ASSESSMENT OF THE COMPETENCE AND IMPROVEMENT NEEDS OF METAL WORK INSTRUCTORS IN COLLEGES OF EDUCATION IN SOUTH WESTERN STATES OF NIGERIA.

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Abstract

This study focused on the assessment of the competence and the improvement needs of the Metal Work Instructors in colleges of education in the south-western states of Nigeria. Four research questions in line with the different areas of the metal work were developed to be answered by the study. The instrument used for data collection was a 98 structured competency cluster questionnaire items and a 30 item competency multiple choice test instrument which was face validated by three experts. The population of the study was 35 instructors in colleges of education in South-western states of Nigeria. All copies of the questionnaire were obtained from the respondent and were for used for data analysis. Product moment correlation and cronbach alpha reliability method were adopted to determine the internal consistency of the competency questionnaire item and the multiple choice test items; a cronbach alpha coefficient of 0.88 for the competency questionnaire and 0.81 for the multiple choice test items was obtained respectively. 35 copies of the instrument were administered and were retrieved and analysed using percentage, mean and improvement need index (INI) for answering the research questions. Frequency and percentage were also used to analyze the data for competency of the instructors in teaching Metal work to students. Findings from the study revealed that the instructors in metal work at the colleges of education in south-western states of Nigeria had a high competence in teaching sheetmetal work and welding and fabrication, an average competence in Machine shop practice and a low competence in teaching Foundry and Forging based on the result from the competency based multiple choice test items. It was therefore recommended that the identified competencies in which improvements were needed by the instructors be packaged and use for re-training them to enable them meet the training needs of the student.

Introduction

The acquisition of manipulative skills as well as basic scientific knowledge and attitude in Metalwork technology by students in Colleges of Education is a function of the quality of teaching received from a qualified metalwork teacher. Metalwork occupies a very important place in our every day lives. According to Walker (2004), it is designed to provide a broad experience in metalworking through the use of hand tools, machines, and materials that are basic to the important area of industry; it also covers both hand and machine – tool operations, and supplies background knowledge on industrial equipment and processes. 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. In the context of this study, Metalwork involves the study of sheetmetal work, machine shop practice, foundry and forging, and welding and fabrication in line with the programme of study at the Colleges of Education is South – western States of Nigeria.

For the instructor to be able to impart the knowledge of the different areas of metalwork to students, he should be skilled, knowledgeable and

competent. However, as a result of technological changes, it requires that the instructor skills competence be updated. Sowande (2002) emphasized that updating of skills of instructors is a professional improvement which is re-training of instructors in relevant job skills to enhance their Performance on the job. This implies that, for the instructor to keep up with the technological advancement, continuous improvements in technical skills through retraining for metalwork instructors are necessary for sustaining quality performance on the job. The retraining for skills in metalwork for continuous and sustainable performance by metalwork teachers on the job is regarded as need.

Need according to Procter (1995), is a condition of lacking or wanting something necessary or very useful. It can be described as something that is required not just, because one would like to have it, but because it is useful or very important. It suffice that any technical skill that is very useful for teaching metalwork and which an instructor lacks becomes a need to such an instructor.

Considering the various importance of Metalwork to our everyday life, and also the overall objective of Vocational and Technical Education (in which metal work is one) which offers training in skill for self–reliant and self sufficient, therefore metalwork becomes an important subject to be taught to students in Colleges of Education under the administration of the National Commissions for Colleges of Education (NCCE) who developed a minimum standard for the academic personnel that will train students effectively in Metalwork programmes for work. One of such people qualify to teach in Colleges of Education is an instructor who must possess a minimum of Bachelors Degree in Industrial Technical Education with a bias in Metal Work. These instructors are charged with the responsibilities of empowering the students with Skills in Metalwork for self or paid employment in Metalwork enterprise.

A student according to Longman Dictionary of Contemporary English (2007) is someone who is studying in school such as college and University. A student in the context of this study is an individual admitted into College of Education after meeting entry requirement lay down by NCCE as a policy. Students of metal work are normally expected to receive instruction and workshop training from the metal work instructor for three years. Within this period, they are normally sent to Secondary Schools to Practice what they have learnt in the College through the teaching of Basic Technology. Metal work teachers and other relevant educators are usually requested to assess the professional competence of these students during teaching practice exercise. No student can perform above the quality of his instructor therefore; the teaching experience of the students on the average appeared to mirror on the competence of their metalwork instructor in the College of Education, hence the need to constantly assess the competence of these instructors teaching these students.

Assessment according to Okoro (2000) is a form of evaluation that uses collected data for estimating the worth, quality or effectiveness of a programme or project. The author also stressed further that assessment is the documenting, usually in measurable terms, knowledge, skill attitudes and beliefs. Assessment can focus on the individual learner,

the learning community (Class, workshop, or other Organized group of learners), the Institution or the educational system as a whole. . In this study, assessment refers to a process of determining the functionality and performance of the instructors in teaching metalwork to students. The assessment effort will indicate level of achievement of the objectives of metalwork in the Colleges of Education which is exhibited by the level of competence of the instructors on the following parameters:

i. Mastery of related technical

information.

ii. Acquisition of specific skills.

iii. Quality of performance as a result of manipulation of resources on the job.

iv. Level of adaptation or creativity to cope with new challenges in the place of work.

v. Provision of knowledge of result of analyzed data.

vi. Knowledge of change or improvement required.

In a College of Education according to Sowande (2002) a metalwork instructor is a person that is trained in metalwork skills and hired to impart skills to students in the areas of metalwork, which include: sheetmetal work, machine shop practice; foundry and forging and welding and fabrication. They impart these skills to students in sequence of course description desired for each level as out lined in the minimum standard of NCCE.

A College of Education according to National Policy on Education of the Federal Republic of Nigeria (2004) is one of the tertiary institutions that provide knowledge and skills to student who have passed through Post Primary School education.

The Researcher's examination of College student's academic records in one of the Colleges of Education revealed that most of the student who participate in teaching practice generally demonstrated low-level competence in imparting knowledge and skills to their students at the junior secondary school level probably because of their incompetence. Complaints received from principal of post primary school visited during teaching practice supervision on the performance of some of the serving teachers confirmed the low quality of their teaching basic technology to the student in post primary education. The observed low performance of college of education student in teaching practice technically revealed that metalwork instructors in the colleges of education need some improvements in order to enhance the quality of the colleges of Education graduates in Metal Work.

If the performance of the instructors is assessed, it will reveal their level of competence and the dimensions of improvement required based on performance gap.

The purpose of this study therefore is to assess the competence and improvements needs of Metalwork instructors in colleges of education south western states of Nigeria. Specifically; the study sought to determine the competence of the instructors in:

1. Skills in sheet metal work operations and areas where the Instructors needed improvements in teaching the skill.
2. Skills in Machine shop Practice and areas where the Instructors needed Improvement in teaching the skills.
3. Skills in foundry and forging operations and areas where the Instructors needed improvement in teaching the skill
4. Skills in welding and Fabrication operations and areas where the Instructors needed Improvement in teaching the skill.

Methodology.

Four research questions were developed to guide the study. Survey research design was adopted. Survey research design according to Eboh (2009) is a design that employs the study of large and small population to discover the relative incidence, distribution and inter relations of sociological, psychological variables through the use of interview or questionnaire.

The study was carried out in South Western States of Nigeria; specifically in both Federal and State Colleges of Education in the Zone, which are running metalwork programme. The States are Lagos, Ogun, Oyo, Osun, Ondo and Ekiti. The population for the study in all the colleges of Education was made up 35 instructors made up of inexperienced and experienced instructors. An inexperienced Instructor is one

that has taught below five years, while experienced teacher is one that has been teaching for over five years and above. Due to the small size, all the population was used for the study. Two sets of Instrument for data collection were validated by three experts from the Department of Vocational Teacher Education, University of Nigeria. Their corrections and suggestions were incorporated to develop the final copies of the instrument. Split – half technique and Cronbach's alpha reliability method were adopted to determine the internal consistency of the Instruments. A reliability coefficient of 0.88 was obtained for the competency cluster items. Product moment correlation coefficient was adopted to obtain the stability of the multiple choice test items; a coefficient of 0.81 was obtained.

Two types of instrument were used for data collection for the study. These were 30 competency multiple choice test items and 98 structured competency clusters items

questionnaire. The competency cluster questionnaire was divided into two parts. Part one was for collecting data on personal information of the respondents. Part two was sub – divided into categories of needed and performance. The needed category has a 4 – point response scale of Highly Needed, Average Needed, slightly Needed and Not Needed, while the Performance category also has 4 – point categories of High Performance, Average Performance, Low Performance and No Performance. With a corresponding value of 4,3,2 and 1 for the two groups of scale respectively.

Thirty five (35) copies of the 30 – multiple choice test items were administered to the instructors on one to one basis with 40 minutes duration for providing answers to the multiple choice test items. This was carried out personally by the researcher in all the participating Colleges of Education in the zone three weeks later, thirty five copies of a 98 – competency cluster item questionnaire were administered on the same instructors in the colleges of Education with a two day interval for the completion of the questionnaire. The entire thirty five copies of the questionnaire administered were returned and analyzed. Frequency, Percentage, mean and improvement need index (INI) were employed for data analysis for answering the research questions. Frequency and percentage were used to analyze the data on competency of the instructors in teaching Metal work to students. In taking decisions on the level of competence of the instructor, the following percentage ranges were used.

i. 70% and above = Very High Competence
ii. 60 – 69% = High Competence
iii. 50 – 59% = Average Competence
iv. 40 – 49% = Low Competence
v. Below 40% = No Competence.

Improvement needed index (INI) was used for taking decision on areas where improvement is required by Instructors in teaching Metal Work to students in Colleges of Education in South Western States of Nigeria. The Improvement needed index (INI) was determined as follows:

i. the mean (X_n) of the needed category was determine for each item
ii. the mean (X_p) of the performance category was also determined for each item.
iii. The Performance gap (PG) was therefore determined by finding the difference between X_n and X_p for each item; ie P. G = $X_n - X_p$.

Where PG is positive, Improvement was needed, where PG was negative,

Improvement was not needed, where PG was Zeros Improvement was not equally needed.

Results

The results for the study were obtained from the research questions answered through data collected and analyzed.

Research Question 1

What is the competency level of the instructors teaching Metal Work to students in Colleges of Education in Southwestern States of Nigeria?

The data for answering research question 1 are presented in Table 1.

Table 1: Percentage scores of Instructors on their Actual Competence in Teaching Metal Work to student in Colleges of Education South Western States of Nigeria.

S/N	CLUSTER ITEMS	FREQUENCY	PERCENTAGE	REMARKS
1	Sheet Metalwork operations	28	60.87	High Competence
2	Machine shop practice	24	52.17	Average Competence
3	Foundry and forging	21	41.65	Low Competence
4	Welding and fabrication	30	65.22	High Competence

Research Questions 2 – 5.

What are the competencies in sheetmetal work operations; machine shop practice; foundry and forging; welding and Fabrication where instructors in Colleges of Education needed Improvement?

Data for answering Research question 2 – 5 are presented in Table 2.

Table 2: Performance Gap Analysis of the Mean Ratings of the Perceived Competencies of the instructors in teaching sheetmetal work operations, machine shop practice, foundry and forging, welding and Fabrication to metalwork students in Colleges of Education in South Western States of Nigeria. **N = 35**

S/N	Technological Skill Items	$\bar{X}_n$	$\bar{X}_p$	INI(PG) $\bar{X}_n - \bar{X}_p$	Remark
Sheet Metal Work					
Skills in Selection and Use of Sheet Metal Work					
1.	Select sheet metal base on the type of work to be done	4.25	3.30	0.90	Very High IN
2.	Select sheet metal base on the its characte ristics and properties	4.27	3.49	0.78	Very High IN
3.	Select sheet metal base on the gauge number	3.95	3.32	0.63	High IN
Skills in Selection of Tools and Machines for Sheet Metalwork					
4.	Select suitable tool for the object to be produced	4.15	3.77	0.38	Little IN
5.	Select suitable machine for the object to be produced	4.12	3.62	0.50	High IN

6.	Develop simple pattern for the object to be produced	4.16	3.46	0.70	High IN
7.	Cut out the pattern to be used carefully	4.11	3.27	0.84	Very High IN
8.	Develop complex pattern for the object to be produced	3.83	3.32	0.52	High IN
9.	Cut out the complex pattern already developed for use carefully	3.94	3.21	0.73	Very High IN
Skills in Bending and Folding of Sheet Metal Edges					
10.	Measure the edges of sheet metal according to specification for he hemming	3.87	3.68	0.19	Little IN
11.	Bend the edges measured to specified degree with folding bar or on a brake	3.92	3.41	0.51	High IN
12.	Fold the bent edges over a piece of sheet metal of the same gauge size with soft hammer blows.	3.84	3.33	0.51	High IN
13.	Mark out the sheet metal for seam making	3.89	3.37	0.52	High IN
14.	Cut the edge of sheet metal for seam making	3.82	3.53	0.29	Little IN
15.	Mark the edges to be burred	3.80	3.33	0.47	High IN
16.	Burr along the marked point for seam making	3.98	3.08	0.90	High IN
17.	Set the seam on seam setting machine	4.16	3.15	101	Very High IN
18.	Turn the seam against the body on double seaming machine	3.83	2.54	0.89	Very High IN
Skills in Soldering Objects in Sheet Metalwork					
19.	Prepare the soldering furnace	3.85	2.86	1.00	Very High IN
20.	Cut sheet metal to be soldered according to specification	3.86	3.42	0.44	High IN

21.	Clean the parts to be soldered.	3.93	3.47	0.46	High IN
22.	Apply the correct quantity of suitable flux on the parts to be soldered	4.20	3.38	0.82	Very High IN
23.	Tinne the soldering copper/bit	4.24	3.08	1.16	Very High IN
24.	Melt solder evenly on the surface of parts to be joined with the tinned bit	4.19	3.34	0.85	Very High IN
25.	Smooth the surface soldered	3.96	3.50	0.46	High IN
26.	Observe safety practice in sheet metal laboratory	4.12	3.26	0.86	Very High IN
II Machine Shop Practice					
Skills in Lathe Operation					
27.	Set lather machine cutting tool according to specification for the job to be performed	4.16	3.45	0.71	Very High IN
28.	Generate plane surface on the lather using a straight edge cutting tool.	3.89	3.62	0.27	Little IN
29.	Generate square surface at the end of work piece using cutting edge of the tool.	3.23	3.19	0.04	Very Little IN
30.	Select the tailstock for altering the path of tool or turning taper on the lather.	3.94	3.41	0.53	High IN
31.	Change the path of tool on the lather using taper adjustment for taper turning	4.06	3.12	0.94	Very High IN
32.	Set the tool path on the lathe using the compound rest method for taper turning	4.14	3.69	0.45	High IN
33.	Generate hole on metals with twist drill or reamer held in the lathe tailstock.	4.18	3.30	0.88	Very High IN
34.	Enlarge hole drilled on the metal using the boring tools held in the held in the lathe tailstock.	3.89	3.45	0.44	High IN
35.	Roughen the surface of work piece with knurling rollers on the lathe machine	3.98	3.37	0.61	High IN
36.	Part-off a specified length from a work piece on the lathe	3.78	3.40	0.38	Little IN
37.	Insert thread -cutting tool into the tool holder for	4.22	3.21	1.01	Little IN

41.	Service lathe regularly	4.30	3.14	1.16	Very High IN
42.	Observe safety rules on the lather machine	4.12	3.40	0.72	Very High IN
Skills in Milling Operations					
43.	Cut horizontal surface on the milling machine	3.86	3.11	0.75	Very High IN
44.	Cut angular surface on milling machine	4.04	2.86	1.18	Very High IN
45.	Cut keyway, groove dovetail and t – slot on the milling machine	4.00	2.96	1.04	Very High IN
46.	Set the knee elevation on the milling machine	4.29	3.10	1.10	Very High IN
47.	Set the table elevation on the milling machine	3.99	3.32	0.67	High IN
48.	Select suitable cutting speed to suit the material being milled	4.15	3.28	0.87	Very High IN
49.	Set the feed rate to suit the material being milled	4.25	3.18	1.07	Very High IN
50.	Select milling cutter suitable for the surface to be generated	4.28	3.03	1.25	Very High IN
51.	Mount milling cutter firmly on the arbor, collect or other holders available on the machine	4.30	2.94	1.36	Very High IN
52.	Determine the feed in relation to the di rection of cutter rotation	4.10	3.23	0.87	Very High IN
Skills in Drilling Operations					
53.	Drill straight hole to specified diameters	3.92	3.60	0.32	Little IN
54.	Enlarge hole to the specified diameter on the drill press	3.68	3.57	0.11	Very Little IN
55.	Enlarge a drill hole accurately with a reamer on the drill press	4.15	3.42	0.73	Very High IN
56.	Select the drilling speed according to the diameter, properties and classification of material to be drilled	4.01	3.30	0.73	Very High IN
57.	Produce a smooth flat surface on a part or component to specification on grinding machine	4.02	3.16	0.86	Very High IN
58.	Generate cylindrical and conical shape on round parts to specification on grinding machine	4.02	3.08	0.94	Very High IN

61.	Centre and balance a grinding wheel on the wheel sleeve	4.28	3.24	1.04	Very High IN
62.	Sharpen the wheel on grinding machine	3.83	3.09	0.74	Very High IN
63.	Grind the wheel to be sport free on the grinding machine	4.00	3.24	0.76	Very High IN
Skills in Power Hacksaw Operations					
64.	Select power hacksaw cutting speed for the material to be cut	4.18	3.02	1.16	Very High IN
65.	Cut a round metal to specification on power hacksaw	3.62	3.33	0.29	Little IN
66.	Cut angle plate to specification on power hacksaw.	3.81	3.45	0.36	Little IN
67.	Cut angular part by swiveling the saw table to the desired degree	3.93	3.12	0.81	Very High IN
Skills in Shaping Operations					
68.	Cut horizontal surface on the shaping machine	4.01	3.00	1.01	Very High IN
69.	Cut vertical surface on the shaper	4.03	3.18	0.85	Very High IN
70.	Cut groove, slots, keyway on the shaper.	4.01	3.18	0.83	Very High IN
71.	Adjust the stroke of the shaper to suit the operation to be performed	4.15	3.16	0.99	Very High IN
Skills in Foundry Operations					
72.	Make cavity within the mould with pattern	3.76	3.47	0.29	Little IN
73.	Select the metal to be melted and pour them into furnace	3.83	3.59	0.24	Little IN
74.	Regulate the pyrometer to read the pouring temperature of the metal to be melted	3.81	3.34	0.47	High IN
75.	Melt metals in the furnace.	3.74	3.34	0.40	Little IN
76.	Pour molten metal into the mould from the ladder	3.75	3.34	0.41	Little IN
77.	Remove raw casting from the mould after cooling	3.94	3.27	0.67	High IN
78.	Clean sands and dirt's on the raw casting	4.00	3.63	0.37	Little IN
79.	Knock off spruces, gate and riser on the castings	4.14	3.37	0.77	Very High IN
80.	Grind the sharp edges on the casting for finishing	3.89	3.52	0.37	Little IN

81.	Observe safety in foundry laboratory shops.	3.94	3.65	0.29	Little IN
Skills in Forging Operations					
82.	Light the gas furnace for forging operation	4.07	3.59	0.48	High IN
83.	Draw out metal to increase the length by hand forging	4.12	3.11	1.01	Very High IN
84.	Thicken (upsetting) the end of a bar by hand forging	4.03	3.22	0.81	Very High IN
85.	Forge weld two pieces of metals until they are joined together	3.92	3.10	0.82	Very High IN
86.	Cut stock of bar to desired length by hot chiseling	4.15	3.09	1.06	Very High IN
87.	Bend, an eye on the anvil by hand forging	3.84	3.27	0.57	High IN
88.	Twist a flat piece of metal in the vice by hand forging,	3.91	3.09	0.82	Very High IN
89.	Maintain the furnace regularly	4.08	3.22	0.86	Very High IN
90.	Observe safety rules in the forging shop	4.07	3.53	0.54	High IN
IV. Welding and Fabrication					
91.	Check the pressure gauges on the Oxyacetylene cylinders to ensure workable pressure	4.09	3.54	0.55	High IN
92.	Light th e welding torch, and adjust to correct flame base on material to be welded	3.99	3.54	0.45	High IN
93.	Braze two pieces of meal until the joint built up	4.02	3.46	0.56	High IN
94.	Weld two pieces of metals together using the Oxyacetylene process	3.90	3.44	0.46	High IN
95.	Weld two pieces of metals together using the Are welding process	3.87	3.59	0.28	Little IN
96.	Clean the joint welded with either of the welding processes	3.60	3.59	0.01	Very Little IN
97.	Observe safety practices in Oxyacetyl ene welding process	3.67	3.94	-0.27	No IN
98.	Observe safety rules in Are welding process	3.89	3.88	0.01	Very Little IN

Key: X =Mean
NN =Needed
P =Performance
IN =Improvement Needed
INI =Improvement Indicator
N =Number of Respondents
PG = Performance Gap

Table showed that out of the 98 competency skills needed by the Metal Work instructors, they require improvement in 97. From the improvement index on the table, competency items are positive and ranged from 0.01-1.39. These revealed that these indicators are above 0, therefore metal work instructors require improvement in all the 97 competency skill items.

Discussion of Results

The results of this study revealed that instructors in colleges of Education in South western States of Nigeria needed Improvement in teaching the following competency areas in metalwork, sheetmetal work, machine shop Practice, foundry and forging; welding and fabrication. These findings agreed with the submission of Ogwo and Oranu (2006) who emphasized that teachers must be continuous learners through Improvement programmes. This will ensure that Instructors are retained to enhance their effectiveness in performing specified teaching activities. The findings also confirmed the views Sowande (2002) that technological skill competence of metalwork teacher is expected to reflect on the following major skill areas: sheetmetal work, machine shop Practice, foundry and forging, welding and fabrication.

The findings of this study showed that the respondent identified 26 corresponding skills in sheetmetal work which teachers needed for effective teaching of metal work. These findings were in agreement with Walker (2004), Repp (1994), Ludwig and McCarthy (1982), who submitted that one of the characteristics of the skilled metal worker / metal worker Instructor) is the ability (Skill) to select sheetmetal for practical instruction based on its properties and classification. They further affirm that once that skill is developed by the teacher, it would be much easier to impart the same skill to students during workshop practicals.

In machine shop practice; foundry and forging; welding and fabrication; respondents identified 45, 19, 8 skill items respectively as needed by metal work instructors for effective teaching. These findings were in agreement with the views of Repp and McCarthy(1984); Krar and Oswald (1990); Repp (1994) that machine shop practice involved operations skill in Lathe machine, Drill presses, Milling machine, they further outlined the operational skills needed by instructors in operating Lathe machine, Milling Machine, Drill Presses, shaping machine, grinding machine and planning machines.

Empirically, the findings from the study is in conformity with the findings of Ebaye (2007) in a study carried out on competency improvement needs of automobile mechanics teachers in technical colleges in Cross River and Akwa Ibon states, Nigeria. The author found out that the teachers needed improvement in Knowledge of subject matter, use of Instructional method / techniques, laboratory and classroom management, Communication Skills and Evaluation techniques.

Conclusion and Recommendation

It is the wish of Colleges of Education Administration to produce high quality teachers to teach the Basic Technology to students in the lower basic secondary school. This responsibility was given to metal work teachers in the Colleges of Education. Observations revealed that Basic Technology teachers Produced by metal work teachers in Colleges of Education could not effectively teach Basic Technology in the Lower Basic Secondary Schools, probably due to the type of training received from metal teachers while in the College. It also observed that students

of metal work in South Western States of Nigeria refuse to Practice the metal trade on graduation, but instead continue to search for while collar jobs since their training needs are not justifiably satisfied and their interest not will motivated in the profession. This could also be attributed to the perceived low level of skills of instructors in the Colleges of Education. The Instructors appeared not to have been teaching the required skills in Metal work very well a Situation which has continued to discourage the students from developing interest in metalwork. This study has assessed the competence of the Instructor and found it to be average; indicating a need for improvement. The study has also identified areas where the Instructors needed improvement for effective teaching of Metal work to student in Colleges of Education in South Western States of Nigeria.

It is therefore recommended that, the required competencies identified by this study be packaged and use to re-train the Instructors in Metal Work to enable them meet the training needs of students and justifiably motivate their interest in Metal working activities

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