Practical Skill Improvement Needs of Mechanical Craft Teachers in Teaching Grinding and Boring Practices in Technical Colleges in South-East Nigeria

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Abstract
The study determined practical skill improvement needs of mechanical craft teachers in teaching grinding and boring skills in technical colleges in south-east Nigeria.Two research questions were raised and two null hypotheses were tested for the study. The study adopted descriptive survey research design. The entire population for the study was 134 which comprised 80 teachers and 54 instructors in technical colleges in South-East Nigeria.A structured and validated questionnaire containing 14 items with two response columns of required and performance was used for data collection. Cronbach alpha formula was used to determine the internal consistency of the questionnaire items which yielded an overall reliability coefficient of 0.83. The researchers administered the instrument with the help of five research assistants to the respondents.Data collected were analysed using weighted mean and improvement need index for both required and performance categories of the instrument in order to answer the research questions. The t-test was used to test the null hypotheses at 0.05 level of significance. The study found thatmechanical craft teachers and instructors in technical colleges in South-East Nigerianeed practical skill improvement in teaching grinding and boring skills. In addition, the study revealed that there was no significant difference between the mean responses of mechanical craft teachers and instructors on practical skill improvement needs in teaching grinding and boring skills in technical colleges in South-East, Nigeria. The study concluded that mechanical craft teachers and instructors in technical colleges in South-East Nigeria need practical skills improvement in grinding and boring practices in order to adequately prepare students to start their own workshop upon graduation. It was recommended among others that technical colleges in South-East Nigeria should foster closer ties with industries to enable students acquire practical grinding and boring skills since technical schools may not have all the needed facilities and machines for learning these skills.
Keywords. Technical colleges, mechanical craft, practical skill, grinding, boring.

Introduction

In Nigeria, technical college, now known as Government Science and Technical College (GSTC) is a specialized educational institution established for the teaching and learning of trade and modular courses as well as general education and science subjects. Technical colleges in Nigeria are established to produce craftsmen at the craft (secondary) level and technicians at the advanced craft (post-secondary) level for the nation industrial economy and technological development. In the same vein, Shodeinde and Yisa (2019) averred that technical college is a section of technical and vocational education designed to produce craftsmen and master craftsmen in various trade skill areas. Mechanical craft practice trade is one of the skill trades in technical colleges in which students are examined by the National Business and Technical Examination Board (NABTEB) for the award of National Technical Certificate (NTC) and the Advanced National Technical Certificate (ANTC).

In Nigerian technical colleges, mechanical craft practice trade defines trades that are having complete bearing with metal welding/forming and or servicing/repairs of machines or machine related equipment and appliances (Saue, 2020). According to Bassey and Saue (2021), mechanical engineering education is the most liberal of all engineering fields, with the broadest applicability and most flexibility in terms of occupations. It is the combination of automobile and metalwork technology which is designed to equip learners with the technical know-how and skills in automobile maintenance, repairs, troubleshooting and develop learners' skills in forging, cutting, joining and machining work among others (Olaseni and Olawale, 2016). The essence of mechanical craft practice trade in technical colleges is to expose students to art and science of fabrication of spare parts to specifications; carrying out routine maintenance of equipment and tools. Explicitly, Amaechi and Thomas (2021) submitted that mechanical craft practice trade provides a post primary training and practical proficiency in machining practices; which includes drilling, milling, shaping, planning and slotting, grinding and boring. These machining practices will help graduates of mechanical craft practice trade in technical colleges to handle different machine models and types in mechanical workshops (Aleru and Logbene, 2021).

The teaching of drilling, milling, shaping, planning and slotting, grinding and boring practices by mechanical craft teachers in technical colleges will enable graduates to excel in workshops where metal or wood working tasks are performed. The study focused on grinding and boring practices because the acquisition of these machining skills would encourage mechanical craft practice trade students to set up entrepreneurial ventures in mechanical technology.Grinding is the process of reducing some rough edges or surfaces of metallic components by the use of a grinding wheel attached to a grinding machine. Beako (2017) averred that grinding is used to remove small amounts of material from both flat surfaces and cylindrical shapes. Through grinding process, three achievements are made in production engineering namely; a high degree of accuracy, a high degree of surface finish and hardness to resist wear (Okorieocha, Beako & Ojotule, 2018). These achievements have been led to the extensive use of grinding process in modern technology especially as the functional requirement of many components demand quality of working surfaces that can hardly be produced by other metal-cutting processes (Onuotu, Nokara and Olumba, 2018).

Grinding operations are carried out with grinding machines but boring machines are the principal machine tools used in boring operations. Boring is the process of enlarging an existing hole. Aleru and Logbene (2021) posited that boring involves the machining of an internal surface of a hole to increase its diameter, this can be performed by either turning the work piece on a lathe (also called internal turning), or a mill where a tool is rotated around the circumference of the hole. Boring machines come in several variations depending on the size of the work. A vertical boring mill is used to machine very large, heavy castings where the work turns while the boring bar is held stationary (Amaechi and Thomas, 2020). Horizontal boring mills and jig borers hold the work stationary and rotate the cutting tool. The boring cutter typically uses a single point to machine the side of the hole, allowing the tool to act more rigidly than a drill bit (Bassey and Saue, 2021). Cored holes in castings are usually finished by boring.

Evidently, machining practices such as grinding and boring practices require practical skills before they can be carried out in machine shops. Practical skill is the ability to perform certain functions without errors. Ali, Yashim and Chimen (2022) defined practical skill as the dexterityof accomplishing responsibilities with a combinationof smoothness, speed and accuracy. Practical skill is a learned capacity to carryout professional tasks with minimum

outlay of time, energy or both. According to Ezugu, Bala and Muhammad (2023), practical skills are sets of abilities or knowledge used to perform sophisticated tasks in the areas of science, technology and engineering. The authors further stressed that practical skills refer to specialized knowledge and expertise needed to accomplish complex actions, tasks, and processes relating to computational and physical technology among other endeavours. Therefore, practical skills are hands-on attributes that mechanical craft teachers must possess and master in the classroom for effective teaching to take place. In the context of this study, practical skills are technical skills required by mechanical craft teachers and instructors for effective teaching of grinding and boring practices to their students in technical colleges.

It is expected that graduates of mechanical craft practice trade in technical colleges are competent in carrying practical drilling and milling practices needed in industrial sector of the economy. The interaction of the researcher with some students of mechanical craft practice trade in technical colleges in South East, Nigeria revealed that mechanical craft practice trade teachers are not exposing them sufficiently to practical grinding and boring practices. Maliki and Ezekiel (2022) reported that most graduates of mechanical craft practice trade in Nigeria are unable to set up their own businesses nor are they self-employed immediately after graduation, rather they work as apprentices for some years before they can fully establish their own businesses.

This suggests that, in order to prepare students for the entrepreneurial engagements in the labour market upon graduation, mechanical craft practice trade teachers and instructors in technical colleges need practical skills improvement for teaching different machining practices.Literally, need is something that is not readily available while improvement is the art of building upon something that is acquired or possessed to a more advanced or effective level. The need for improvement always arises when there is a gap to fill (Abusomwan and Osaigbovo, 2020). The need for improvement is therefore, a robust exercise used to compare perceived performance with actual performance. In this study, improvement is the process of increasing the proficiency level of mechanical craft practice trade teachers and instructors in the area of machining practices. In the context of this study, the end result of carrying out improvement needs exercise is to facilitate the acquisition of skills to a standardized level where mechanical craft practice trade teachers and instructors can effectively teach practical machining practices to students in technical colleges. Thus, skill improvement needs can be expressed as identifying the practical grinding and boring skills possess by mechanical craft practice trade teachers in technical colleges and the updated skills, they need to possess thereby generating gaps that are to be filled when they are re-trained.

That is, skill improvement needs show the discrepancy between a current state of affair and a desired future state in the sense that mechanical craft practice trade teachers and instructors in technical colleges in South East, Nigeria are assessed to demonstrate the practical grinding and boring skills they possess and the machining practices they were expected to possess. Hence, Ogbonna (2020) averred that skill improvement needs is not concerned with what is but what it should be. Ali, Yashim and Chimen (2022) submitted that skill improvement needs is the process of strengthening and equipping teachers and instructors with the content, knowledge, skills, access to information and training that will enhance their professional performances in an efficient and effective way.Withreference to thisstudy, skill improvement needsconnote the performancegaptobefilledbymechanical craft teachers and instructors in technical colleges in order to teach their students practical grinding and boring skills.

It therefore becomes imperative to examine the current skill improvement

needs of mechanical craft teachers and instructors in teaching grinding and boring practices in technical colleges in South East, Nigeria. Adequate classroom teaching and laboratory exposure of students to the different practical grinding and boring skills in technical colleges require the efforts of mechanical craft practice trade teachers and instructors. Mechanical craft teachers and instructors were selected for the study because mechanical craft teachers throw sufficient light on the what to do aspects of the subject matter while an instructor throws more light on the how to do aspects of the subject. Technically, if mechanical craft teachers and instructors in technical colleges are not skilled in grinding and boring practices, they will produce graduates of the mechanical craft practice trade who cannot diagnose and perform maintenance and repair of engines and machines in the society. Against this backdrop, this study sought to find out the practical skill improvement needs of mechanical craft teachers for teaching grinding and boring practices in technical colleges in South East States of Nigeria.

Statement of the Problem

Mechanical craft practice trade involves the acquisition of skills to produce, assemble and fit machine components together. The Nigerian government has done much to improve the quality of mechanical craft practice trade in technical colleges by procuring machines, engines, tools and equipment and providing in-service training opportunities for mechanical craft teachers and instructors. Despite these developments, there is a growing concern among industrialists that mechanical craft practice trade graduates of Nigerian technical colleges do not seem to possess the requisite practical skills for employment in the industry. Based on different interactions with employers of labour in South East, Nigeria, the researcher noted that graduates of mechanical craft practice trade lack machining skills to secure jobs and compete in today's complex industrial environment.

The problem of the study is that the initial training received by mechanical craft teachers and instructors during their teacher education programmes could limit their ability to teach practical grinding and boring skills to students in technical colleges in South East, Nigeria because new and more sophisticated machines and engines are manufactured for use in the society. Grinding and boring skills cannot be acquired by students, if they are not adequately taught by their teachers and instructors in technical colleges. This situation necessitated the study to explored practical skill improvement needs of mechanical craft teachers and instructors in technical colleges in South-East Nigeria in teaching grinding and boring practices, otherwise unemployable graduates will continue to be produced.

Purpose of the Study

The purpose of this study was to investigate practical skill improvement needs of mechanical craft teachers in teaching machining practices in technical colleges in South East States of Nigeria. Specifically, the study determined the practical skill improvement needs of mechanical craft teachers and instructors in teaching:

1. Grinding practice in technical colleges in South-East Nigeria
2. Boring practice in technical colleges in South-East Nigeria.

Research Questions

The following research questions guided the study

1. What is the practical skill improvement needs of mechanical craft teachers and in instructors in teaching grinding skill in technical colleges in South-East Nigeria?
2. What is the practical skill improvement needs of mechanical craft teachers and instructors in teaching boring skill in technical colleges in South-East Nigeria?

Hypotheses

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

1. There is no significant difference in the mean responses of mechanical craft teachers and instructors on practical skill improvement needs in teaching grinding

practice in technical colleges South East, Nigeria

2. There is no significant difference in the mean responses of mechanical craft teachers and instructors on practical skill improvement needs in teaching boring practice in technical colleges South East, Nigeria

Methodology

The study adopted descriptive survey research design. The researchers chose this research design for the study because the study surveyed the opinions of mechanical craft teachers and instructors in technical colleges in South-East Nigeria regarding the practical skill improvement needs for teaching grinding and boring practices in technical colleges with the use of a questionnaire.The population for the study comprised 134 mechanical craft teachers and instructors in the 11 government technical colleges offering mechanical craft in South-Eastern states. This was made up of 80 teachers and 54 instructors.The entire population was studied.

A structured and validated questionnaire containing 14 items was used for data collection. Clusters B1 and B2 of the questionnaire have response column with two categories of response scales of required and performance. The required category scale had five point response scales of Very Highly Required (VHR), Highly Required (HR), Moderately Required (MR), Slightly Required (SR) and Not Required (NR) with corresponding values of 5, 4, 3, 2 and 1. The performance category scale had five point response scales of Very High Performance (VHP), High Performance (HP), Average Performance (AP), Low Performance (LP) and Not Performance (NP) with corresponding values of 5, 4, 3, 2 and 1. That is, the mechanical craft teachers and instructors were asked to rate the extent each skill item was required and the extent they could perform each skill item if asked to do so. Then, the mean of their performance was subtracted from the mean of the required, the difference constituted the improvement gap which could be filled by re-training them.

The instrument for data collection was subjected to face validation by three experts; two experts in technology and vocational education and another in educational foundations all from Nnamdi Azikiwe University, Awka. The reliability of the instrument was determined through a pilot test.Fifteen copies of the instrument were administered to 15 mechanical craft teachers and instructors in Delta and Edo States in South-South, Nigeria who were not part of the research population. Data collected were analyzed using Cronbach alpha formula to determine the internal consistency of the questionnaire items and co-efficience of 0.91 and 0.74 for clusters B1 and B2 were obtained with an overall reliability co-efficient of 0.83. A total of 134 copies of the questionnaire were administered to the respondents in their offices personally by the researchers with thehelp of five research assistants. The distribution and collection of copies of the questionnaire lasted for two weeks. Out of the 134 copies of the questionnaire administered, 122 copies (representing 91 percent) were successfully retrieved and used for data analysis.

Data collected from the respondents was analysed using weighted mean and improvement need index for both required and performance categories of the instrument in order to answer the research questions. In taking the decision, the following steps were followed:

1) The weighted mean of each item under the required column was calculated (X_R)

2) The weighted mean of each item under the performance column was also calculated (X_P)

3) As (Adapted from Olaitan and Ndomi, 2000), the difference between the two means for each item (X_R-X_P) was determined for decision making on the practical skill improvement needed by mechanical craft teachers and instructors thus:

Where the difference was zero, (0), there was no need for skill improvement

because the level at which the skill was required was equal to the level at which mechanical craft teachers and instructors could perform the skill

Where the difference was positive (+), there was need for skill improvement because the level at which the skill was required was greater than the level at which mechanical craft teachers and instructors could perform the skill

Where the difference was negative (-), there was no need for skill improvement because the level at which mechanical craft teachers and instructors could perform the skill was greater than the level at which the skill was required.

The t-test was used to test the null hypotheses at 0.05 level of significance. A hypothesis was accepted where the p-value is greater than the alpha level of 0.05 ($p > 0.05$), at an appropriate degree of freedom; otherwise, the null hypothesis was rejected. Data collected were analysed using SPSS version 23.0.

Results

The results were presented in tables in line with research questions and hypotheses.

Table 1: **Mean and standard deviation of responses of respondents on practical skill improvement needs in teachinggrinding practice in technical colleges in South-East Nigeria**

S/N	Statements Ability to;	$\overline{x_r}$	$\overline{x_p}$	$(\overline{x_r} - x_p)$	Decision
1.	mount the wheels correctly on the grinding machine	3.53	3.99	-0.46	NIN
2.	firmly secure the abrasive wheel on the grinding machine	4.24	3.76	0.48	IN
3.	inspect the flaws of cracks on the grinding machine	3.12	3.70	-0.58	NIN
4.	determine fractures on the wheel	3.36	3.81	-0.45	NIN
5.	test to see if the wheel runs through at the central axis (wheel balancing)	4.00	3.52	0.48	IN
6.	use grinding machine vice	3.65	2.83	0.82	IN
7.	clamp work directly on the table during grinding operations	2.79	1.95	0.84	IN
8.	use special fixtures during grinding operations	2.81	2.14	0.67	IN
9.	determine the appropriate speed to run the grinding machine	4.03	3.88	0.15	IN
10.	select the right grinding wheel for the right work	4.26	4.47	-0.21	NIN
	Grand Mean	**3.58**	**3.41**	**0.17**	**IN**

N = 122; X_r= Mean of required skill level; X_p= Mean of performance level; *Xr– Xp*= Skill Improvement need index; In=Improvement Needed; NIN= No Improvement Needed.

Data in Table 1 reveal that the performance gap value of seven skills items ranged from 0.15 to 0.84 and were positive while four skills items have negative values

ranged from -0.21 to -0.58. The Table summarizes that mechanical craft teachers and instructors need practical skill improvement in teaching grinding practice in technical colleges in South-East Nigeria.

Table 2: Summary of t-test analysis of the mean responses of respondents on practical skill improvement needs in teaching grindingpractice in technical colleges South East, Nigeria

Variable	N	$\bar{x}$	SD	df	t-value	p-value	Decision
Teachers	73	4.33	2.06	120	1.110	0.263	Not Significant
Instructors	49	3.81	1.74				

Table 2shows that there is no significant difference between the mean responses of mechanical craft teachers and instructors on practical skill improvement needs in teaching grinding practice in technical colleges South East, Nigeria. This is shown by the p-value of 0.263, which is greater than the significance level of 0.05. The null hypothesis of no significant difference between the two groups is therefore accepted.

Table 3: Mean and standard deviation of responses of respondents on practical skill improvement needs in teachingboring practice in technical colleges in South-East Nigeria

S/N	Statements Ability to;	$\overline{x_r x_p}$	$\overline{(x_r - x_p)}$	Decision
1.	hold work piece on the boring machine table	4.63	4.14	0.49 IN
2.	carry out simple maintenance on boring machine	4.28	3.90	0.38 IN
3.	Ability to ensure that the boring tool and work piece are properly aligned in order to produce symmetrically round holes	3.52	3.07	0.45 IN
4.	carry out repairs on boring machine	4.09	3.86	0.23 IN
	Grand Mean	**4.13**	**3.74**	**0.39 IN**

N = 122; X_r= Mean of required skill level; X_p= Mean of performance level; *Xr– Xp*= Skill Improvement need index; In=Improvement Needed

Data in Table 3reveal that the performance gap value of all the four skills items ranged from 0.23 to 0.49 and were positive. The Table summarizes that mechanical craft teachers and instructors need practical skill improvement in teaching boring practice in technical colleges in South-East Nigeria

Table 4: Summary of t-test analysis of the mean responses of respondents on practical skill improvement needs in teaching boringpractice in technical colleges South East, Nigeria

Variable	N	$\bar{x}$	SD	df	t-value	p-value	Decision
Teachers	73	4.66	2.39	120	1.215	0.130	Not Significant
Instructors	49	4.18	2.13				

Table 4shows that there is no significant difference between the mean responses of mechanical craft teachers and instructors on practical skill improvement needs in teaching boring practice in technical colleges South East, Nigeria. This is shown by the p-value of 0.130, which is greater than the significance level of 0.05. The null hypothesis of no significant difference between the two groups is therefore accepted

Discussion of findings

The outcome of the study revealed that mechanical craft teachers and instructors in technical colleges in South-East Nigerianeed practical skill improvement in teaching grinding practice. The study indicated that mechanical craft teachers and instructorsin technical colleges in South-East Nigerianeeded practical skill improvement in the ability touse special fixtures during grinding operations, determine the appropriate speed to run the grinding machine, test to see if the wheel runs through at the central axis (wheel balancing), use grinding machine vices, clamp work directly on the table during grinding operations and firmly secure the abrasive wheel on the grinding machine. The finding of this study agrees with Bassey and Saue(2021) that teachers and instructors needed practical skill improvement for carrying out grinding machinesoperations. The fact that mechanical craft teachers and instructorsin technical colleges in South-East Nigeria needed practical skill improvementin teaching grinding practice means that mechanical craft teachers and instructors need to improve their skill base on grinding operations because grinding is an importantmachining process for improving the finishing surface of metals

In addition, the study revealed that there was no significant difference between the mean responses of mechanical craft teachers and instructors on practical skill improvement needs in teaching grinding practice in technical colleges South East, Nigeria. This finding means that mechanical craft teachers and instructorsin technical colleges in South-East Nigeriashared the same position on practical skill improvement needsin teaching grinding practice. This finding supports,Maliki, Yashim and Jamous (2022) who reported no significantdifference in the mean responses of the technicalteachers and instructors on skill improvement needs of technical teachers in grinding practicein technical colleges.The researchers are of the opinion that mechanical craft teachers need practical skill improvement in teaching grinding practice because grinding is a machining method that removes small amounts of material from both flat surfaces and cylindrical shapes.

Furthermore, the findings of the study showed that mechanical craft teachers and instructors in technical colleges in South-East Nigerianeed practical skill improvement in teaching boring practice. The study indicated that mechanical craft teachers and instructorsin technical colleges in South-East Nigerianeeded practical skill improvement in the ability to hold work piece on the boring machine table, carry out simple maintenance on boring machines, carry out repairs on boring machines and ensure that the boring tools and work pieces are properly aligned in order to produce symmetrically round holes. This finding is consistent with Aleru and Logbene (2021) who reported that mechanical craft teachers and instructorsneed skill improvement in

boring practices. The fact that mechanical craft teachers and instructorsin technical colleges in South-East Nigeria needed practical skill improvement in teaching boring practicesmeans that mechanical craft teachers and instructors are not competent in refining the dimensions and accuracy of a drilled hole.

Additionally, the study disclosed that there was no significant difference between the mean responses of mechanical craft teachers and instructors on practical skill improvement needs inteaching boring practice in technical colleges South East, Nigeria.This finding means that mechanical craft teachers and instructorsin technical colleges in South-East Nigeriacollectively agree that they needed practical skill improvementin teaching boring practice. The findings corroborate the findings ofMaliki, Maidawa, Jamous and Mattew (2022)who reported no significant difference between the mean responses of mechanical craft teachers and instructors on boring skills needs of mechanical engineering craft practice teachers. The researchersare of the opinion that mechanical craft teachers and instructorsin technical colleges in South-East Nigeria collectively agree that they needed practical skills improvement in teachingboring practices because it is a machining practice used for engine shafts, gun cylinders and turbine cylinders.

Conclusion

From the findings of this study, it is concluded that mechanical craft teachersand instructors in technical colleges in South-East Nigeria need practical skills improvement in grinding and boring practices in order to adequately prepare students to start their engineering venture upon graduation.

Recommendations

Based on the findings of the study, the following recommendations are made.

1. Mechanical craft teachers and instructors should attend workshops/seminars regularly to keep abreast with the current happenings in grinding and boring practices in order to adequately prepare their students for effective performance in machine shops
2. The skill improvement in grinding and boring practices needed by mechanical craft teachers and instructors should be integrated into mechanical engineering craft practice by curriculum planners in technical colleges to enable teachers acquire practical machining skills required in machine shops
3. Administrators of technical colleges in South-East Nigeriashould through the science and technical schools' management board, set in motion a process for providing in-service training to mechanical craft teachers and instructors who need skill improvement in grinding and boring practices.
4. Technical colleges in South-East Nigeria should foster closer ties with industries to enable students acquire practical grinding and boring skills since technical schools may not have all the needed facilities and machines for learning these skills.

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