ENHANCEMENT AND INNOVATION IN THE TEACHING OF METALWORK TECHNOLOGY

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Abstract

Education is dynamic that warrants changes in the curriculum content, concept and teaching methodology to go with current or modern development with the world. To accommodate these changes, the new concepts must be designed to be in conformity with National Policy on education and delivered or taught with new methodologies. The current concept of metalwork curriculum is deficient in the metallurgical perspective at both NCE and degree levels. The paper looked into certain areas of the minimum standard under metalwork technology and suggested reframing to give room for neglected concepts, so that metalwork technology graduates can familiarize themselves with these concepts and have the opportunity to further study in postgraduate engineering related programmes in metallurgy and have a place in advanced metal related specialization and industries.

Keywords: Concept, curriculum, minimum standard and metalwork

In every society the education structure is developed based on the aspirations which shall deliver it to the dream land. Similarly, as life goes with changes, which are due to developments, education policies and framework changes in order to tally with current situations. This assertion is in line with May (2012) commenting on the position of technical and further education of Australia "since education is the mechanism by which we transmit civilization from one generation to the next, large changes in our social and economic structures will always cause changes in the educational process". In a similar perception by Sen (1989) "if one studies the development process in totality and historical perspective it may not be difficult to establish beyond doubt that social changes are the products of economic development and cultural transformation is subservient to social changes". In Nigeria, the National Policy on education is the guiding document towards all education structure that came from people's aspiration as a result of social changes and is the determining framework on how the curriculum and its implementation will be carried out.

The National policy on Education of 2014 stated among the objectives of technical and vocational education "to give training and impart the necessary skills to the production of craftsmen, technicians, and skilled personnel who will be enterprising and self-reliant, and to enable young men and women to have an intelligent understanding of the increasing complexity of technology".
It is worth consideration that objectives of the technical and vocational education are solid in meaning, all necessary efforts are needed to make the society realized them in order to go with rest of the world.

Nigeria Certificate in Education Programme (NCE)

The National Certificate of education (NCE) programme is a programme designed to produce teachers with minimum teaching qualification for teaching at the primary and junior secondary school levels among the five areas, which the programme is designed for as stated in the document "the mandate of the teacher training programme at the NCE level, which is the recognized minimum teaching qualification in Nigeria, is to produce quality teachers for the basic education sub-sector" (NCCE, 2012). Technical and vocational is part of the education programme run under the NCE structure. According to the minimum standard students trained in technical education are meant to teach technical and technology related subjects. The objective is to prepare the young ones towards understanding and orienting them for technological development.

The minimum standard special edition 2012 of the NCE programme for technical education in particular stated the objectives expected after completion produced by the National Commission for Colleges of Education (NCCE) include the followings among others:-

- To produce technical NCE teachers who will be able to inculcate scientific and technological attitudes and values into the society;
- To produce qualified technical teachers motivated to start the so much desired revolution of technological development right from the Nigerian schools.

The above stated objectives are only achievable if the enrolled students into the programme are directed towards technological orientation by refocusing their minds on industrial and modern manufacturing processes. This is obtainable if the instructional modules have linked in context and practical with the industries. In context, meaning the learning material or concept should reflect the activities of the industries; while in practical means students should be introduce to modern methods of industrial production with examples of real world in terms of finished goods and by going on excursions to relevant industries and manufacturing companies. This will open their minds as to production or manufacturing routes for some of these products, which will give them ideas to what they are learning in class and the world outside the classroom. Similarly, the student industrial work experience scheme (SIWES) should be carry out in relevant industries. The SIWES programme as a matter of seriousness, institutions and the industries should have linkage and give room to students to acquire the expected experiences rather than ending in irrelevant quarters virtually doing nothing and at the end of the exercise learnt nothing.

NCE technical courses out line is part of the minimum standard that explains what components each course is made up of and each of these components is meant to expose the students in understanding what manufacturing processes involved. These are the learning components deliver to the students during class teaching and the practical exercise for the purpose of acquiring the necessary knowledge and skills, with the end goal of participating in industrial development.

Metalwork Technology Modules

Metalwork technology learning modules labeled TED 011, TED 021, TED 111, TED 211, TED 221, TEM 321 and TEM 322 for pre-NCE, NCE I, II and III comprised the areas student admitted for NCE (Technical) programme in metalwork to have covered by the end of the period of study.

If referred back to the stated objectives above, the instructional and learning framework now cannot deliver Nigeria to the promising land. The metalwork learning module is not well designed considering routes to achieve those objectives. There are some areas having repeated course code and content at different levels with out neither making any adjustment to the learning modules nor expanding it. The curriculum considered TED 011 and TED 111 as introduction to Metalwork. While it is believed that TED 011 is for Pre-NCE level; a level as preparatory ground for those students without technical background or those with deficiency to direct NCE technical programme and TED 111 s for those with required entry qualification, coming from technical colleges. In this situation both levels should not have similar learning modules.

The Pre-NCE is serving as preparatory ground for the NCE proper. Students from Pre-NCE going to NCE I having completed the one year programme having acquired the basic knowledge together with qualified NCE direct admitted students are expected to have module reflecting related but higher learning material than the Pre-NCE and secondary experience. This will expose them to new concept to build on their past experience, rather than repeating same content of material at different level. Because of this, the curriculum should carry new learning material that has relationship with concept learnt earlier. As an example, while the student at pre-NCE level learnt introductory aspect on production of metal, the curriculum should focus entirely on processes and application of metal and metal industries. By reaching NCE I. the student should be exposed to new and high material under the title “Introduction to Metallurgy”. The content of this concept should deal with more of the science and technology in the behavior of metal in common condition or environment.

The learning process shall continue going to NCE II, where the curriculum focus on machineshop processes. At this level, the students will interact with common machinetools available in typical school workshop, common machining processes and to be familiar with safety rules and regulations governing the use of these machines and the workshop. On reaching the final year, NCE III, the student shall be learning advanced industrial applications of metal and machining processes.

It is expected this will fully prepare the students as skilled technical teachers after graduation and ready in taking the teaching job expected; the student shall have materials for “Mechanical Craft Practice” and “Introductory Technology” subjects for both junior and primary schools. Similarly the student can confidently take up job with any metal related industries and at the end this will clear road towards achieving the two listed objectives above and others.

Why Enhancement and Innovation in Metalwork Teaching

There is a sign of development when there are changes in anything we do. Teaching is dynamic and learning is progressing when new concepts are introduced, which resulted from past experience. The newly identified concepts are brought into use when they are meant to enhanced both learning and skill acquisition.

In the world of metal or metallurgy there are a lot of new concepts that are in use ranging from iron and steel production, foundry, forging, application of light metals to light alloys. The procedure of curriculum review should be cognizance with the happenings in the field of technology especially in manufacturing industries. The complexity of today's technology cannot over emphasize. Everyday people interact with these new innovations consciously and unconsciously. Similarly people are not aware of how and why these changes despite the fact their advantages are beyond comment. Because of these situations, institutions of technical and technology education need to keep up with trend of events, by constantly enhancing the learning materials for the students especially those receiving train to be teachers. Nevertheless, in the field of technology and technology education, careful study of an event that warrants changes leads to finding the appropriate answer to these changes. The route to take is from with in us, train and obtain competent people as seen by May (2012) of Australian model of Technical and Further Education (TAFE) experience that "A TAFE is not a pickle factory, but a colloquium of minds of knowledge, understanding and skills. It is neither making nor selling a generic product, but providing a guide environment in which individuals have the chance to cultivate socially and economically useful skills, according to personal aptitude."

A typical example, today if one look at the modern vehicle around, their parts are made from highly precision technology, the technology that considers *tolerance at micron* ($\frac{1}{1000mm}$) *or nano* ($\frac{1}{1000,000mm}$) levels. Typical parts of this modern vehicles is the popular "alloyed rim", other parts include the block engine and the carburetor (injector type). These parts or products are manufactured from new casting technology called "Semi-solid Metal Process" (SSMP) of aluminium alloys.

The best forum to acknowledge these new innovations and give room for the required enhancement is not better than our schools; technical colleges and technical teacher training institutions. Our industries are the laboratories of any new innovations and changes; similarly they are the evaluation center of new concepts. Therefore, it is important to have an umbrella for the institutions and are partners in progress towards developing the technology needed in the society. This is the typical structure in use for some European countries like Romania in view of maintaining quality of VTET that "actively involving all stakeholders and particularly employers in the quality assurance process, the National Quality Frame work in Technical Vocational training and Education (TVET) has a critical role in achieving the major objectives regarding Vocational Education Training (VET)."

The expectations of the government and the policy designed are to have competent human resources to participate in the field of technology; the technology that will bring out general

potentialities on Nigeria as a nation with abundant natural resources, to be extracted and processed in Nigeria by Nigerians.

The natural materials or resources are not exhausted talk less of going into synthetic or man-made ones that the advanced world are in now.

Our environment is full of used remnants from our homes and industries and recycling of these used products is a problem of its own causing hazards to human life. Recycling technology is one of the major technologies that keep the advanced countries at safe side despite their increasing industrial development. Lack of Material scientists and technologists constituted a major setback to Nigeria in this perspective. Similarly, no part of the country is free from unused vehicle parts that can easily be recycled. The idea of recycling metal parts should have started the same time when the establishment of steel industries in Nigeria. This would have save the country huge sum of money from the importation of *pig iron* in the form of billet, bloom or ingot and other raw materials. Although the process of collecting this resource is going on now, if one can asses how trucks are carrying used metallic parts to our steel industries and compared with the surroundings, one may ask when shall we finish collecting this golden material? This is a stepping stone towards the development of steel industries. Along this line, may be the gigantic Ajaokuta steel plant abandoned for years could surface and function in its full capacity. The graduates of metalwork, metallurgy and material science will have a place to exhibit their potentials.

The idea of full knowledge or training in metal and other related engineering materials is to allow the students understanding the impact of two important variables on materials today, these are environment and temperature, how they affect the behavior of material in service, as full functioning or failure of any material is determine by the condition of the environment and the temperature at the time servicing. Most times the use of these products in a wrong environment and temperature cause failure or malfunction, but this cannot be realized as such the idea of taking appropriate measures is not known.

Conclusion

It is worth mentioning in conclusion that in order to achieve the objectives of technical education in Nigeria, there is need to refocus the curriculum sequentially, the training format should be arrange from the basic to advanced in such a way that the graduates in this field will have the opportunity of going deep into more practical aspect of metallurgy. This adjustment or modification of the learning concepts will serve as a step to the degree programme not only in the current "Bachelor of Technology" but also in "Metallurgy" and "Materials science" at postgraduate level. At the end, this knowledge together with the practical skills acquired at both NCE and the degree levels will give the chance for admission to postgraduate programme in either the metallurgy or materials science, which the present policy has not provided, similarly it is an opportunity in expanding the whole concept of technical knowledge needed by having direct linkage with manufacturing or production industries concern with steel, light alloys, composite and other non-metallic materials that are in use currently in industries like automobile, aerospace, oil/gas etc.

Recommendations

It is the hope of this presentation that our technical education curriculum planners will have a second thought on what really is the need of the technical programme taking into cognizance of the aspiration on Nigeria as a nation. The following recommendations may serve as a guide towards bringing the desired changes for better and progressive society full of science and technological opportunities.

- All the metalwork courses need to be modified by making adjustment to give room to new concepts
- The courses titles need to be changed, like TED III from "Introduction to Metalwork" should be "Introduction to Metallurgy";
- The teaching approach should have direct linkage with industries;
- In the curriculum development, industries should be given room to participate; this is from European Centre for The Development of Vocational training (CEDEFOP, 2009) model;
- There is need for an independent body in-charge of development of technical and vocational education. The National Board for Technical Education (NBTE) and National Commission for Colleges of Education (NCCE) are supervisory bodies for polytechnics and colleges of education; they are not doing enough in the development of technical and vocational education; this is Singapore (2009) model;
- At degree level, experts or industrialists should be invited to deliver lectures in relevant areas, with question and answer sessions for the students. At the end students will be required to prepare a report based on lecture delivered;
- The credit/workload need to be reviewed down, to give room for the students to focus on the core subjects/area of specialization, as suggested by Colleges of Education Academic Staff Union, (COEASU) (2011) position paper;
- All GSE courses should be limited to level I, while some education courses should end in level II and not more than two education courses should taken in the final year;
- All technical students should be made to have their Student Industrial Work Scheme (SIWES) exercise in relevant workshop and related industries and not local government secretariats.
- Lastly this will open the way towards full technological development that Nigeria is aspiring and not necessarily competing with the advanced world but to match with her counter parts countries like India, Singapore etc.

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