

Availability and utilization of mechatronics facilities in higher institutions in north-central, nigeria: the way forward

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Abstract: The implementation of automobile technology education curriculum to produce technological know-how graduates through effective teaching and learning in higher institutions cannot be achieved without the availability and utilization of mechatronics facilities. The paper investigated the availability and utilization of mechatronics facilities in higher institutions in North-Central, Nigeria and the way forward. The paper highlighted on the concept of high institution, mechatronics systems, automotive mechatronics, mechatronic systems facilities, availability and utilization mechatronic systems facilities in high institution as well as way forward in the provision of mechatronic systems facilities in higher institutions. Conclusions were drawn and recommendations include among others, Government should provide adequate facilities to higher institutions workshops using current strategies identified to ensure acquisition of relevant skills, and knowledge and experience that are relevant to the growth of the country

Key words: Mechatronics, Facilities, Availability, Utilization, and Higher institutions

INTRODUCTION

Higher institutions are places of learning above secondary school level where students are trained to acquire relevant knowledge and skills in different occupations for employment in the world of work. According to Abdulkadir (2011), higher institutions are organized school where education aimed at providing skills and knowledge required for employment in an occupation is given. Higher institutions all over the world have the prime aim of improving and impacting knowledge through teaching and research to produce manpower in different occupations such as automobile engineers and technologists. Higher institutions in Nigeria include

Universities, Colleges of Education and Polytechnics among others. According to Dokubo and Dokubo (2013), high institution graduates of automobile technology are expected to understand the operational principles and carryout maintenance services on automobile. The maintenance services on automobile require high degree of expertise due to the integration of mechanical systems with computer and electronics systems called mechatronics.

Mechatronics System

Mechatronics system is composed of *mecha* from mechanics and *tronics* from electronics. According to Harshama *et al.* (2006), mechatronics is the synergetic integration of mechanical engineering with electronic and intelligent computer control in the design and manufacturing of industrial products. A typical mechatronic system picks up signals from the environment, processes them to generate output signals, transforming them for example into forces, motions and actions. Basically, the major function in mechatronic system is the capability of sensing the change of the real-world environment to assist mechatronic systems in achieving desired actions of a mechanical component, or the technological restrictions required in a specific manufacturing process. Shetty and Kolk (2017) revealed that, the importance of mechatronics include the following:

1. It brings more efficiency: Mechatronics adds intelligence to design of the system, by which efficiency of the system improves.
2. It reduces cost: Mechanical solutions are expensive when compared to mechatronics solutions, which lowers cost.
3. A mechatronic solution improves design time, product size and reliability: It is also more user-friendly and safer to use.

4. Mechatronic uses microcontroller, by which precision, position, speed, flow rate, and variables can be controlled.
5. Using mechatronic solution increases reliability: Mechanical designs get damaged over time whereas mechatronic design is more reliable. An example is the odometer present in the cars.

Modern mechatronic system presents many improved and smart functions, e.g the estimation of non-measurable variables, the self-tune and adaptation of controller parameters, reconfiguration, supervision and fault diagnosis, safety and fault tolerance on engineering products such as automotive.

Automotive Mechatronics

Automotive Mechatronics is an engineering product that involves the multidisciplinary integration of automotive mechanical and electronic systems. Akele *et al.* (2011) defined automotive mechatronics as the replacement of mechanics with electronics or enhance mechanics with electronics in automobile systems. More and more mechatronic systems were integrated into automotive application. These systems include electronic fuel injection, engine management, transmission control, Antilock Brake System (ABS), Cruise Control System (CCS), Traction Control System (TCS), Vehicle Dynamic Control System (VDCS), power door locks, seat, mirror control, and window lift systems among others. Keys (2011) revealed that, mechatronic systems play a more important role for improving automotive functionality, safety, economy, comfort, and the designed functions assist the driver to prevent unstable or unpredictable behaviour and to stabilize the motion of the automobile. Alciatore and Histan (2015) further revealed that, the complex capabilities of fault detection and diagnosis are achieved by the integration of several growing technologies in the field of actuators, sensors, data processing among others.

Automotive mechatronics also offer intelligent engine control that reduce emission of pollutants and also increases the demands placed on diagnostics and maintenance. Despite the importance of these systems, their maintenance is a great challenge among large populace of high institution graduates of automobile

technology. Dhall and Solanki (2017) attributed the challenge faced by high institution graduates of automobile technology in the maintenance of automotive mechatronics systems to the lack of facilities.

Mechatronics Systems Facilities

Facilities can be generally seen as buildings, properties and major infrastructure which include physical and material assets. Facilities are materials resources that enhance completion of certain tasks thereby making the process meaningful and purposeful. Asiyai (2012) defined facilities as the essential concrete features that enable the craftsmen and technicians carryout effective maintenance of automobile in workshops. Fenker (2014) defined facilities as materials designed to serve technological purposes in the world of work. Nevertheless, facilities could be seen as the infrastructural that includes workshops, laboratories, equipment, machines, consumable materials and tools which enable a skillful craftsmen and technicians to achieve a level of maintenance effectiveness.

Mechatronics systems facilities refers to the material resources required for the teaching and learning the maintenance of modern automobiles in higher institutions. According to Schweitzer (2016), mechatronics systems facilities in higher institutions such as adequate workshops, tools and equipment, laboratories, computers and electricity are required in appropriate quantity and quality should be available for the teaching and learning in higher institutions to be effective. Jacob (2012) disclosed that, mechatronics systems facilities include a standard workshop, internet connected computer, scan tools, ohmmeter, voltmeter, oscilloscope, engine analyzers among others. These facilities help to actualize proficiency in job performance of lecturers and enhanced transfer of learning processes. Hassan and Hassan (2010) further stressed that, available and adequate modern facilities such as mechatronics systems facilities play a vital role in the teaching and learning technological related courses in higher institutions. Lack of mechatronics systems facilities brings critical concerns to educational system, automobile craftsmen, owners, users and the maintenance industry at large. Audu (2013) *et al.* revealed that, the effective teaching and learning of mechanical or automobile related courses

largely depends on the availability of mechatronics systems facilities.

Availability of Mechatronics Systems Facilities in Higher institutions

Availability is the degree to which facilities, service, or functional materials provided and made ready for use. Availability refers to the condition of being obtainable or accessible at a particular point in time. Availability expresses how instructional facilities can easily be acquire and use for a particular purpose. According to Longman (2000), availability refers to the quality, quantity, functionality and disposability of facilities at every point in time for effective utilization in this study. Availability means the condition with which lecturers and students have access and make use of mechatronics systems facilities for effective teaching and learning processes. Asilokun (2004) noted that, availability of mechatronics systems facilities is a holistic term that is attributed to the level of obtainability of material resources in the study of automobile technology. Available mechatronics systems facilities play pivotal role in the actualization of the goals and objectives of learning automobile technology.

Most automobile technology departments in our higher institutions do not have available mechatronics systems facilities. Where these facilities exist, they are grossly inadequate, obsolete and in a dilapidated state. Etuk and Asukwo (2015) posited that, what is seen and referred to as facilities in various institutions today are eye-sores as the workshops only have items or equipment that were provided at the point the departments were established. Dokubo (2013) indicated that 60% of higher institutions in Nigeria do not have mechatronics systems facilities and this affects the low quality of technology education programme in higher institutions. This situation is partly responsible for the reason why it has been increasingly difficult to run experiments effectively for students and thus making the teaching and research in technology education programme difficult.

These deficiencies constitute a major gap in the quality of input and output in education, thus the non-attainment of the set standards and goals in technology education programme in general and automobile

technology in particular. However, higher institutions in the North-Central, Nigeria turned into producing insufficient, unqualified and ill-prepared technology education graduates who ordinarily are supposed to be the driving force for the economic and industry transformation of the country as experienced in developing countries. The unavailability of mechatronics systems facilities has contributed to poor performances on the part of students. Ekpo (2010) noted that the quality of education depends on the resources such as human, material and financial resource. When these are not properly provided in adequate quantities, the goals and objectives of technology education programme is defeated. Nevertheless, the availability of mechatronics systems facilities is meaningful with effective utilization.

Utilization of Mechatronics Systems Facilities in Higher institutions

Utilization is the process of using procured and accessible facilities tools, components equipment and appliances to make automobile maintenance process easier, interesting and rewarding. According to Kelani (2017), utilization is the primary method by which asset performance is measured and business determined. It is the transformation of a set of input into goods or services (Anaele, 2012). Utilization, in this context, refers to the rate at which mechatronics systems facilities in higher institutions workshops are used by lecturers and students of automobile technology. Utilization of available mechatronics systems facilities promotes meaningful teaching and learning processes. Okah-Avae (2015) noted that, the poor service delivery in automobile maintenance industry is due to non-utilization of mechatronics systems facilities in higher institutions responsible for graduating automobile engineers and technologists. This implies that, the ultimate goal of providing the technological manpower for ensuring effective maintenance of automotive mechatronics systems on modern automobiles cannot be achieved. Akele *et al.* (2011) further revealed that, poor maintenance of automotive mechatronics systems on modern automobiles is due to the lack of accessible, available and adequate mechatronics systems facilities in higher institutions. It is therefore paramount to device means

to address the ugly situation that hinders the teaching and learning processes in higher institutions designed to produce technical personnel to effectively maintain automotive mechatronics systems on modern automobiles.

Ways Forward in Ensuring the Availability and Utilization of Mechatronics Systems Facilities in Higher institutions

1. **Private Sector Involvement:** The private sector in Nigeria should be encouraged to initiate and participate in the provision of mechatronics systems facilities in higher institutions to facilitate adequate and efficient transfer of knowledge.
2. **Linkages between Higher institutions and Private Sector:** Linkages between higher institutions and the private sector should be strengthened to ensure the appropriate interface with the world of work. This could be achieved through constant invitation of private sectors to participate in school programs leading to proper understanding and integration.
3. **Partnership between Higher institutions and Automobile Maintenance Companies:** Partnership between higher institutions and automobile maintenance companies should be established to assist in provision of mechatronics systems facilities in higher institutions. This could be achieved through interactions as higher institutions provide industry with a pool of potential employees.
4. **Seeking Supports from Non-Governmental Organizations (NGOs) and Community Based Organizations (CBOs):** NGOs and CBOs should be sought for support in supplying relevant mechatronics systems facilities to workshops in higher institutions as obtained in some nations.
5. **Special Intervention Funds:** Special intervention funds should be set aside by government for procurement of mechatronics systems facilities in higher institutions, such channels may include Education Tax Fund (ETF).

6. **Allocation of percentage of Income Tax:** A specific percentage of income tax generated annually by Government should be utilized for the provision of mechatronics systems facilities in high institution.

Conclusion

The implementation of curriculum of automobile technology in order for effective teaching and learning to take place in higher institutions cannot be achieved without adequate provision of mechatronics systems facilities to cater for the teeming number of students. The availability and utilization of mechatronics systems facilities will enhance teaching and learning and improve automobile technology students' academic performance and the acquisition of practical skills for gainful employment in industries or related organizations, so that they can contribute to the development of their immediate society and the nation at large.

Recommendations

Based on the above revelations from the findings of this study, the following recommendations are necessary in order to improve on the availability and utilization of mechatronics systems facilities in higher institutions:

1. The private sector in Nigeria should be encouraged to initiate and participate in the provision of mechatronics systems facilities in higher institutions

Government should provide adequate facilities to higher institutions workshops using current strategies identified to ensure acquisition of relevant skills, and knowledge and experience that are relevant to the growth of the country.

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