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Assessment of the Skills Possessed By the Teachers of Metalwork in the Use of Computer Numerically Controlled Machine Tools in Technical Colleges in Oyo State

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Abstract
The purpose of this study was to assess the skills possessed by the teachers of metalwork in the use of computer numerically controlled machine tools in technical colleges in Oyo State. Three research questions and three null hypotheses tested at 0.05 level of significance guided the study. A survey research design was adopted for the study. The population for the study comprised of all the 35 metalwork teachers in the technical colleges in Oyo State. A structured questionnaire consisting of 41 items was used for data collection. Two experts from the Department of Vocational Teacher Education, University of Nigeria, Nsukka, and one expert from the Advanced Manufacturing Unit, Scientific Equipment Development Institute, Akuke, Enugu, face validated the instrument. The reliability co-efficience of the instrument was 0.86. Data collected were analyzed using mean and standard deviation for the research questions while t-test was used for testing the null hypotheses. It was found from the study that six skills were not possessed by metalwork teachers in the use of computer numerically controlled lathe and grinding machine, while seven skills were not possessed in using computer numerically controlled milling machine. It was recommended that regular and systematic retraining should be organized for metalwork teachers who lack required skills in using these machines.
Keywords: Assessment, Technical College, Metalwork, Computer Numerically Controlled Machines, Skills

Introduction

Technical colleges are institutions where students are trained to acquire relevant knowledge and skills in different occupations for employment in the world of work. Okorie (2001) explained that technical colleges in Nigeria are established to prepare individuals to acquire practical skills and basic scientific knowledge within the confinement of a technical institution or industrial technical education unit. According to the National Board for Technical Education (NBTE), (2004), Technical colleges in Nigeria are established to produce craftsmen at the craft (secondary) level and technicians at the advanced craft (post-secondary) level. Metalwork trade is one of the subjects that is taught in technical colleges in Nigeria. Metalwork trade comprises a blend of both theory and practical that leads to the production of goods and services by the use of tools, equipment and metalwork materials (NBTE, 2001). At the technical colleges, metalwork comprises of other sub-modular trade components such as machine shop practice, welding and fabrication, forging, heat treatment and foundry practices. Oranu, Nwoke and Ogwo (2002) explained that metalwork involves activities in occupations that entail designing, processing and fabrication of metal products; it includes activities in foundry, forging, machine shop and welding. Considering the various importance of metalwork to everyday life and also the overall objective of vocational and technical education (in which metalwork is one) which offers training in skill for self-reliance, self-sufficiency and employment into the world of work, metalwork becomes an important subject to be taught to students.

Metalwork students upon graduation from technical colleges are presently finding it hard to perform effectively in industries using modern equipment's like the computer numerical control (CNC) machines. This is due to the fact that they have been trained with old and obsolete equipment's that have become outdated. The skills gained from learning and training with these old and out of date equipment is no longer enough to perform effectively in the modern industries. The Computer Numerical Control (CNC) is a technology in which the functions and motions of a machine tool are controlled by means of a prepared program containing coded alphanumeric program data. CNC can control the motions of the work piece or tool. The introduction of Computer Numerically Controlled machines radically changed the manufacturing industries, CNC machines have enabled industries to consistently produce parts automatically with amazing speed, accuracy, efficiency and repeatability. The CNC machines are the CNC Lathe Machine, CNC Milling Machine and CNC Grinding machine. To effectively train students in the use of CNC machines the metalwork teachers themselves must possess the relevant technical skills which are different from the conventional technical skills already possessed.

Skill according to Osinem and Nwaoji (2005) is the proficiency displayed by someone in the performance of a given task. In the context of this study, skill is the ability that an individual has acquired that enables him perform a task efficiently such as using computer numerically controlled machine tools. To

effectively use these machines the teacher must possess relevant technical skills. Technical skills are a skill, expertise or technical competence related to the field of the worker, whether engineering or technical (Medina, 2010). Technical skill is often associated with the use of tools, equipment related to work, as well as all technical matters. It can be known and understood more easily as it can be seen clearly with the naked eye. Assessment according to Goldrick (2002) is the process by which teachers are appraised professionally Goldrick also asserted that it is an informal tool to help administrators identify teachers who need additional or specialized assistance and to help individual teachers improve their instructional practices.

There is a noticeable gap between the skills possessed by metalwork graduates of Oyo state technical colleges and the skills required in using CNC machine tools because the students are still been taught with old technologies. To bridge this gap student should be taught with modern technologies so that they will possess the relevant skills required in these technologies. It therefore becomes important to determine if the teachers have the relevant skills needed in using these modern technologies like the CNC machine tools. This study was therefore embarked upon to find out through research, the skills possessed by the teachers of metalwork in the use of computer numerically controlled machine tools in technical colleges in Oyo State.

Statement of the Problem

Changes in technology have caused the relationship between education and work in modern societies to become extremely complex. The use of computer numerically controlled machine tools in the industry is not in line with the content of teaching in technical institutions and this has become a problem for the industry because students lack the required skills needed in using these machine tools. This problem occurred because of the lack of sophisticated tools and equipment for practical work and by maintaining the existing equipment and not upgrading to new and modern machine tools.

This has led to a decline in the performance of students upon entering into the world of work. Metalwork students are finding it hard to perform effectively in the modern industries because of the lack of required skills needed to perform in the industries. The use of computer numerically controlled machine tools in the industries has rendered the skills possessed by metalwork students to be ineffective and has caused a sharp decline in their performance.

To solve this problem and enhance their performance, metalwork students must be properly equipped with the necessary skills that will enable them to be effective. These skills which are learnt while in school are as a result of the skills the teacher possesses on these machine tools, and uses it in teaching the students. Hence it becomes pertinent to assess the technical skills possessed by metalwork teachers in the use of computer numerically controlled machine tools such as lathe, milling and grinding machines

Research Questions

This following research questions were formulated to guide this study:

1. What are the technical skills possessed by metalwork teachers in the use of computer numerically controlled (CNC) lathe machine?
2. What are the technical skills possessed by metalwork teachers in the use of computer numerically controlled (CNC) milling machine?
3. What are the technical skills possessed by metalwork teachers in the using computer numerically controlled (CNC) grinding machine?

Hypotheses

The following research hypotheses (Ho) were tested in the study:

Ho_1: There is no significant difference between the mean responses of metalwork teachers in urban and rural areas on the technical skills possessed in the use of a computer numerically controlled Lathe machine

Ho_2: There is no significant difference between the mean responses of metalwork teachers in urban and rural areas on the technical skills possessed in the use of a computer numerically controlled milling machine.

Ho_3: There is no significant difference between the mean responses of metalwork teachers in urban and rural areas on the technical skills possessed in the use of a computer numerically controlled grinding machine.

Methodology

A descriptive survey design was adopted for this study. The study was carried out in all the technical colleges in Oyo State. The population of the study consisted of all the 35 metalwork teachers from all the technical colleges in Oyo State. Since the numbers of the teachers are not too large, the entire population was used because it was manageable for the study. A structured questionnaire was the instrument for data collection. The response categories of the instrument used are Very Highly Possessed (VHP), Highly Possessed (HP), Moderately Possessed (MP), Barely Possessed (BP) and Not Possessed (NP), which were assigned numerical values of 5, 4, 3, 2, and 1 respectively. The instrument was subjected to face and content validation by two lecturers from the

Department of Vocational Teacher Education, University of Nigeria Nsukka, and one expert from the Advanced Manufacturing Unit, Scientific Equipment Development Institute, Akwuke, Enugu to attest the appropriateness of the instrument in measuring what it intended to measure. The instrument was trial tested on 20 metalwork teachers in four technical colleges in Lagos State. This yielded a reliability co-efficience of 0.86 using the Cronbach Alpha formula. The data was collected by administering the questionnaire directly on the respondents by the researchers and two research assistants.

Method of Data Analysis

The data collected from the study were analyzed using mean for answering the research questions and t-test for testing the hypotheses at probability level of 0.05 and 94 degree of freedom (df). Any item with a mean value of 3.50 and above was regarded as possessed while any item with a mean below 2.50 was regarded as not possessed. For the hypotheses, if the calculated value of t is less than table-t value, for an item, accept, otherwise reject, but if the calculated value of t is more than the table-t value, reject.

Results

Table 1: Mean and t-test Analysis of the Responses of Metalwork Teachers on Technical Skills Possessed in the Use of Computer Numerically Controlled Lathe Machine

S/N	Item Statements	X	Decision	X1	S^2_1	X2	S^2_2	t-cal	H0
1	Set lathe machine cutting tool according to Specification for the job to be performed	3.97	HP	4.04	0.87	3.83	0.71	0.71	NS
2	Change the path of tool on the lathe for taper turning	4.20	HP	4.34	1.07	3.91	0.90	0.19	NS
3	Insert thread cutting tool into the tool holders for different thread cut operation on the lathe	4.22	HP	4.21	0.90	4.25	0.62	0.11	NS
4	Select suitable cutting speed for a particular size of material to be machined on the lathe	4.28	HP	4.34	0.77	3.75	0.62	0.30	NS
5	Interpret technical and engineering drawing	4.11	HP	4.26	0.68	3.83	0.83	0.62	NS
6	Install software from a CD	3.08	MP	4.21	0.79	3.83	1.02	0.22	NS
7	Use keyboard appropriately	3.80	HP	3.56	1.23	4.25	0.86	0.71	NS
8	AUTOCAD production of the specimen to be Machined	1.36	NP	3.69	0.97	2.91	1.16	0.10	NS
9	Knowing how to pick position points from the AUTOCAD drawing of specimen to be machined	1.22	NP	4.26	0.81	3.75	0.96	0.65	NS
10	General knowledge of computer programming	1.06	NP	4.30	0.87	4.08	0.90	0.70	NS
11	Recognize the computer numerical control Codes	1.18	NP	3.39	0.73	3.42	0.67	0.04	NS
12	Know the meaning of each code command	1.21	NP	3.60	0.76	3.33	0.92	0.57	NS
13	Use the computer numerical control codes to write programs	1.09	NP	2.95	0.82	2.83	0.70	0.24	NS

Note **X** = Grand Mean; **X1** = Mean of Metalwork Teachers in Urban Areas; **X2** = Mean of Metalwork Teachers in Rural Areas; $\mathbf{S^2_1}$ = Variance of Metalwork Teachers in Urban Areas; $\mathbf{S^2_2}$ = Variance of Metalwork Teachers in Rural Areas; T-table = 1.56; NS = Not Significant; HP = Highly Possessed; MP = Moderately Possessed; NP = Not Possessed; t-cal = t-calculated; H_0 = Null Hypothesis.

Data presented in Table 1 shows that the technical skills with mean values from 3.08 – 4.28 are possessed by metalwork teachers while the technical skills with mean 1.06 – 1.22 are not possessed by metalwork teachers in the use of computer numerical control lathe machine. Table 1 also shows that all the 13 technical skills items had their t-calculated values less than that of the t-table of 1.56. This indicated that, there was no significant difference between the mean responses of metalwork teachers in urban and rural areas on technical skills possessed by metalwork teachers in the use of a CNC lathe machine.

Table 2: Mean and t-test Analysis of the Responses of Metalwork Teachers on Technical Skills Possessed in the Use of Computer Numerically Controlled Milling Machine

S/N	Item Statements	X	Decision	X1	S^2_1	X2	S^2_2	t-cal	H0
1	Set the knee elevation on the milling machine	4.23	HP	3.17	0.76	3.33	1.70	0.34	NS
2	Set the table elevation on the milling machine	3.72	HP	3.82	0.81	3.50	1.50	0.72	NS
3	Select suitable cutting speed to suit the material being milled	3.52	HP	3.30	0.93	3.66	1.15	0.73	NS
4	Set the feed rate to suit the material being milled	3.62	HP	2.47	0.74	2.91	1.44	0.85	NS
5	Select milling cutter suitable for the surface to be generated	3.51	HP	2.39	1.30	2.75	1.35	0.76	NS
6	Mount milling cutter firmly on the arbor, or other holder available on the machine	3.68	HP	3.86	0.74	3.33	1.30	0.25	NS
7	Determine the feed in relation to the direction of the cutter rotation	1.22	NP	4.26	0.91	4.16	1.16	0.25	NS
8	Interpret technical and engineering drawing	3.50	HP	4.21	0.90	3.58	1.24	0.73	NS
9	Install software from a CD	3.31	MP	4.34	0.93	4.20	0.86	0.30	NS
10	Use keyboard appropriately	3.54	HP	4.26	0.91	3.97	1.08	0.99	NS
11	AUTOCAD production of the specimen to be machined	1.22	NP	4.30	0.87	4.08	0.90	0.70	NS
12	Knowing how to pick position points from the AUTOCAD drawing of the specimen to be Machined	1.20	NP	4.34	0.93	3.91	1.08	0.22	NS
13	General knowledge of computer programming	1.34	NP	4.00	1.00	3.83	1.14	0.43	NS
14	Recognize the computer numerical control Codes	1.14	NP	4.30	0.82	4.41	0.51	0.43	NS
15	Know the meaning of each code command	1.28	NP	3.69	1.18	3.66	1.30	0.06	NS
16	Use the computer numerical control codes to write programs	1.11	NP	4.08	1.23	4.16	1.11	0.18	NS

Note **X** = Grand Mean; **X1** = Mean of Metalwork Teachers in Urban Areas; **X2** = Mean of Metalwork Teachers in Rural Areas; $\mathbf{S^2_1}$ = Variance of Metalwork Teachers in Urban Areas; $\mathbf{S^2_2}$ = Variance of Metalwork Teachers in Rural Areas; T-table = 1.56; NS = Not Significant; HP = Highly Possessed; MP = Moderately Possessed; NP = Not Possessed; t-cal = t-calculated; H_0 = Null Hypothesis.

Data presented in Table 2 shows that the technical skills with mean values from 3.31 – 4.23 are possessed by metalwork teachers while the technical skills with mean 1.14 – 1.34 are not possessed by metalwork teachers in the use of computer numerical control milling machine. Table 2 also shows that all the 16 technical skills items had their t-calculated values less than that of the t-table of 1.56. This indicated that, there was no significant difference between the mean responses of metalwork teachers in urban and rural areas on technical skills possessed by metalwork teachers in the use of a CNC milling machine.

Table 3: Mean and t-test Analysis of the Responses of Metalwork Teachers on Technical Skills Possessed in the Use of Computer Numerically Controlled Grinding Machine

S/N	Item Statements	X	Decision	X1	S^2_1	X2	S^2_2	t-cal	H0
1	Select suitable grinding wheels for generating different shape on grinding machine	3.71	HP	4.34	0.71	4.25	0.62	0.40	NS
2	Sharpen the cutting tools correctly	4.45	HP	4.56	0.78	4.25	0.75	0.14	NS
3	Grind all forms of cutting tools to specified shape and degree on grinding machine	4.40	HP	4.43	0.72	4.08	0.90	0.25	NS
4	Interpret technical and engineering drawing	3.52	HP	4.17	0.93	3.83	1.26	0.90	NS
5	Install software from a CD	3.34	MP	4.26	1.05	3.91	1.08	0.90	NS
6	Use keyboard appropriately	3.72	HP	4.13	0.91	4.25	0.45	0.42	NS
7	AUTOCAD production of the specimen to be machined	1.31	NP	4.43	0.72	4.08	0.51	0.10	NS
8	Knowing how to pick position points from the AUTOCAD drawing of the specimen to be machined	1.04	NP	4.21	1.16	4.08	0.51	0.31	NS
9	General knowledge of computer programming	1.30	NP	4.43	0.78	4.33	0.65	0.38	NS
10	Recognize the computer numerical control Codes	1.44	NP	4.78	0.76	4.41	0.51	0.87	NS
11	Know the meaning of each code command	1.48	NP	4.47	0.94	4.50	0.52	0.07	NS
12	Use the computer numerical control codes to write programs	1.09	NP	4.30	0.73	4.50	1.16	0.45	NS

Note **X** = Grand Mean; **X1** = Mean of Metalwork Teachers in Urban Areas; **X2** = Mean of Metalwork Teachers in Rural Areas; $\mathbf{S^2_1}$ = Variance of Metalwork Teachers in Urban Areas; $\mathbf{S^2_2}$ = Variance of Metalwork Teachers in Rural Areas; T-table = 1.56; NS = Not Significant; HP = Highly Possessed; MP = Moderately Possessed; NP = Not Possessed; t-cal = t-calculated; H_0 = Null Hypothesis.

Data presented in Table 3 shows that the technical skills with mean values from 3.34 – 4.45 are possessed by metalwork teachers while the technical skills with mean 1.04 – 1.48 are not possessed by metalwork teachers in the use of computer numerical control lathe machine. Table 1 also shows that all the 12 technical skills items had their t-calculated values less than that of the t-table of 1.56. This indicated that, there was no significant difference between the mean responses of metalwork teachers in urban and rural areas on technical skills possessed by metalwork teachers in the use of a CNC grinding machine.

Discussion of the Results

The findings of the study showed that six technical skills were not possessed by metalwork teachers in the use of computer numerically controlled lathe machine. This finding is in agreement with Miller (2006) who found out that, teachers of metalwork needed improvement in technological skills for teaching metalwork effectively in colleges of education.

Further, the results of the study also showed that seven technical skills were not possessed by teachers of metalwork in the use of computer numerically controlled milling machine. This finding is in agreement with Olaitan and Hassan (2010) who found out that metalwork teachers require skills in carrying out machine shop practices.

It was also found from the study that six technical skills were not possessed by metalwork teachers in the use of computer numerically controlled grinding machine. This is in line with Sowande (2002) that technological skill competence is required by metalwork teachers in the use of machine tools.

Conclusion

Based on the findings of the study, it can be concluded that metalwork teachers are deficient in some technical skills in the use of computer numerically controlled lathe, milling and grinding machines. The study found no significant difference in the mean ratings of the respondents on the technical skills possessed by metalwork teachers in the use of computer numerical control lathe, milling and grinding machine.

Recommendations

Based on the findings of the study, the following recommendations were made:

- Metalwork teachers should be retrained on those technical skills that they do not possess in the use of computer numerically controlled lathe, milling and grinding machines
- Technical skills that were not possessed by metalwork teachers in the use of computer numerically

controlled lathe, milling and grinding machines should be integrated into the curriculum of metalwork teacher preparation institutions such as colleges of education and universities.

- Government and employers of metalwork graduates should donate modern machine tools to various technical colleges in Oyo state
- Metalwork teachers that are well experienced in AUTOCAD and programming should be employed by government to teach in technical colleges.
- Government and administrators of technical colleges should organize seminar and workshop for metalwork teachers on technical skills in the use of computer numerical control lathe, milling and grinding machines.

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