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Technology requirements assessment for the development of digital logic trainer

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Abstract

The object of this study is to assess the innovated design of a digital logic trainer. It also discusses the technology requirements of digital logic trainer in terms of management, technical and financial requirements as well as the efficiency. Descriptive research design was utilized in this study to determine the significance of the device. The respondents of this study are the Electronics Instructors/Professors of Surigao State College of Technology, Surigao City. This study used the mean and ordinal rank statistical tools in analyzing the data. The data revealed that requirements in developing a digital logic trainer is ***much needed*** on factors of "Technical", the highest got the mean of 3.79 "Management", second in rank with 3.68 mean, and "Efficiency" with the mean of 3.55. However, the lowest is "Financial" got the mean of 3.40 and describe as ***needed***. The results implied that electronics instructors/professors demonstrate highest interest in accomplishing first the technical requirement, then follows the management and efficiency requirement, and these three are highly needed requirement to be achieved to make the device successful.

Keywords: digital logic trainer; instruction; development; perceptions; assessment

Technology requirements assessment for the development of digital logic trainer

1. Introduction

Digital Electronics is designed to be used as an introductory learning for students who are new to the field of electronics. Students should have a general mathematics background and an introduction to do circuits connection before using this digital trainer. Digital Electronics may be studied concurrently with a course in basic electronics since knowledge of active discrete components is not prerequisite. Digital Electronics is no longer a specialized field in electronics. Digital circuits were first used in computing devices, but they are now commonly found in almost all more sophisticated electronics products. Digital circuits are found in automobiles, communication gear, toys, audio systems, computers and calculators. They are also found in television receivers, home appliances, and test equipment.

Analog/Digital Electronics Trainer is a most comprehensive and self-contained training system, that provides a complete test lab in a single gadgets. It is equally suitable for individuals, IT institution, Engineering Colleges, Universities and Technical Colleges. All necessary test equipment such as power supply, function generator, frequency counter, trigger pulse generator, variable, variable PWM generator, logic probe, SCR tester and DMM are installed on the main unit. All essentials topics of above three disciplines are being covered on a single unit. It is indeed a time saving and cost effective system for both students and professionals interested in training, developing and testing circuit prototypes.

According to Gottfried Wilhelm Leibniz, who proposed a binary computing system that Digital Technology was based on mathematical concept (Encyclopedia.com, 2020). Digital Technology is a base two process. Digitized information is recorded in binary code of combinations of the digits 0 and 1, also called bits, which represent words and images. Digital electronics is the world of calculator, the computer, the integrated circuit, and the binary numbers 0 and 1. This is an exciting field within electronics because the uses for digital circuits are expanding so rapidly. One small integrated circuit can perform the task of thousands of transistors, diodes, and resistors. The various digital circuits in operation every day, at stores the cash registers read out digital displays, also like tiny pocket calculators verge on becoming personal computers. All sizes of computers perform complicated tasks with fantastic speed and accuracy. Factory machines are controlled by digital circuits. Digital clocks and watches flash the time. Some automobiles use microprocessors to control several engine functions (Tokheim, 1985).

The digital trainer board is a very useful tool in testing and evaluating digital circuits. The digital trainer board is equipped with eight data outputs, and eight data monitors, a clock pulse output, a clock signal generator, a 3-LED indicator logic probe, and a 5-volt power supply. Interconnections between circuit nodes are accomplished by using solid wire (AWG 22) and these jumpers should be insulated for safety and should be of various lengths with the exposed tip of about 1 cm to allow secure connections. It is advisable to have jumper wires of different lengths to facilitate connections at different tie points.

Designing and developing a digital logic trainer during project making and as doing experiments are being engaged by all electronics major students as one among the various technical skills that they have to develop. Likewise, they are also made to understand what Electronics Technology is in the digital logic trainer in terms of management, technical, financial and efficiency requirements. As they progresses in studying the course, designing and developing this digital logic trainer device are assigned to them, where they are to perform different application of circuit connections to find the effectiveness of the device to their work thru demonstration and experiments.

To determine the significance of these device among electronics students based on aspects of its functionality, aesthetics, durability, economical and workability, the researcher being the instructor of this course

have a felt need to study and further investigate how these electronics digital logic trainer device influence or affect students technical skills formation before and after using it in their circuits connection application.

1.1 Objectives of the study

The general objective of this study is to innovate a digital logic trainer that will augment the scarcity of instructional materials in electronics technology instruction. The specific objectives are:

- To design a circuit for digital logic trainer device using a pre-established parameters.
- To develop and integrate the design elements of the digital logic trainer utilizing a generally acceptable integration protocol.
- To implement device commissioning, testing and troubleshooting of the devices?
- To evaluate the device performance and acceptability using a pre-established measurement parameters.

1.2 Framework of the study

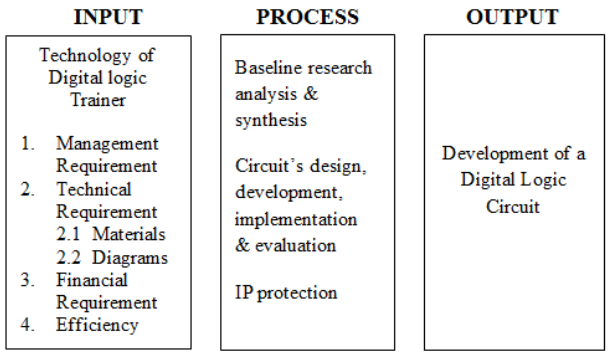

Figure 1. Flow of the study

2. Research methodology

2.1 Research design

Descriptive research design was utilized in this study employing the survey technique. Descriptive was used to determine the significance of the innovative digital trainer board to be used for electronics engineering instructors. Differential and correlation design will be used to ascertain the significant difference in the ratings of the students in the electronic circuit connections before and after the using the digital trainer board and the significant relationship between the ratings of respondents on the digital trainer board based on problem 2 and the ratings based on problem 3.

2.2 Research environment

This study was conducted at the Surigao State College of Technology, Surigao City Campus. Surigao State College of Technology has four campuses: the Del Carmen Campus, Magpayang Campus, Malimono Campus and Surigao City Campus.

2.3 Respondents

The respondents of this study are Electronics Instructors/Professors in the Bachelor of Electronics Engineering Technology course of Surigao State College of Technology, Surigao City. The data presented in Table 1 gathered from the office of the school registrar.

2.4 Research instrument

The instrument to be used in the study is the researcher- made questionnaire which was anchored on the

previous related studies. The questionnaire contains pertinent questions to be checked and supplied answers by the respondents.

2.5 Data analysis

This study used the following statistical tools in analyzing the data.

Mean and Ordinal Rank - These tools were used to measures the technology of electronics digital trainer device in problem 1 the extent the student rate the device as stated in problem 2 and the level of students rating before and after using the device in electronic circuit connections in problem 1.

Weighted mean - This is used to analyze the data pertaining to the evaluation of the significance of the develop digital logic trainer as assessed by the respondents.

Pearson's r and t-test - These tools were used to determine the significant relationship between the respondents rating of the device based on problem 2 and the ratings on the problem 3.

3. Results and discussions

3.1 Management requirement

Table 1

Management requirement in developing a Digital Logic Trainer device for electronics technology instruction

Items No.	As an Electronics Engineering Technology Teacher, I find the following necessary	*Mean*	Rank	Description
1	Prepare a project plan for the digital trainer board design.	3.50	5	Much Needed
2	Schematic diagram for digital trainer board.	3.75	2	Much Needed
3	Scheduling appropriate time for the work.	3.63	4	Much Needed
4	Organize the work to be done.	3.75	2	Much Needed
5	Set priorities among the series of experiments to be done.	3.75	2	Much Needed
	Average	3.68		Much Needed

The data showed that on management requirement for developing a digital logic trainer, there are three items ranked highest which obtained the same mean of 3.75 and rated Much Needed and these are "Schematic diagram for digital trainer board" "Organize the work to be done" "Set priorities among the series of experiments to be done". Next in rank is "Scheduling appropriate time for the work", got the mean of 3.63, and the lowest is "Prepare a project plan for the digital trainer board design" with 3.50 mean. All of the items are rated much needed and with an average mean of 3.68 the evaluative description is ***Much Needed***.

3.2 Technical requirement

Table 2

Technical requirement in developing a Digital Logic Trainer device for electronics technology instruction

Items No.	As an Electronics Engineering Technology Teacher, I find the following necessary	*Mean*	Rank	Description
	Materials			
1	Identify the use of Integrated Circuit (IC).	3.88	2	Much Needed
2	Understand the pin configuration of the IC.	3.88	2	Much Needed
3	Know the exact size or types of wire to use.	3.75	4.5	Much Needed
4	Identify the uses and value of resistors, capacitors, diodes, and transistors.	3.88	2	Much Needed
5	Understand the polarity of Light Emitting Diode (LED).	3.75	4.5	Much Needed
	Average	3.83		Much Needed

Table 2 … continued

Items No.	As an Electronics Engineering Technology Teacher, I find the following necessary	*Mean*	Rank	Description
	Diagram			
1	Sketch clear and simple diagram.	3.50	5	Much Needed
2	Recognize the code number of various electronics parts.	3.75	3.5	Much Needed
3	Know the value of Integrated Circuit (IC).	3.88	1.5	Much Needed
4	Identify the power supply needed in the experiment.	3.88	1.5	Much Needed
5	Sketch the block diagram	3.75	3.5	Much Needed
	Average	3.75		Much Needed
	Grand *Mean*	3.79		Much Needed

Revealed from the above Table are the results of ratings on the technical requirement in innovating a digital trainer device for electronics technology instruction as perceived by teacher-respondents as to material and diagram.

3.3 Financial requirement

Table 3

Financial requirement in developing a Digital Logic Trainer device for electronics technology instruction

Items No.	As an Electronics Engineering Technology Teacher, I find the following necessary	*Mean*	Rank	Description
1	Adequate amount to purchase the materials.	3.38	3.5	Needed
2	List of materials to be used.	3.50	1.5	Much Needed
3	Canvass the prices of the electronic parts to be used.	3.50	1.5	Much Needed
4	Purchase of tools to be used.	3.25	5	Needed
5	Purchase soldering lead for the experiment.	3.38	3.5	Needed
	Average	3.40		Needed

Revealed from the above Table the ratings of teacher-respondents on financial requirement in innovating a digital trainer device of the five items, there are two obtained the same mean of 3.5 and ranked highest, these are; "list of materials to be used", and "canvass the prices of the electronic parts to be used", and described ***Much Needed*.** However, "adequate amount to purchase the materials", and "purchase soldering lead for the experiment" obtained the same mean of 3.38 and described ***Needed***. The lowest item is "purchase of tools to be used", with 3.25 mean and described needed. The financial requirement obtained the average mean of 3.40 and is evaluated descriptively as ***Needed***.

3.4 Efficiency requirement

Table 4

Efficiency requirement in developing a Digital Logic Trainer device for electronics technology instruction

Items No.	As an Electronics Engineering Technology Teacher, I find the following necessary	*Mean*	Rank	Description
1	Wise use of materials and other resources.	3.63	3	Much Needed
2	Familiarize the electronics parts to be used in the experiment.	3.75	1.5	Much Needed
3	Follow the schematic diagram strictly.	3.75	1.5	Much Needed
4	Use proper length and sizes of insulated wire.	3.25	5	Needed
5	Create a unique design.	3.38	4	Needed
	Average	3.55		Much Needed

Displayed in Table 4, the ratings of teacher-respondents on the efficiency requirement in innovating a digital trainer device, and results showed that among the factors enumerated, the highest items went to "familiarize the electronics parts to be used in the experiment", and "follow the schematic diagram strictly" both got the mean of 3.75 followed is the item "wise use of materials and other resources" with a mean of 3.63 all these items are

described ***Much Needed***. While the two lowest items went to "create a unique design", and "use proper length and sizes of insulated wire" with the mean of 3.38 and 3.25 respectively. The average mean of 3.55 describe the efficiency requirement as ***Much Needed.***

3.5 Summary of requirements

Table 5

Summary of requirement in developing a Digital Logic Trainer device for electronics technology instruction

Requirements	*Mean*	Rank	Description
Management	3.68	2	Much Needed
Technical	3.79	1	Much Needed
Financial	3.40	4	Needed
Efficiency	3.55	3	Much Needed

The data revealed that requirements in developing a digital trainer device is ***Much Needed*** on factors of "Technical", the highest got the mean of 3.79 "Management", second in rank with 3.68 mean, and "Efficiency" with the mean of 3.55. However, the lowest is "Financial" got the mean of 3.40 and describe as ***Needed***.

4. Recommendations

The Administration are requested to extend the necessary supervision and support to the electronics engineering technology instructor in doing the acquires of various tools, equipment, raw materials and other resources essential to the making of innovative digital logic trainer device and also heartened to give students assistance especially to those poor and deserving students in whatever way to make the students perform the task and develop their skills.

- The administration may provide assistance for patenting of this developed digital logic trainer for IP protection and also to augment the scarcity of electronics technology instructional materials for effective instruction.
- The electronics technology faculty members are encouraged to teach and demonstrate appropriately the process and latest engineering technology in developing the digital logic trainer device.
- The electronics technology students are heartily encouraged to understand the significance of developing the digital logic trainer device toward acquisitions of the better technical skills in electronics engineering technology.
- The future researchers are encouraged to conduct other future researchers on other problems and concern on electronics engineering technology with valuable taken from this study.

5. References

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