



Construction Process of Robotic Devices to Teach Aspect of Auto Mechanic in Nigeria Basic Schools

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ABSTRACTS

The 21st-century world is powered by technology. The education of any nation is to empower the citizens to fit successfully into society. The 21st-century world is ruled by information, only individuals with the ability and skills to utilize modern digital tools to access and generate information and knowledge can perform in the global work atmosphere. The technologies of today have completely changed the learning environment. People in the 21st century live in a technology and media-suffused environment, marked by access to an abundance of information, rapid changes in technology tools. To be effective in the 21st century, an individual must be able to exhibit a range of functional and critical thinking skills related to information, media, and technology. Technology has become more powerful and universal and this has provided educators with valuable tools to support learning. The utilization of technological devices in education has become familiar with the fast advance of technology in the 21st century. We can see a high potential particularly in technical tools which will develop the imagination and creative thinking of students. There is a need of implementing the content of the curriculum through robotic devices. In the light of this view, this study shows the construction process of robotic instructional devices to teach aspects of Auto Mechanic in Nigeria basic schools.

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1. INTRODUCTION

Several years back, the technology-focused subject was not prioritized at the lower level of the Nigerian educational system. To address the gap, a change was necessitated, and the former 6-3-3-4 system that introduced the teaching of introductory technology as a subject in junior secondary schools in Nigeria evolved. Now technology-focused education was formerly restricted to technical education which in essence meant skills training in crafts and certain trades and can be used interchangeably (Alegbemi & Olokoyo, 2015).

Basic Science and Technology as the aspect of education which leads to the acquisition of practical and applied skills as well as basic scientific knowledge. It is also a subject that deals with the fundamentals of engineering and technology and its components. Nigeria Educational Research and Development Council (NERDC) described Basic Science and Technology as a compulsory subject in the 9-year basic education program. The 9-year Basic Science and Technology curriculum is restructuring and re-alignment of the revised core curriculum for the Junior Secondary School currently in use, and it's been infused into every class of Basic 1-9. Basic Technology is also an integrated study of skills subjects such as woodwork, metalwork, building technology, auto mechanic, electrical/electronic, ceramics, and technical drawing (Olaniyan & Ojo, 2008). As the subject implies, Basic Technology combines so many skillful subjects or courses at their basic levels from which learners can choose a career in the future.

The objectives of the new Basic Science and Technology curriculum are to enable the learner: develop an interest in science and technology; acquire basic knowledge and skills in science and technology; apply scientific and technological knowledge and skills into contemporary societal needs; take advantage of the numerous career opportunities in science and technology and so on.

The purpose of Basic Science and Technology is to contribute to the achievement of the national education goals through the inculcation of technology literacy, exposure of students to the world of work to match their talents and interests for wise vocational choice and inculcation of positive attitudes toward work as a source of human identity, livelihood, and power. The teaching became necessary due to technological development and increased national policy orientation towards technical and vocational education development.

Basic technology is one of the essential pre-vocational and integrated subjects offered in upper basic schools in Nigeria which introduces students to the basic rudiment of technology. Basic Technology involves the academic and practical study of materials and sources of energy with the sole purpose of providing a broad-based skills development approach to practically oriented work, where practical knowledge and skills acquired are used in the services of a man in providing his daily needs as well as making his environment more conducive for his continual survival.

The Basic Technology curriculum is structured in such a way that, at the end of the first three years in upper basic classes, students should at least be capable to be literate about Artisans and Craftsmen (Babafemi, 2016). In the junior secondary school curriculum, Basic Technology includes a broad range of fields of study and subjects such as auto mechanics, applied electricity, building, ceramics, metalwork, woodwork, plastics, rubber, food preservation, storage, technical drawing, and other miscellaneous topics. The subject guidelines and contents have been carefully structured into a teaching sequence, which consists of clear explanations and descriptions of how results are obtained by using different tools, machines, and materials. It is also a skill-developing subject, which aims at providing students with technical literacy for everyday life. This is also meant to provide basic

knowledge about industrial technology. It is designed to develop in students an appreciation of technology and interest in specific areas of industrial technology.

The Basic Science and Technology Curriculum produced by the Science Teachers Association of Nigeria (STAN) was more comprehensive and integrated. The document adopted the nomenclature for the title of the subject in line with happenings in the developed countries of the world. There is no doubt that relevance and functionality have become the major consideration for teaching and learning Basic Technology. The consequence of these considerations made the association design the subject that would relate the child to the environment and develop in the child, inquisitiveness, and skill that relate to the discovery of science concepts and their applications.

Technical Education is the gateway to industrialization. It is also established as a vehicle of productivity, social and economic development. Technical Education was established in direct response to the country's need for skilled innovation and technological-oriented manpower resources for the development of a technologically based economy. The curriculum became necessary due to technology development and national policy orientation to the teaching of technology as an integral part of world globalization trend in education.

The objectives of technical education as follows: to provide the young ones with diverse basic education knowledge and skills for entrepreneurship and educational advancement to develop patriotic young people equipped to contribute to social development and in the performance of their civic responsibilities, and to inculcate values and raise morally upright individuals capable of independent thinking, and who appreciate the dignity of labor.

The basic technology, therefore, is a subject taught in the junior secondary school with the incorporation of many skilled subjects such as woodwork, metalwork, electrical/electronics, mechanics, technical drawing, and local crafts to enable students of that school-age to be aware of basic technical skills and competencies for meaningful living in the society. In the Nigerian Federal curriculum, the objectives of basic technology are to: provide pre-orientation for further training in technology, provide basic technological literacy for everyday living and Stimulate creativity. This curriculum is designed to develop students and appreciate technology and develop an interest in specific areas of industrial technology. On completion of junior secondary school, students are streamed into senior secondary school, technical college and out-of-school vocational training center, and an apprenticeship scheme. Indeed, the introduction of the scheme by the Federal Government has strengthened science and technical education at the secondary school level.

Bingimlas (2017) indicated that technology is widely used in this current society, most especially for teaching and learning. Modern technology offers many tools that can be used in the classroom to improve teaching and learning. Noted that technology has great potential to increase learners' motivation, link learners to various sources of information, support interactive learning, and allow teachers more time for facilitation in the classroom. Basic technology incorporates subjects comprising of woodwork, metalwork, auto mechanic, electrical and electronics, technical drawing, building technology at their basic level. Students will learn about construction technology, construction materials and management, and project design. They will study building foundations, subsystems, and structures, and learn how these systems are maintained, repaired, or altered. Commercial, industrial, and engineered construction processes and procedures are also included.

The point that the use of instructional tools to facilitate learning or instruction is significant. Therefore, designing and construction are equally important, some of the useful instructional tools are not easily improvised. This makes those tools to be unavailable in large quantities.

The ability to make the best use of the instructional tools that are available with modern innovation is grossly lacking. This could be a result of many problems such as lack of teachers' professionalism and technical knowledge, time limitation, financial constraint, poor maintenance, and environmental factors.

Buildings and urban infrastructure create the framework for our daily life. [Alegbemi & Olokoyo \(2015\)](#) posited that the adoption of technology in education will result in the use of the product of technology for creativity, inventions, and scientific research in the service of man. Observed technology as the making, modification, usage, and knowledge of tools, machines, techniques, craft, system, and methods of organization, to solve a problem, improve a pre-existing solution to a problem, achieve a goal, handle an applied input/output relation or perform a specific function.

Asking questions and defining problems, planning and carrying out investigations, and engaging in arguments from the evidence are some of the skills that are encouraged in robotics classes. He also reported that robotics not only helps students to learn and understand mathematics subjects but also contributes to promoting problem-solving and teamwork skills, thinking skills, developing and reflecting on their learning. Robotics can be applied as a tool that gives opportunities for students to engage and develop computational thinking skills ([Gorakhnath & Padmanabham, 2017](#)).

Automated instructional materials frequently seek to mimic the best practices of one on one human tutors to drive improved student learning outcomes in a manner that is both scalable and cost-effective. Next-generation learners will have access to both automated and human sources of instruction in a variety of learning contexts. It will be most effective if students can be assisted to appropriately navigate between these sources of instruction. For example, human tutors, when helping a struggling student, might benefit from having access to the learning profile an automated tutor possesses on the student, including what the student already knows, detected misconceptions, inferred effective state and details about the student's work with the automated system before requesting human help.

The basic technology is an integration of subjects comprising of woodwork, metalwork, building technology, auto mechanic, electrical and electronics, technical drawing, and automobile at their basic level. One of the problems facing education in Nigeria is the non-provision of quality science and technology education. Factors militating against the teaching and learning of basic technology practical work are poorly equipped laboratories or workshops, lack of qualified teachers to teach practical concepts, and non-availability of facilities to aid the teaching of basic technology. Concluded that Nigerian schools at all levels are lacking the essential teaching materials, especially for science practical classes. This, no doubt, affects the learning process.

Most secondary schools lack science materials, and those that claim to have are managing the old ones. Hence, the students only cram theoretical steps rather than carrying out the practical. Therefore, this study examined the construction processes of Automated models of cars, airplanes, trains, and ships to teach an aspect of Auto Mechanic in Nigeria basic schools to bridge the existing gap.

2. METHODS

This study, construction processes of a robotic prototype of car, airplane, train, and ship to teach an aspect of Auto Mechanic in Nigeria basic schools was a production-oriented type of research. It involves the construction of a robotic model of car, airplane, train, and ship. This type is appropriate because it allows researchers to express themselves in terms of design and construction in the teaching and learning process. Materials sourced from the

environment were used to produce the models. Such materials include Plywood, 4volts rotor, Top bond, 4volts led light, 8volts battery, Tester, Wire, Sandpaper, Jigsaw, Table saw, Hot Knife Cutter, Hammer, Nails, Wire stripper, Plier, Hot glue gum, Led, Multimeter, Soldering accessories, Compass and so on.

3. RESULTS

The construction of a robotic instructional model is a task that can be engaged by an expert in the area of Instructional Technology. It requires several practices and devotion to the principles and use of elements of design. Also, the appropriate use of relevant tools, equipment, and tools is indispensable. However, for an interested individual, skills for model construction can be acquired by first having an adequate observational view of the real objects to get familiar with the forms and features of the object. The process began with coming up with the idea and later proceeded to scriptwriting with a narration of the task and content coverage of those models. The scriptwriting helped us to develop a storyboard. This gave definite directions to us on effectively carrying out those activities in the production stage. Principles and elements of design (proportion, harmony, texture, balance, colors, lines, tone, shapes, and form) that was used for production were scripted.

The second stage in the development of the models involved cutting of 1/8-inch (3 mm) plywood with cutter and G-saw (a simple machine used to cut hard materials such as wood). The shapes of the models (Car, Airplane, Ship, and Train) were sketched on the plywood after which the shapes were cut out with the aid of hand cutter and G-Saw respectively. Rough surface sandpaper was used to scrape the surface of cut-out wood before top gum was applied on the edge of the wood and later clamped together to form the shape of the models.

The automated aspect of the model involved two devices: 4-V rotor and 4-V LED Light. The rotor was connected to the tire of the car and also the train. 8-V battery was used to power both the rotor and LED light. The positive wire of the 4-V rotor and positive 4-V LED light were connected while the negative wire of the 4-V rotor and the 4-V LED light were connected and directed to the power source of the batter. Car paint (red and white) and emulsion paint were used to paint the models. Emulsion paint was applied first before smooth surface sandpaper was used to smooth the surface of the models. With the aid of the spryer, car paint was sprayed on the surface of the models to aid the actual resemblance of the real object.

4. DISCUSSION

The 21st Century learning framework describes the learning expectations in a digital world. The need for teachers to keep pace with the new technologies in teaching by upgrading their knowledge for use of these technologies in meeting the learning needs and expectations of the 21st Century students has become a necessity. This study has great implications on instructional delivery, techniques, and approaches in teaching and learning of Auto Mechanic in Nigeria basic schools. The study provided practical knowledge and experimental awareness on improving the instructional practices in Nigerian educational institutions, particularly upper basic schools in the area of teaching and learning of basic technology. Automated instructional materials can exhibit gestures and body movements so they could be used by the teacher to explain a concept.

This study illustrational explained the process involved in the construction of robotic replicas of cars, airplanes, trains, and ships to teach an aspect of Auto Mechanic in Nigeria basic schools. The robotic replica of cars, airplanes, trains, and ships is a direct copy of the actual objects. The construction was successfully carried out with the following materials and tools; Plywood, 4-V rotor, Top bond, 4-V led light, 8-V battery, Tester, Wire, Sandpaper,

Jigsaw, Table saw, Hot Knife Cutter, Hammer, Nails, Wire stripper, Plier, Hot glue gum, Led, Multimeter, Soldering accessories, Compass and so on. Construction involves the translation of a design into reality, this involves a systematic and conscientious process of bringing together or assembling diverse elements or parts to form a whole. Therefore, special care has to be taken during construction as the design intentions must be achieved. Construction is the process of moving and assembling materials and equipment into completed forms for use. This finding aligned with the finding of [Gorakhnath & Padmanabham \(2017\)](#) on educational robotics in the teaching-learning process, they posited that the use of robots to support teaching and learning has gained popularity. Over the past decade, researchers have provided substantial evidence that the robot is a great teaching aid for mathematics and science. Furthermore, educational robots are helpful to students in developing collaboration and problem-solving abilities.

5. CONCLUSION

Robots can create an interactive and engaging learning experience. Teachers will have more time to guide weaker students when the robot is the primary focus of attention. The important factors that influence whether the robot is likely to be useful in teaching include usability and the availability of appropriate learning activities and content. Compared to other instructional tools such as still objects for teaching; automated or robotic instructional materials have the advantages of being able to demonstrate highly mobile behaviors and extensive repetition. However, based on current technologies, there are many challenges and limitations to the expanded use of automated or robotic instructional materials in the teaching and learning process. The problem includes curriculum structure, this gives no room for creativity on the part of teachers and students. The curriculum is not only time-framed but also highly sequenced and teacher-centered.

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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