



MILLING MACHINE OPERATIONAL SKILLS REQUIRED BY METALWORK FACILITATORS FOR EFFECTIVE PRODUCTION OF READY-TO-WORK GRADUATES IN TERTIARY INSTITUTIONS IN RIVERS STATE, NIGERIA

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ABSTRACT: *The study investigated milling machine operational skills required by metalwork facilitators for effective production of ready-to-work graduates in tertiary institutions in Rivers state. The study adopted descriptive survey design. The population of the study was 174 respondents which comprised 67 metalwork facilitators (43 lecturers and 24 instructors) and 107 final year students of Metalwork/Mechanical Technology department. No sampling was done as the population was manageable; therefore, census technique was adopted. Two research questions and two hypotheses were formulated. A survey questionnaire was developed to elicit responses from the respondents. The instrument was validated by two experts in the Department of Vocational and Technology Education, Rivers State University, Port Harcourt. The reliability of the instrument was established using Cronbach Alpha Reliability Coefficient which yielded a reliability index of .84. Statistical Mean was used to answer the research questions while standard deviation was used to determine the homogeneity in the responses of the respondent and z-test was used to test the null hypothesis at .05 significance level. The study found among others that skills prepare metalwork facilitators to contribute meaningfully to their area of specialty, help individuals to be outstanding, and prepare graduates to be ready-to-work. It was recommended that from time to time, there should be on-the-job training for all the skills facilitators in metalwork technology on the operation of the various machines in the workshop to enable them contribute meaningfully to student's skills acquisition in the area of study; accuracy in machine operation should also be enacted as criteria for metalwork facilitators promotions, to effectively produce ready-to-work metalwork graduates in tertiary institutions in Rivers state.*

KEYWORDS: Milling, Operational skills, Metalwork facilitators, Ready-to-work.



INTRODUCTION

Tertiary institutions are places where students are trained to acquire relevant knowledge and practical skills in different occupations for employment in the world of work. Tertiary institutions involve so many fields of study including technical or industrial education, mechanical engineering which metalwork is part and parcel of, among others. Ehimen and Ezeora (2010) opined that metalwork practice is one of the courses in technical education or engineering which aims at training skilled labor for self-employment or paid jobs. Metalwork as a field is aimed at introducing and equipping her learners to an activity that they can make do with in their future occupation. This field of study comprises other sub-modular trades or areas components such as machine shop practice, welding and fabrication, forging, heat treatment, and foundry practices. Nwoke and Ogwo in Ede and Anyo (2015) explained that metalwork involves activities that entail designing, processing, and welding, considering the various importance of metalwork to everyday life and also the overall objective of technical education in which metalwork is part, offers training in skill for self-reliance, self-sufficiency and employment into the world of work. Metalwork and its practical skills become an important field to be taught to students. More so, Affero, Hassan, Alias and Hamzah (2016) pointed out that study areas in this field are a bit different from the existing educational system as metalwork is more on hand and practical activities. Hence, the practical knowledge of the knowledge facilitators (teachers) often becomes a major concern. This suggests that every teacher that teaches metalwork courses must clearly understand that teaching a course in this field is not just always imparting theory but also guiding the learners into practical understanding. This will give the learners a firm grip of the practical and applied skills. Metalwork knowledge facilitators, therefore, are crucial components of the educational system because no organized learning can take place without good practical oriented teacher(s). Kennedy (2011) said, a teacher who is not currently in tune with the skills to effectively operate the various machines in the metalworking shop for effective teaching is dangerous to the system.

The relevance of metalwork facilitators' practical skills cannot be over emphasized, as Udo (2015) explained that acquisition of appropriate skill abilities and competencies both mental and physical are important for all Nigerians to live and contribute to the development of their area of specialty and the society at large. It equips individual for self-reliant; it makes them to be fulfilled in the labor market (Ezeani, 2012); it prepares metalwork graduates to be ready-to-work; it prepares an individual to use their knowledge expertly; it prepares personal greatness, helps to reduce criminal activities and as well help the individuals to engage in productive work; it helps to make the individual intelligent user of the products of technology as well as the most reliable vehicle for economic prosperity and diplomatic supremacy of the nation. Benson and Obiukwu (2014) opined that skills are not a person's fundamental, innate capacities but must be developed through training, practices and experiences.

Milling machine is a machine tool in which a horizontal arbor or vertical spindle rotates a cutting tool above a work piece. The machining process is that in which the removal of metal takes place due to the cutting action of a rotating milling cutter. In a milling machine, the cutter is rotated due to the workpiece being fed against it. This machine can hold more than one tool at a time. The cutter rotates at high speed and because of the many cutting edges, it removes metals at a very fast rate. Milling machine is one of the most important machines in the workshop. With the machine, all the operations can be performed with high accuracy; the metal



removal rate is high as compared to a lathe, planner machine, and shaper machine. It has accuracy and a better surface finish. This is why a milling machine finds wide application in production work, and is widely used in manufacturing industries after the lathe machines.

To effectively use the milling machine, teachers must possess a certain level of competency on the relevant technical skills. Adesanmi, Vanduha, Balogun and Mohammed (2020) stated that the bane of the Nigerian economy was lack of the needed skills and those who were certified to possess these skills were half-baked or ill-prepared. This is seen as a defect in Nigeria's educational system because of the theoretical inclination. In many cases, many employers compensate for insufficient academic preparation by organizing training and remedial courses for new employees. These steps ultimately increase the company's operational cost and reduce their profitability margin and market comparative ability. Companies that cannot afford to take the risk of up-skilling new employees simply source for available and suitable candidates from home or abroad. Since the quality of metalwork programmes is measured by the extent to which the recipient has acquired practical skills. The acquisition of milling machine operational skills in metalwork by students to be ready-ro-work is dependent on the practical skills possessed by the knowledge facilitators in the field. Hence, some of the milling skills required by metalwork facilitators, according to Ajie and Osoh (2021), are: accurate skills in mounting milling single or multi-cutters, skills to accurately adjust the swivel table at either direction, ability to abide by the milling machine operational principles, skills to machining flat curves, or irregular surfaces by feeding the work piece against a rotating cutter containing a number of cutting edges, skills to identifying faults in a motor driven spindle of the milling machine, skills to differentiating left hand and right hand multi-cutters and their methods of mounting, skills to identifying materials used for the productions of milling cutter, skills on the correct usage of a collet in reducing the size of a hole in the milling machine spindle so that small shanks tool can be fitted into large spindle recesses, skills to adjust the adjustable angle plate correctly so that bevels and tapers can be cut without using a special milling cutter or an adjustable cutter head, skills to fit and use the offset boring head on the machine spindle to permit drilling and greater diameter accuracy, skills to accurately clamp a work piece to the machine table and fixture, skills to lock the graduated dial on the traverse feed correctly and when to engage the automatic feed.

Statement of the Problem

The need for competent and skilled facilitators in metalwork/mechanical technology is imperative for an effective teaching and learning process in Nigerian tertiary institutions. Generally, metalwork facilitators play pivotal roles in equipping skilled graduates with excellent personality. Kennedy (2012) observed that one of the challenges on needed skills by youths and individuals who graduate from this field in recent times is skills mismatch, skills obtained through training and those required to create a job often do not match, resulting in skill shortage and inappropriate placement. Lack of workplace skills as it concerns metalwork, such as machines operation, welding, fabrication, foundry and forging, creativity skills, etc. are what the employers often complain about in their new employees in Nigeria. Many people who have enrolled in metalwork technology in Nigerian tertiary institutions often find themselves with general or theoretical knowledge that does little to prepare them for the actual tasks they encounter on their job placement. Since the quality of metalwork programmes is measured by the extent to which the recipients have acquired practical skills, the acquisition of milling machine operational skills in metalwork by students to be ready-to-work is dependent on the practical skills possessed by the skills/knowledge facilitators in the field. It is based on this that



this research is aimed at investigating milling machine operational skills required by metalwork facilitators for effective production of ready-to-work graduates in tertiary institutions in Rivers State.

Purpose of the Study

The study investigated milling machine operational skills required by metalwork facilitators for effective production of ready-to-work graduates in tertiary institutions in Rivers state. Specifically, the study sought to:

1. Ascertain the relevance of practical skills in production of ready-to-work graduates of Metalwork Technology in tertiary institutions in Rivers state; and to
2. Investigate milling skills required by metalwork facilitators in tertiary institutions in Rivers state.

Research Questions

The following research questions guided the study:

1. What is the relevance of practical skills in the production of ready-to-work graduates of Metalwork Technology in tertiary institutions in Rivers State?
2. What are milling skills required by metalwork facilitators in tertiary institutions in Rivers state?

Hypotheses

1. There is no significant difference between the mean responses of metalwork facilitators and students on the relevance of milling machine skills in the production of ready-to-work graduates of Metalwork Technology in tertiary institutions in Rivers state
2. There is no significance difference between the mean responses of metalwork facilitators and students on the milling skills required by metalwork facilitators in tertiary institutions in Rivers state

METHODOLOGY

The study adopted a descriptive survey design in conducting the investigation on milling machine operational skills required by metalwork knowledge facilitators for effective productions of ready-to-work graduates in tertiary institutions in Rivers state. The population for the study comprised all the 67 skill/knowledge facilitators (43 lecturers and 24 instructors) and 107 final year students in the Department of Metalwork/Mechanical Technology in tertiary institutions in Rivers state. The sample was 100% of the population as the population is manageable. A structured questionnaire consisting of 25 item questions was adopted for the study using the following options: strongly agree (AS), agree (A), disagree (D), and strongly disagree (SD). To determine the internal consistency of the instrument, it was subjected to Cronbach Alpha Reliability test after administering it to 21 respondents in University of Uyo who were not part of the class of respondents. The instruments were face and content validated by two experts (Lecturers) in the Department of Vocational and Technology Education, Rivers



State University, Port Harcourt. 174 Copies of the instruments were administered directly to the respondents by the researcher and all were retrieved. Mean and standard deviation were used to analyze the research questions while z-test was used to test the hypothesis at 0.05 level of significance. Mean value less than 3.00 was rejected while mean value equal or greater than 3.00 was accepted

Question 1: What is the relevance of milling machine skills in the production of ready-to-work graduates of Metalwork Technology in tertiary institutions in Rivers state?

Relevance of Milling Machine Operational Skills RMK	Facilitators (n=67)			Students (n=107)		
	M	SD	RMK	M	SD	RMK
1. Helps the individual to contribute meaningfully to his area of specialty	4.67	.47	A	3.37	.77	
2. Equip individual for self-reliance	4.67	.47	A	3.29	.76	
3. Cause the individual to be fulfilled in the labor market	4.64	.54	A	3.28	.76	
4. It prepares metalwork graduates to be ready-to-work	4.61	.65	A	3.28	.67	
5. It makes individuals to be outstanding amongst others	4.64	.64	A	3.33	.71	
6. Helps to reduce social criminal activities	3.11	.47	A	3.23	.83	
7. It is a means of productivity	3.17	.57	A	4.56	1.10	
8. It prepares personal greatness	3.23	.83	A	3.49	.73	
9. It is a most reliable vehicle for economic prosperity and diplomatic supremacy of the nation	4.52	.69	A	3.15	.49	
Total	4.14	.59	A	3.09	1.24	

Results in Table 1 above show that both facilitators of knowledge in metalwork technology and final year students agreed that all the variables highlighted are the relevance of milling machine operational skills. This is evidenced in the grand mean score of 4.14 for facilitators (lecturers and instructors) and 3.09 for final year students, which are both greater than 3.00 which is the acceptable mean value. Also, the closeness in the standard deviation for both groups, .59 and 1.24 respectively, shows homogeneity in the response of both groups. This is in consonance with Udo and Udo (2015) that acquisition of appropriate skill abilities and competencies both mental and physical are important for all Nigerians to live and contribute to the development of their area of specialty and the society at large. It equips individuals to be self-reliant and it makes them feel fulfilled in the labor market, among other benefits.



Question 2: What are the milling machine operational skills required by metalwork facilitators in tertiary institutions in Rivers State?

Milling Machine Operational Skills Required by Metalwork Facilitators RMK	Facilitators (n=67)			Students (n=107)	
	M	SD	RMK	M	SD
10. Skills to identify single and multi-cutters	5.00	.00	A	4.85	.42
11. Accurate skills for adjustment of swivel table to either directions	5.00	.00	A	4.74	.67
12. Skills on operational principles of milling machine	5.00	.00	A	4.50	.82
13. Machining of flat curves or irregular surfaces skills	4.47	.85	A	4.63	.63
14. Accuracy on feed taking on workpiece	4.68	.46	A	4.59	.72
15. Skills on fault identification in a motor driven spindle of the milling machine	4.62	.64	A	4.63	.63
16. Skills to differentiating a left handed and right handed multi-cutters and their mounting methods	4.62	.64	A	4.64	.60
17. Skills to identifying cutting tool materials used for Cutters production	4.68	.46	A	4.62	.68
18. Skills on the usage of collet in reducing the size of a hole in the machines spindle	4.68	.46	A	4.56	.80
19. Skills on accurate fitting of small shank into a large spindle recesses.	4.67	.47	A	3.28	.62
20. Skills on the use of adjustable cutter head to cut a bevel or taper	4.67	.47	A	3.21	.64
21. Skills on fitting and using the offset boring head to the machine spindle to permit drilling, and greater diameter accuracy	4.64	.54	A	3.26	.71
22. Skills to correctly clamp a workpiece to the machine table and fixture	4.61	.65	A	3.27	.59
23. Skills to correctly lock the graduated dial on the traverse feed	4.64	.54	A	3.28	.65
24. Skills to engage the automatic feed correctly	3.13	.48	A	3.23	.74
25. Milling machine repair and maintenance skills	3.22	.59	A	4.46	1.10
Total	4.52	0.95	A	4.11	.68

Results in Table 2 above show that both facilitators of knowledge/skills in metalwork technology and final year students agreed that the variables highlighted are some of the milling machine operational skills required by metalwork facilitators for effective production of ready-to-work graduates in tertiary institutions in Rivers state. This is evidenced in the grand mean score of 4.52 for facilitators (lecturers and instructors) and 4.11 for final year students which are greater than 3.00, the acceptable mean value. Also, the closeness in the standard deviation for both groups, .95 and .68 respectively, shows homogeneity in the response of both groups. This is in consonance with the view of Ajie and Osoh (2021); accurate skills in mounting milling single or multi cutters, skills to accurately adjust the swivel table at either direction, ability to be used to the milling machine operational principles, skills to machining flat curves, or irregular surfaces by feeding the workpiece against a rotating cutter containing a number of cutting edges, skills to identifying faults in a motor driven spindle of the milling machine, skills



to differentiating left hand and right hand multi cutters and there methods of mounting, skills to identifying materials used for the productions of milling cutter, skills on the correct use a collet to reducing the size of a hole in the milling machine spindle so that small shanks tool can be fitted into large spindle recesses , skills to adjust the adjustable angle plate correctly so that bevels and tapers can be cut without using a special milling cutter or an adjustable cutter head, and so on.

Hypothesis 1: There is no significant difference between the mean responses of metalwork facilitators and final year students on the relevance of practical skills in the production of ready-to-work graduates in tertiary institutions in Rivers State

Table 3: Z-test analysis on the Relevance of Milling Machine Skills

Category	n	M	SD	z-cal	z-crit	Decision
Facilitators	67	4.14	.59	1.62	1.98	Not Significant
Students	107	3.09	1.24			

The result in Table 3 shows that the mean and standard deviation of metalwork facilitators were 4.14 and .59 respectively while the mean and standard deviation of final year students were 3.09 and 1.24 respectively which give a z-cal value of 1.62 and z-crit value of 1.98. From the result above, z-cal was less than z-crit of 1.98, hence the hypothesis was accepted which means that there is no significant difference between the mean responses of metalwork facilitators and final year students on the relevance of facilitators milling machine skills in the production of ready-to-work graduates of metalwork technology in tertiary institutions in Rivers state.

Hypothesis 4: There is no significant difference between the mean responses of metalwork facilitator and final year students on the milling machine operational skills required by metalwork knowledge facilitator in tertiary institutions in Rivers state

Table 4: Z-test Analysis on Milling Machine Operational Skills Required by Metalwork Facilitators

Category	n	M	SD	z-cal	z-crit	Decision
Facilitators	67	4.52	.95	1.67	1.98	Not Significant
Students	107	4.11	.68			

The result in Table 4 shows that the mean and standard deviation of metalwork facilitators were 4.52 and .95 respectively while the mean and standard deviation of final year students were 4.11 and .68 respectively which gave a z-cal value of 1.67 and z-crit value of 1.98. From the result above, z-cal was less than z-crit of 1.98, hence the hypothesis was accepted which means that there is no significant difference between the mean responses of metalwork facilitators and final year students on the milling machine operational skills required by metalwork facilitators in the production of ready-to-work graduates in tertiary institutions in Rivers state.



CONCLUSION

Metalwork technology under technical education or mechanical engineering is a programme that specialized in practical training of individuals (students); it is set up to equip those that will pass through it with various practical skills of which milling machine operational is one of the pertinent, so that after graduation they will be ripe and be ready-to-work in any trade of the metalwork fields. It is called metalwork technology because it involves modern ways of making metal products using different tools, equipment, and machines. Ombugus in Beako, Okagwa, Hilary and Wordu (2019) opined that the goals of metalwork technology curricula at the tertiary level is to prepare learners to practice the trades independently upon graduation using qualified and skillful teachers as facilitators. The capacity of the facilitators engaged to drive every trade and process in the field determined the output and the performance of the students after graduation cause they turned out graduates who mount various industries across the state and the nation at large. The relevance of milling machine skills has been stated as well as some of the milling machine operational skills required by metalwork facilitators for effective production of ready-to-work graduates.

RECOMMENDATIONS

Based on the findings, the following recommendations are made for the effective workplace relevance of metalwork facilitators:

1. The government and school management through TETFUND should make provision for on the job training of all metalwork facilitators to enable them to equip themselves with the required skills for effective production of ready to work graduates.
2. Perfection on machine operation should be part of the promotion requirements for all knowledge and skill facilitators in the metalwork technology department.

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