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Detail Experimental Procedure for the Construction Process of Robotic Devices to Teach Aspect of Auto Mechanic

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ABSTRACTS

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. 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. Robotic instructional devices can exhibit gestures and body movements so they could be used by the teacher to explain a concept. Robots can create an interactive and engaging learning experience. 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. There is a need of implementing some content of the curriculum through robotic devices. In the light of this view, this study shows the detailed experimental procedure for the construction process of robotic devices to teach an aspect of Auto Mechanic in Nigerian basic schools.

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1. INTRODUCTION

Design is a form of blueprint for the construction of an object (Monroe *et al.*, 1997). Designing often necessitates considering the aesthetic, functional, economic, and socio-political dimensions of both the design object and the design process. It may involve considerable research, thoughts, modeling, and interactive adjustment and re-design. Design can be a roadmap or strategic approach for someone to achieve a unique expectation (Kerr & Phaal, 2015). It defines the specifications, plans, parameters, costs, activities, processes, how and what to do within legal, political, social, environmental, safety, and economic constraints in achieving that objective. In the context of this study, design is used to mean the drawings that are to be drawn before the construction of the robotic devices which takes into consideration durability, aesthetic, and functional factors of instructional devices.

Design is the creation of a plan or convention for the construction of an object or a system. Designing often necessitates considering the aesthetic, functional, economic, and social-political dimensions of both the design object and design process. It may involve considerable research, thoughts, modeling, and interactive adjustment and re-design. Design is a roadmap or strategic approach for someone to achieve a unique expectation. It defines the specifications, plans, parameters, costs, activities, processes, and how and what to do within legal, political, social, environmental, safety, and economic constraints in achieving that objective. Design is also defined as a specification of an object, manifested by an agent, intended to accomplish goals, in a particular environment, using a set of primitive components satisfying a set of requirements, subjects to constraints. Design work is often created purely as a means of artistic expression. Construction involves the translation of a design into reality.

Construction involves a systematic and painstaking 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. In the context of instructional technology, the design and construction of instructional robotic devices can be done comfortably with the aid of an instructional design model to guide the developers to effectively carry out the task to achieve the stated objectives. Instructional design models provide a framework to facilitate gaining new knowledge, skills, or attitudes. Instructional designers use these models to guide the creation of engaging learning activities based on the science of how people learn.

Instructional system design models for designing and constructing instructional devices include ADDIE model (1990), Dick & Carey (2005), Kemp ISD models (1994), Smith and Ragan model (1999), Gerlach-Ely model (1971), Stufflebeam's Content Input Process and Product (CIPP) evaluation model (1960) (decision-making); Tyler's Evaluation Model (1940) (goal-based); Scriven's Goal-Free Evaluation Model (1991) (goal-free); Kirkpatrick's Evaluation Model (2006) (system-analysis); Bates ACTIONS Model (1995) and ETIMI Model (1999). While there are a lot of instructional design models, the ADDIE model is still the most widely used model, which includes the generic phases found in most of the subsequent models. The ADDIE model is the generic process traditionally used by instructional designers and training developers. ADDIE model aims for a learner-centered rather than the traditional teacher-centered approach to instruction so that effective learning can take place. This means that every component of the instruction is governed by the learning outcomes, which have been determined after a thorough analysis of the learners' needs. The five phases: Analysis, Design, Development, Implementation, and Evaluation. This sequence, however, does not impose a

strictly linear progression through the steps (Khalil & Elkhider, 2016). In the context of this study, the first three out of the five stages of the ADDIE instructional system design model were adopted to guide the designers for the pre-production and production activities. The first three stages include Analysis, Design, and Development. As an instructional design model, Addie Model has found wide acceptance and use (Khalil & Elkhider, 2016).

The most common practice in the design and construction of robotic devices is to employ the process of ADDIE. It is the most basic and applicable, generic, and systematic instructional system design model which includes the generic phases found in most of the subsequent models. The ADDIE model correlates with the designing and construction of robotic instructional devices. The purpose of this study was to explain in detail experimental details regarding our previous study in Babalola and Omolafe (2022).

2. METHODS

This is a construction process-oriented type of research. It shows the detailed experimental procedure for the construction process of robotic instructional devices to teach an aspect of Auto Mechanic in Nigeria basic schools. The design and construction involved the first three stages of the ADDIE instructional system design model (Figure 1); these are Analysis, Design, and Development. 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, MultiMate, Soldering accessories, Compass and so on.

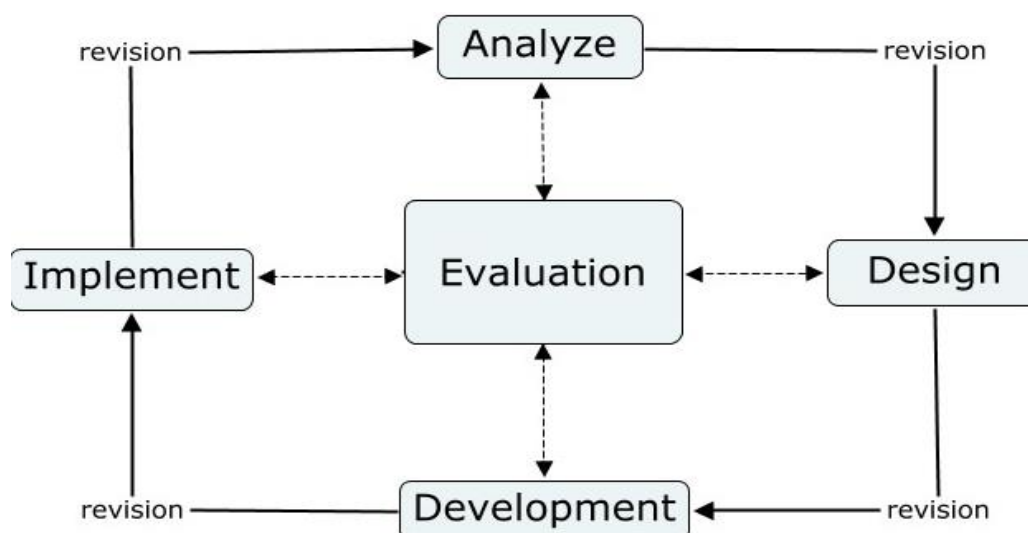


Figure 1. ADDIE model.

3. RESULTS AND DISCUSSION

The first three phases of the ADDIE instructional system design model were adopted for the construction of the robotic devices. They are ADD, Analysis, Design, and Development. The analysis phase is the foundation of all other phases of instructional system design. This phase requires the instructional designers to identify the source of the problem, define it and determine the possible solution. The instructional designers need to identify the learning environment, the instructional objectives and the students' needs, existing knowledge, and any other relevant characteristics. In this study, the researchers gathered all the necessary information regarding Auto Mechanic basic school students' characteristics, including their

entry behavior/previous knowledge, available facilities in the Auto Mechanic workshop to gain insight into that difficult concept in learning Auto Mechanic before the design process.

The design phase came after analysis, where researchers created an overall blueprint of how the instructional robotic models look like. This phase deals with the outputs obtained from the analysis stage and planned a strategy for the construction of robotic instructional devices. Therefore, described all the content areas that will be covered in form of scriptwriting, storyboard, text, and sketches in preparation for the construction of the robotic devices. Thus, the outputs of this phase were the inputs for the development phase.

Development is a stage in the construction of robotic instructional devices in which both analysis and design processes interact. The development phase is built on both the analysis and design phases (Eskandari *et al.*, 2014). It is the actual production of the instructional content robotic devices based on the design phase. This is, after selecting the methods of instructional delivery and creating the learning objectives in the design phase, the development phase deals with creating and organizing the actual learning material that will be used during lesson presentation (Cheung, 2016). The robotic devices which are to be used to facilitate the teaching and learning of the concept of an auto mechanic in Nigeria basic schools were constructed accordingly. 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. Detailed photograph images in **Figures 2 - 8** show the materials and procedures involved in the design and construction of the robotic instructional devices.

This study shows the detailed experimental procedure for the construction process of robotic devices (car, airplane, train, and ship) to teach an aspect of Auto Mechanic in Nigeria basic schools. The step-by-step procedural process involved in the design and construction of replicas of cars, airplanes, trains, and ships. The construction was successfully carried out with the following materials and tools; 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, MultiMate, Soldering accessories, Compass and so on.

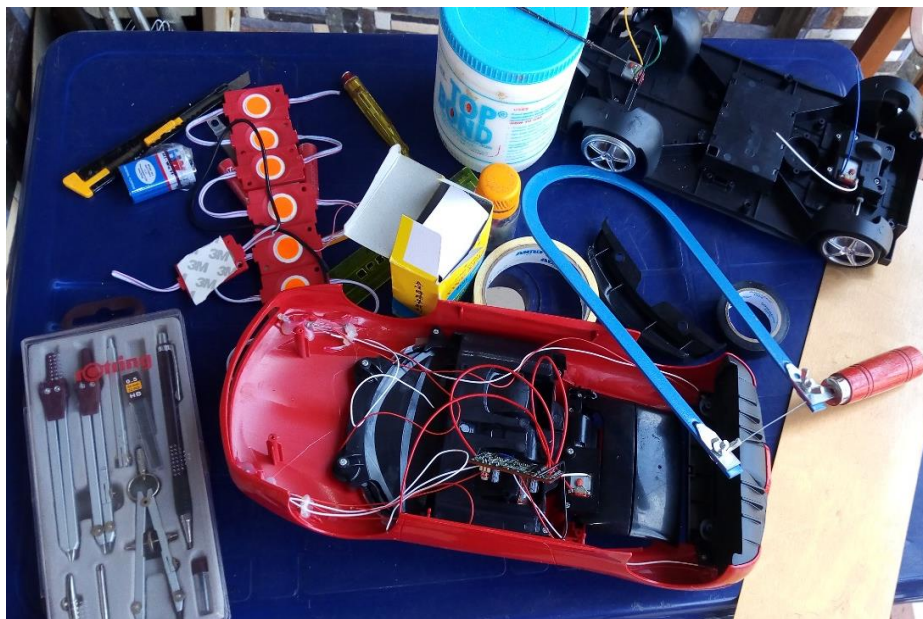


Figure 2. Materials and tools for the construction of robotic instructional devices.



Figure 3. Cutting part of the shape of the constructed robotic instructional devices.

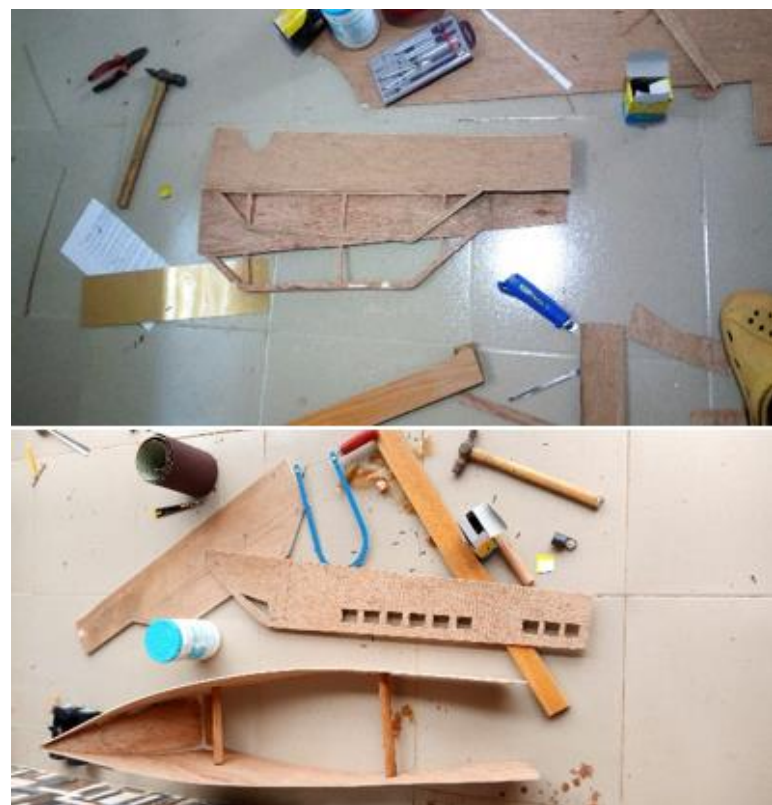


Figure 4. Cutting the shape of the constructed robotic instructional devices.



Figure 5. Cutting and assembling of the parts of the constructed robotic instructional devices.



Figure 6. Assembling of the part of the robotic instructional devices.



Figure 7. The photographic images of the devices used for the automated aspect of the model.



Figure 8. Painting car and plane.



Figure 9. Painting results.

4. CONCLUSION

The relationship between design and construction is one of planning and executing. In theory, the plan should anticipate and compensate for potential problems in the execution process. Design involves problem-solving and creativity. In contrast, construction involves a routine or pre-planned process. Before designing any instructional media, the audience for which it is meant should be seriously considered, that is the students in different categories. Visual instruction as this was called was the attempt to make abstract ideas concrete and to promote intellectual or cognitive learning. 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.

5. 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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