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Justifiably Improved Model for Car Engine and Lighting Simulation: A Teaching Device for Automotive Servicing, National Competency Level 1 (NC 1)

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Abstract

Learning engine and chassis electrical system in automotive technology should conform to the manipulative requirements of the Technical Education Skills Development Authority (TESDA). National Competency (NC) in levels I, and II requires tedious trainings for automotive student-trainees in order to pass the TESDA certification body. Subsequently, the K-12 program of the Department of Education(Dep-Ed) in the country offering automotive as one of it's course should be made acceptable and compliant to the TESDA National Competency (NC) standard as embodied in the Philippine TVET Qualifications Framework (PTQF. Infancy of the program offering require trainers, mock-ups and relative educational materials in automotive technology to facilitate and heighten automotive technology instructions specially in the implementation of the K-12 program.

A need to design, develop, try-out and evaluate an environment-friendly instructional device for automotive technology using locally available materials was made and utilized with aims to enhance the manipulative skill of the trainees.

The researchers opted to follow the Research and Development (R&D) process. The descriptive method was introduced through a survey questionnaire to automotive technology students, mentors of Partido State University (PSU) and selected shop owners in the locality as respondents. T-test is also applied to further validate the study.

The instructional model was introduced in automotive mainly for learning automotive engine and chassis electricity, thus this study was conceptualized.

Keywords: automotive technology, chassis wiring, design, engine electricity, instructional model

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1. Introduction

Teaching and training future skilled workers in the Philippines was entrusted by the Aquino government to the Department of Education (Dep-Ed) through the establishment of the K-12 program before his term ends. The first two years in college was today's new burden delegated to the Department of the Education (DepEd) considering the inadequacy of relative teaching materials for the course. Said program was aimed at producing workers competitive in the Association of South East Asian Nation (ASEAN) and throughout the world. Teachers in the secondary schools were sent to trainings and are required to have their National Competency (NC) levels to cope up with new program requirements of the government.

National certificate is a certification issued to individuals, students and professionals who achieved all the required units of competency for a national qualification as defined under the TESDA training regulations. National certification are aligned to specific levels within the Philippine TVET Qualifications Framework (PTQF-TESDA board resolutions no. 2004-13, Training regulations framework) where worker is expected in a. NC1 performs a routine and predictable task; and works under supervision and b. NCII perform prescribe range of function involving known routines and procedures; has limited choice and complexity of functions, and has little accountability.

Reality, to pass the certification test, instructional mock-ups and trainers in the K-12 program of Department of Education (Dep-Ed) must be available and functional. But it was found to be inadequate considering it's infancy and newness of the curriculum offered to the secondary education. Specifically, almost all high schools in the province start from the basic in an attempt to introduce K-12 programs including automotive technology as course. In this sense, acquisition of the needed knowledge and manipulative skills of the students will definitely be taken for granted. Newly recruited and illegible teachers of the program will resort to the written and oral use of words. Expectation from this mentors should be at par with instructors teaching in the college or universities offering the same program.

Corpus (2016) explained that his study was aimed at revolutionizing learning through his online module to make highly technical computer languages used in microchip technologies accessible, suitable, and operational for the benefit of engineering students. The study was a descriptive and developmental in nature which utilize the Analyze-Design- Develop-Engage-Engage-Evaluate(ADDEE) framework as guide. The product is a promising project in creating a platform that will ensure student achievement and improve learning technical disciplines.(p.vii)

Babalcon (2015) reiterated that concerns about instructional modifications inspire faculty researchers to get ready with instructional materials, teacher–made tools and gadgets as well as technology- laden learning approaches to enable K to 12 graduates who may pursue courses in college to acquire lifelong learning skills that will make them better prepared for job opportunities for self-employment (p.61)

As Cruz (2012) explained that instructional materials a r e specific items in a lesson and delivered through various m e d i a formats such as video, audio, print, improved devices and so on. It is a channel of communication that carry messages with an enhanced instructional purpose.(p.23)

Marty (2010) also stated that the economic progress of a county depends on technological advancement and manpower training. He reiterated that technology has a great contribution to economic progress, as the economy is periled with continuous increase in price of oil and prime commodities and other threats to our industry, to policy makers are giving great importance on research and development, specifically on the introduction of new discoveries and invention of new products.(p.15)

Needless to say, as instructors, improvement of teaching styles trusted much how the instructor faces the main concern of teaching, thus, various application of teaching is at cost and must properly be identified. In this premise, instructional device is an indispensable aid in carrying out the ideals and objectives formulated in developing would-be trainees and future workers in the automotive discipline.

In an attempt to answer and provide solution to lack of instructional materials in the Department of Education (DepEd) offering the technology strands in Partido, thus this study was conceptualized.

2. Objectives of the Study

The present study attempted to: 1.design, fabricate, try-out and evaluate a device that will expedite teaching-learning process in automotive compliant to Technical Education and Skill Development Authority (TESDA)NC-1 level, 2. test the capability and limitation of the training device, 3. perform try-out and revision, 4. determine the level of acceptability of the device in terms of: a. functionality and b. usability, 5. know the performance of the student respondent in pre-test and post-test following required National Competency (NC)1 learning areas: a. starting system, b. charging system, c. ignition system, d. lighting, and accessory system 6. compute the significant difference on the of the student-respondents as revealed by pre-test and post-test on the identified learning areas, and 7.identify the significant difference between the

evaluation of two groups of respondents on the acceptability of the improved training device.

3. Materials and Methods

The Research and Development process (R&D) was the technique employed in the study for the output is the project that will be valuable to the teacher. Likewise, the descriptive method was used since a survey questionnaire was administered in order to realize the validation of the improved teaching material.

Experimental method using two groups- experimental and control groups was adapted to compare the conventional manner of teaching with the utilization of the improved instructional device compliant to Technical Education and Skills Development Authority (TESDA) NC-1 standards based on what is required in the curriculum.

Bachelor of Technology **(**BAT) 212 subject of Partido State University (ParSU) to find out the accomplishment of the groups of respondents.

Weighted mean and t-test was also used in the validation of the study..

4. Results and Discussion

Project Presentation, Analysis and Interpretation

The teaching device in this study is a utility model for engine electricity comprised of ignition, starting and charging system. It is also combined with chassis electricity for lighting system accessories for headlight, signal light, park tail light, stop light horn system and wiper system in the device.

4.1. Stages in the construction of design and plan

The proponents followed different stages in fabricating the improved teaching device: 1) Conceptualization of the design-The researchers designed the trainer applicable for engine and chassis training. The planned working drawings was followed to assure accuracy of the proposed project, 2) Supplies and materials, tools and equipment needed were estimated, purchased and used in the fabrication of the trainer, 3)The construction and assembly of parts include: a) mock-up (main frame) fabrication through welding, brazing grinding and finishing based on the prepared working drawing, and b) mounting of required engine electrical parts and other sub-component parts for headlight; signal light; tail/park light, stop light, horn and wiper circuit.

Figure 1: The trainer and students manipulating the teaching device.

During the try-out of the improved device, the Technical Education and Skills Development Authority (TESDA) NC-1 core competencies was applied: 1) test, service and replace battery, 2) test, service and repair wiring/lighting system, 3) Remove and re-install starting, charging and ignition circuitry, and 4) use special service tool for checking dwell and ignition timing following prescribed specifications.

Appropriate number of Three hundred(300) hours was allotted for the fabrication and development of the teaching device. The activities are as follows: preparation of the main frame, welding of the frame assembly, installation and mounting of components. The time table set in the preparation of the device minimize wastage of time, money and effort.

Figure 2: The researcher during the fabrication of the device.

Some minor defects were identified and revised while testing the trainer: Necessary attachment and alignment was made. Proper grounding and lubrication of some moving parts were made.

The total cost of the project was based on the current prices in terms of supplies and materials include overhead cost and return of investment is thirty five thousand pesos. (Php 35,000.00)

Discussed below is the level of performance of the experimental group and control group as revealed by the pretest and posttest in different learning areas.

Above result presents the computed mean and standard deviation on the level of performance in BAT212 of the experimental and control groups in the pretest and posttest.

As shown, the experimental group obtained " Poor " performance in all learning areas in the pretest with mean score of 4.36, 3.64, 3.84, 3.04, 4.00 and 3.56 respectively with standard deviations of 1.80, 1.55, 1.97, 1.64, 1.60 and 1.72. High performance was obtained in all learning areas except in "Charging system" with "Average" performance in the post test of the experimental group after the exposure utilizing the improved training device with mean score of 8.80, 6.88, 7.88, 8.32, 8.16 and 7.48 respectively.

Table 1: Computed Mean and standard deviation on the level of performance of the experimental and control groups as revealed by the pretest and posttest.

LEARNING AREAS	EXPERIMENTAL GROUP						CONTROL GROUP					
	Pretest			Post Test			Pretest			Post Test		
	Mean	VI	SD	Mean	VI	SD	Mean	VI	SD	Mean	VI	SD
Starting system	4.36	P	1.80	8.80	H	1.41	4.64	P	1.55	7.28	H	2.07
Charging system	3.64	P	1.55	6.88	A	1.09	2.96	NI	1.40	4.96	P	1.54
Ignition system	3.84	P	1.97	7.88	H	1.24	4.20	P	1.55	6.76	A	1.94
Lighting system	3.04	P	1.64	8.32	H	1.18	2.84	NI	1.47	6.56	A	2.09
Accessory system	4.00	P	1.60	8.16	H	1.72	4.08	P	1.67	6.56	A	2.03
Storage battery	3.56	P	1.72	7.48	H	1.81	3.60	P	1.35	5.04	A	1.88

H-High **A-**Average **P-**Poor **NI-**Needs Improvement

For the control group, four (4) learning areas obtained "Poor" performances and two(2) " Needs Improvement." "Charging system and Accessory system" obtained the lowest mean score of 2.96 and 2.84 respectively and standard deviation of 1.40 and 1.47. Posttest result in "Starting system" obtained the "High Performance" with a mean rating of 2.07 while "Charging system" got "Poor" performance with a mean score of 4.96 and a standard deviation of 1.54.

However, all other items obtained 6.76, 6.56, 6.56 and 5.04 mean scores and interpreted " Average." The findings connote that performance in BAT 212 of the experimental group improved immensely after exposure to the training device. Much the same, the control group's performance also gained with modest mean increases in favor of the post test.

The significant difference on the level of performance in BAT212 of the two groups of respondents in the pretest and posttest in the different learning area is discussed below.

As reflected in the table, the performance of the experimental group differs significantly in the pretest and posttest since the computed t-value of 6.857, 8.538, 7.439, 13.313, 8.823 and 7.935 exceeded the tabular t-value of 2.064 at.05 level of significance with 24 degrees of freedom. The findings imply that the use of the improved teaching device contributed to the significant improvement in students performance.

Table 2: Computed t-values on the level of performance of the *experimental group* in the pretest and postest in the different learning areas.

Learning Areas	Mean		Df	t_{comp}	t_{tab}	Ho	VI
	Pre test	Post test					
Starting system	4.36	8.80	24	6.857	2.064	Rejected	Significant
Charging system	3.64	6.88	24	8.538	2.064	Rejected	Significant
Ignition system	3.84	7.88	24	7.439	2.064	Rejected	Significant
Lighting system	3.04	8.32	24	13.313	2.064	Rejected	Significant
Accessory system	4.00	8.16	24	8.823	2.064	Rejected	Significant
Storage battery	3.56	7.48	24	7.935	2.064	Rejected	Significant

Table 3: Computed t-values on the level of performance of the *control group* in the pretest and posttest in the different learning areas.

Learning Areas	Mean		Df	t_{comp}	t_{tab}	Ho	VI
	Pretest	Posttest					
Starting system	4.64	7.28	24	4.878	2.064	Rejected	Significant
Charging system	2.96	4.96	24	13.680	2.064	Rejected	Significant
Ignition system	4.20	6.76	24	5.179	2.064	Rejected	Significant
Lighting system	2.84	6.56	24	7.307	2.064	Rejected	Significant
Accessory system	4.08	6.56	24	4.731	2.064	Rejected	Significant
Storage battery	3.60	5.04	24	3.106	2.064	Rejected	Significant

Table above revealed that the computed t-values all exceeded the t-value of 2.064 at.05 level of significance with 24 degrees of freedom, thus rejected the null hypothesis. The result disclose that the meaningful function of automotive instructors in the teaching-learning process cannot be refuted.

4.1.1. Functionality

In terms of functionality, the table manifest that respondents evaluated the improved trainer as "Extremely functional" with a general weighted average mean of 4.8. The findings revealed that students and instructors discern the improved training

Table 4: Acceptability mean rating as perceived by student and instructor respondents.

ITEM	1	2	3	4	5	Total	Weighted Ave.
Teaching model in teaching engine and chassis electricity	0	0	3	2	25	30	4.73
	-	-	9	8	125	142	
Comparable to a functional car engine and chassis electrical unit.	0	1	3	1	25	30	4.67
	-	4	9	4	125	140	
Teaching device simulates engine electricity:	0	0	1	3	26	30	4.83
a. Ignition	-	-	3	1	130	145	
system				2			
b. Charging system							
c. Starting System							
Teaching device simulates chassis electricity:							
a. Headlight Circuit							
b. Signal Light Circuit							
c. Park/Tail Light Circuit	0	0	0	3	27	30	
d. Stop Light Circuit							4.9
e. Horn Circuit	-	-	-	1	135	147	
f. Wiper circuit				2			
General Weighted Average							4.8
Interpretation							Extremely Functional

device as valuable instructional material in the teaching-learning process in BAT212. Besides, the training device is very useful in unravelling of practical problems.

4.1.2. Usability

Table 5: Usability of the teaching device as perceived by the respondents.

I T E M	1	2	3	4	5	TOTAL	Weighted Ave.
The teaching device is usable for teaching automotive electricity.	0	1	5	3	19	30	4.13
	-	2	15	12	95	124	
The utility model can be easily repaired if found defective.	0	1	3	5	20	30	4.37
	-	2	9	20	100	131	
Availability of genuine parts to maintain usability of the teaching device.	0	2	6	3	19	30	4.3
	-	4	18	12	95	129	
General Weighted Average							4.27
Interpretation							Highly Usable

As to the "Usability" of the teaching device, findings revealed the general weighted average mean rating is 4.27 which mean " Highly usable."

Based from the computed weighted mean of the two (2) main indicators, the Functionality with a mean of 4.8 which means "Highly Functional", and Usability with a rating of 4.27 which means "Highly Usable" has an acceptability mean rating of 4.535.

5. Conclusion and Recommendation

Students exposed to the improved training device attained better performance than students taught without the use of the trainer. The teaching device has provision for developing students for Automotive Servicing National Competency I (NC-I) in ignition, charging and starting system combined with chassis electricity for headlight, signal light, park/tail light, stop light, horn and wiper circuit.

The role of the instructor in the educational process is still the key factor in classroom learning situation specially when suitable learning strategies are coupled with teachers' competencies-success in the teaching learning process is ensured.

In this sense, the utility model as perceived by respondents was effective and an added strategy for learning engine and chassis electricity. Other researchers with similar study may follow the same processes and stages in modifying device like a trainer into a utility model.

Utilization of the improved training material is hereby recommended for use in automotive instruction. And, to maintain the functionality of the teaching device, the supplies and materials used in the trainer, must be supplied by the administration through the professor/instructor of the university.

Students and teachers using the teaching model should continuously check and diagnose possible functions or failures to identify its defects for immediate repair and maintenance.

The utility model could be introduced to other school as instructional model for teaching engine and chassis electricity. More innovations can be made to the enhanced instructional material (Phase 2). In addition, the Competency Based Learning Module (CBLM) can be prepared to further support strategy in teaching while using the device.

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