

The Effectiveness of Switching Mode Power Supply Trainer Kit for Electronic Equipment Repair Course at Polytechnic Ibrahim Sultan

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Abstract

This study was about the effectiveness of Switching Mode Power Supply Trainer Kit. This trainer kit was developed from the Switching Mode Power Supply circuit block diagram to strengthen the understanding of the subtopic The Basic Principle of Switching Mode Power Supply (SMPS) from topic Electronic Devices Troubleshooting in Electronic Equipment Repair (DEE30052) course. Switching Mode Power Supply circuit was the important part to troubleshoot in electronic appliances such as television and radio AM/FM. The kit was emphasizing the block diagram and also the important component that involved in the troubleshooting session. Data obtained through questionnaires to the 30 samples were selected by random from the student semester 3 Department of Electrical Engineering session December 2019. Data collected through the questionnaire and analysed by the distribution of frequency, percentage and score min using software Statistical Package for Social Science (SPSS version 11). The findings of the study show the impact positive of the students against trainer which has developed based on the design and the modules are implemented is very compelling students to use it. Through the trainer's technique, teaching and learning can dip faster and not focused on the conventional circuit installation. In addition to that, the trainer is also able to increase the level of safety of students because it involves high alternating current (AC) and Direct current (DC). In conclusion, students will be able to improve the knowledge and skills that are used in the measurement and testing of Switching Mode Power Supply circuit. This in turn will be able to increase the marketability of students' work with existing skills and confidence.

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Key Words: Switching Mode Power Supply Trainer Kit, Alternating Current, Direct Current, Electronic Equipment Repair

1. Introduction

The Electric Equipment Repair (DEE 30052) is a compulsory course that must be taken by all semester 3 students of diploma program at the Department of Electrical Engineering, Polytechnic Ibrahim Sultan. This course has 3 credit hours which emphasize the knowledge and skills on troubleshooting and repairing the electronics equipment. This course also focuses on the identification of faults in several circuit such as audio equipment, television system and cell phones. Student need to fulfil all the requirement in the coursework assessment that contain six practical work, quizzes, theory test, tutorial question and assignment to measure their generic skill. Most of the coursework are based on the hands-on skill in the practical work session. This method will support the student in order to increase their knowledge and skill.

There are several techniques that lecturer can practice in order to create the effective teaching and learning process. Learning aid was one of the techniques to implement in their teaching and learning session (M.N.A & Mustapha, 2014). Basically, the learning aid is developed according to the objective of the topic in the syllabus. The multifunction trainer can attract and help student to understand the topic in better way compared to the theory session in the classroom (Hamdan & Mohd Yasin, 2010). According to (Geoffry Moss, 1987) an organization needs to wisely plan and design their training program. The use of tools and materials of lesson resources in a planned and orderly manner will make education more meaningful and have a positive impact in the teaching and learning process. Switching Mode Power Supply Trainer Kit was developed to support the teaching and learning session for topic Electronic Devices Troubleshooting in Electronic Equipment Repair course at Electrical Engineering Department.

2. Problem Statement

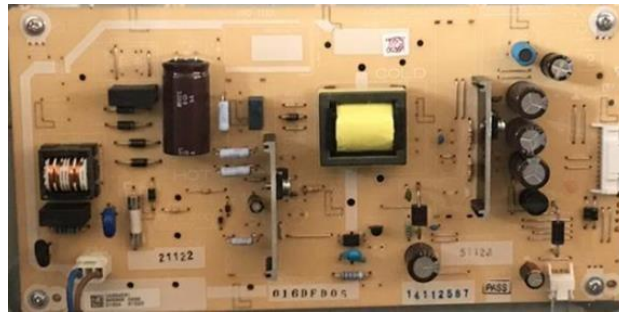


Figure 1: Power supply LED TV board

Teaching and learning process are divided into two types method which is theory and practical. In this course, student have difficulties in the experimental session but not in the theoretical session. Figure 1 shows that the power supply for LED TV board. This power board supply high voltage at 320V direct current. This circuit requires high guidance and safety for the student to operate. The function switching mode power supply is the combination of a switching regulator that will convert to efficient electrical energy either from an Alternating Current (AU) or Direct Current (AT) source to a Direct Current (AT) load (Radzi, 2015). Basically, it will involve high voltage of AC and DC current. Beside the block diagram of the circuit, student need to identify fault and troubleshoot the circuit. Usually, student will construct circuit by using protoboard in way to understand the block diagram and the structure of the circuit. From this problem, the Switching Mode Power Supply Trainer Kit was developed to increase the knowledge and safety of the student for the circuit. This trainer was also used to identify fault in the circuit.

3. Objective

The objectives of this study are to:

- i. Identify students' perceptions about the design of the Switching Mode Power Supply Trainer Kit and its usage in assisting the teaching and learning process
- ii. Evaluate the level of effectiveness of the use of Switching Mode Power Supply Trainer Kit for Electronic Equipment Repair course.

4. Methodology

a. Research Design

This study is an observation to identify the effectiveness of the use of Switching Mode Power Supply Trainer Kit. Questionnaires were made through questionnaires. This quantitative data analysis study was made using Statistical Package for Social Science (SPSS) version 22.0 application. From the questionnaires conducted, these data were analyzed using descriptive statistical techniques. This analysis has been helpful in looking at the feedback implications of using this trainer kit. A pilot study will be conducted before the actual study is conducted. According to Mohamad Najib (1999), a pilot study will use a sample that has similar characteristics to the population. The purpose of this pilot study was to determine the validity and reliability of the questionnaire items made. The data obtained were then analyzed using Cronbach's Alpha value to obtain the value of the reliability coefficient of the questionnaire instrument.

b. Population and Sample Study

This study was conducted on 3rd semester students, Department of Electrical Engineering, Ibrahim Sultan Polytechnic who took the Electronic Equipment Repair DEE30052 course. Sample responses were taken from 30 students randomly selected involving 2 classes who had conducted practical sessions using this trainer kit.

This study consists of three parts, namely Part A and Part B. Part A contains the demographics of respondents aimed at obtaining information about student programs as well as gender. Part B is about the effectiveness of the design development of the Switching Mode Power Supply Trainer Kit. This section contains 10 items divided into two sub topics which about the Learning Aid Model Design and the aspect of the usage of the trainer. These items will be measured using a scale Likert 5 points where students mark the agreement on each statement made consciously on a scale of 1 to 5 as shown in Table 1. Section C is an open-ended question where it asks for suggestions and comments from respondents about the design of the kit. Table 2 shows that the classification of mean scores is broken down into five, namely very low, low, medium, high and very high.

Table 1: Likert Scale score

Definition	Scale
Strongly disagree	1.00
Do not agree	2.00
Not sure	3.00
Agree	4.00
Strongly agree	5.00

Table 2: Classification Score Mean

Mean Score Range	Min Score Value
1.00-1.49	Very low
1.50-2.49	Low
2.50-3.49	Moderate
3.50-4.49	High
4.50-5.00	Very High

Source: (Ghafar, 1999)

5. Result of the study

The results of the analysis obtained through the questionnaire on the respondents are discussed in this section. Data analysis and results are processed based on the scope of the study that has been mapped. Before the actual study was conducted, a total of 10 3rd semester students were selected to undergo a pilot study. Analysis of the data shows the value of Cronbach's Alpha is 0.972 for 10 items. This proves that this questionnaire has high reliability and can be used in real studies.

Table 3 shows the mean scores on the aspects of evaluation of the Learning Kit Model Design. The average mean score was 4.525 and was interpreted at a very high level. This mean value indicates that the design of this trainer kit is suitable for practical use for the sub-topic Switching Mode Power Supply. This also indicates that the majority of respondents gave positive feedback on all items that have been submitted to them.

Table 3: The mean value of the evaluation aspects of the Learning Kit Model Design

No	Item	Mean Score	Value Level
1	This Switching Mode Power Supply Trainer Kit kit is easy to operate	4.57	Very High
2	The arrangement of the components in this teaching kit is very neat and in a suitable position.	4.53	Very High
3	The labels on this teaching kit help me to identify the position of the components accurately.	4.57	Very High
4	The design of this trainer reduces the risk of danger	4.43	High
Average Min		4.525	

Table 4 shows the mean scores on the evaluation aspects of the use of the Trainer Kit. On average the average mean score is 4.455 and is interpreted at a high level. This mean value indicates that the respondents agree that this trainer kit helps theoretical understanding, improves measurement and testing skills and gives the respondents confidence in the practice conducted.

Table 4: The mean score on the evaluation aspect of Trainer Kit usage

No	Item	Mean Score	Value Level
1	This teaching kit is very effective in helping me relate to the theories learned	4.47	High
2	This teaching kit increase the interest to understand Switching Mode Power Supply (SMPS), understand measurements and testing procedures.	4.40	High
3	This teaching kit can improve my skills in doing the measurement and testing work given.	4.47	High
4	This teaching kit is effective to build my confidence in practicing Switching Mode Power Supply (SMPS).	4.53	Very High
5	Each instruction given in the practical worksheet and usage manual is easy to understand to implement.	4.53	Very High
6	This teaching kit is very suitable for use in courses related to Switching Mode Power Supply (SMPS) in every polytechnic.	4.40	High
Average Min		4.455	

6. Suggested improvements

Overall, there are some improvements that can be implemented in the future in the trainer. It will be an addition of the fault switches to specific points or components. This is because the trainer kit developed has only 3 circuit fault switches for time being. With the addition of this switch, students explore the other part the operation of the Switching Mode Power Supply (SMPS) system. In order to enrich the usage of the trainer, the output of the Switching Mode Power Supply (SMPS) Trainer Kit will be divided into more output point for voltage and current. Furthermore, student is also encouraged to replace the fault component in the future.

7. Conclusion

From the findings of this study, it is found that the mean score on each item exceeds 4.40 and shows the interpretation at a high level. The majority of respondents gave positive feedback on all aspects of evaluation consisting of user understanding. With the result of this Switching Mode Power Supply (SMPS) Trainer Kit can increase the number of Learning Aid for practical in the Department of Electrical Engineering, Ibrahim Sultan Polytechnic. The development of this trainer kit supports the study of (Muhamad Sobri Bin Hussin, 2000) who stated that the use of teaching aids in practical work plays an important role in improving student understanding in a course. Therefore, with this kit, the improvement of the quality of delivery and the quality of R & D during practice and theory are more effective. Finally, it can sustain TVET learning by using their creativity.

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