 1 shows the mean scores of students' performance in Facing Operation for both treatment and control groups. The students in the treatment group had a mean score of 81.21, while the control group had a mean score of 52.50. This shows that the mean score for the treatment group is higher than the control group, indicating that those taught with the instructional guide performed better.

Research Question 2

What are the mean performance scores of students taught with the instructional guide and those taught without the instructional guide in Drilling Operation?

Table 2 answers the research question.

Table2: Mean performance scores of students taught with the developed practical skills instructional guide and students taught using the conventional lesson plan in Drilling Operation

Group	School	N	Mean	SD	Group Mean	Group SD
Experimental	GTC Kaduna	16	85.00	5.16	83.33	6.92
	GTC Bukuru	17	81.76	11.98		
Control	GTC Kano	19	56.32	10.54	50.83	13.17
	GTC Orozo	17	44.71	13.23		

Table 2 shows the mean score of students in Drilling Operation for both treatment and control groups. The students in the treatment group had a mean score of 83.33, while the control group's mean score is 50.83. The result indicates that the mean score for the

treatment group was higher than the control group, indicating that those taught with the instructional guide performed better.

Hypotheses

The two hypotheses formulated for the study were tested at 0.05 level of significance and the results are presented below.

Hypothesis 1

There is no significant difference in the mean performance of students taught facing operation with the instructional guide and those taught with conventional lesson plan.

Table 3: The t-test showing difference between students taught with instructional guide and those taught with conventional lesson plan in Facing Operation

Group	N	Mean	StdStd Deviation	Mean Error	Difference	df	t	Decision
Exp.	33	81.21	8.57	1.49				
					28.71	67	12.35	Significant
Control	36	52.50	10.52	1.75				

The data presented in table 3 indicates that there is a significant difference in the mean score performance of students taught with instructional guide and those taught with conventional lesson plan in Lathe Machine Facing Operation (t-cal > .05). Therefore, the null hypothesis of the difference in the mean performance of the treatment and control groups is rejected.

Hypothesis 2

There is no significant difference in the mean performance of students taught drilling operation with the instructional guide and those taught with conventional lesson plan.

Table 4: The t-test of difference between students taught with instructional guide and those taught with conventional lesson plan in Drilling Operation

Group	N	Mean	StdStd Deviation	Mean Error	Difference	df	t	Decision
Exp.	33	83.33	6.92.57	1.21				
32.50	67	12.66	Significant					
Control	36	50.83	13.17	2.20				

The data presented in table 4 indicates that there is a significant difference in the mean score performance of students taught with instructional guide and those taught with the conventional lesson plan in Lathe Machine Drilling Operation (t-cal > .05). Therefore, the null hypothesis of the difference in the mean performance of the treatment and control groups is rejected.

Summary and Discussion of Findings

The following are the major findings of this study, based on the data obtained

through the stated research questions and hypotheses.

1. The mean performance of students taught with the instructional guide in Facing Operation is 81.21, while the mean performance of students taught with conventional lesson plan is 52.50. Therefore, the Instructional Guide is effective for teaching practical skills in Facing Operation.

2. The mean performance of students taught with the instructional guide in Drilling Operation is 83.33, while the mean performance of students taught with conventional lesson plan is 50.83. The Instructional Guide is therefore effective for teaching practical skills in Drilling Operation.

The findings of the study are discussed below in the same order in which the two research questions were arranged. Based on the above, discussions of the findings are arranged under the following subsections: Facing, Drilling.

Facing

Facing Operation is one of the simplest operations that can be done due to its few and less complicated steps. All other machine operations are built on the successful completion of this simple yet important operation. The operation involves four basic steps; namely (1) mounting and clamping the work securely and at the appropriate length

of overhang, (2) holding securely the tool in the tool post (3) setting the cutting edge of the tool at 90^0 to the center line of the lathe spindle and, (4) feeding the tool into the work. Although the mean difference of 28.71 in performance of the groups is wide, their mean performance (treatment group 81.21, and control group 52.50) is within acceptable range. This does not come as a surprise, because it is in line with the assertion of Repp& McCarthy (1986), that Facing Operation, with its few steps and less complicated steps, is one of the simplest operations that a beginner-learner can perform on the Lathe Machine with minimal effort. However, it would be noticed that a better performance is achieved with the treatment group due to the effect of the instructional guide. The instructional guide therefore, with its emphasis on following detail instruction on performing an operation (Ogwo and Oranu, 2006), had a positive influence on the performance of students in facing operation.

Drilling

Drilling has three steps in carrying out the exercise namely (1) securing the work piece, (2) securing the tool bit (drill), and (3) feeding the drill into the work by manipulating the tailstock spindle to the desired depth. The mean performance of the treatment group is 83.33 and the control group is 50.83. This indicates a mean difference of 32.50. The difficulty level of carrying out a drilling operation is not high due to the few steps involved in the operation. However, the positive effect of the instructional guide is very clear on the treatment group. This finding is in agreement with the theoretical assertion of Baird (1986) that the less the operational steps involved in carrying out a practical work, the easier and better the performance of the trainee in the particular exercise.

Conclusion

Based on the outcome of the study, which shows that the mean performance of 81.21 for students taught facing operation and 83.33 for students taught drilling operation with the instructional guide is superior to the mean performance of 52.50 for students taught facing operation and 50.83 for those taught drilling operation with conventional lesson plan.This superior performance consistent in the two machine operations cannot be said to have occurred by chance, but rather due to the truthfulness and effectiveness of the instructional guide.

Educational Implications of the Study

The results of the study have far reaching implications in the process of teaching and learning of practical skills in general and in mechanical engineering craft practice in particular. The developed guide has provided a readily available instructional guide of high quality for use by technical teachers in teaching these basic yet important skills in mechanical engineering craft practice. It is therefore expected that these teachers may now be able to use the developed instructional guide to teach practical skills much better. The findings of this study could also serve as an initial input into the development and implementation of very functional instructional guides in various technical, vocational and

technology teacher programs of higher institutions for preparing them in skill acquisition occupations.

Recommendation

Based on the findings of this study and the implications, it is recommended that:

The National Board for Technical Education (NBTE), should consider introducing the instructional guide as a standard instructional guide for the implementation of a uniform instructional strategy in teaching these skills in mechanical engineering craft practice in technical colleges.

References

Baird, R.J. (1986). Contemporary industrial teaching solving everyday problems. South Holand, III.The Good heart – Wilcox Co. inc. publishers.

Bralla, J. R. (1997). Machining. The Encyclopedia of Science and Technology, 220 – 224) New York: McGraw Hill.

Danjuma, E. (2004). The level of improvisation of instructional materials in secondary schools in Biu and Hawul LGA of Borno State. Waka Journal of Vocational Education, Arts and Science Studies (WAJOVEASS). 1 (April 2004).

Federal Republic of Nigeria (2004): National Policy on Education (4th Edition). Lagos, Nigeria: Federal Government Press.

Fraenkel, J.R. &Wallen, N.E. (2000).How to design and evaluate research in education. Boston. McGraw-Hill

National Board for Technical Education (2007). Revised Curricula for Technical Colleges and Polytechnics. Kaduna. NBTE

National Business and Technical Examination Board (2004). Chief examiners report. Benin. NABTEB

Ogwo, B.A. and Oranu, R. N (2006).Methodology in formal and non-formal Technical/Vocational Education.Nsukka.University of Nigeria Press Ltd.

Okoro, O.M. (2006). Principles and Methods in Vocational and Technical Education. Nsukka, University Trust Publishers.

Olorunshelu, R.O. (2011). Introductory Technology. A means toward industrialization

of Nigeria. *Education today* 3 (4), 31 – 35.

Osagie, V. A. (1997). Vocational/Technical Education in the Primary School in Nigeria: A Myth or a Reality, *TNTT.* 5 (1&2), August, Kaduna: NCCE.

Repp, V.E. and McCarthy, W.J. (1984).Machine Tool Technology. Bloomington: McKnight pub.Co.