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Integrated briefcase model: A teaching aid in the practicum of digital electronics

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Abstract: *This study is aimed at designing as well as producing an integrated briefcase model as a teaching aid in the teaching of digital electronics practicum and its feasibility. This study can be classified as research and development study. It was conducted in the Electronics Engineering Education Department and State Vocational School 2 Yogyakarta. The teaching aid was developed through: conducting needs analysis, designing, implementing, and testing. The testing was carried out twice covering the performance and feasibility. The data were collected by using questionnaires distributed to the users. The students of SMK Negeri 2 Yogyakarta were the subjects of the research. In this study the data were analyzed descriptively. The study findings showed that the teaching aid could be realized and meet the competence required in the digital electronics subject. The score obtained from the content validity test was 90% (categorized as very feasible). The score of the material validity was 80% (categorized as feasible). The score of the feasibility in terms of the material aspect was 42% (categorized as feasible). The technical aspect was scored 69.83% (categorized as feasible).*

Keywords: *briefcase model, digital teaching aids*

1. Introduction

The increasing demand of the relevance of education to the industry world results in the implementation of various concepts related to curriculum, materials, teaching media, methods, and teaching strategies. It is stated in the 2004 Curriculum of Vocational Schools that vocational education constitutes a secondary education which prepares the students, especially to work in a certain field, who possess skills, knowledge, and attitude to be competent. Competent graduates can be produced only through a process supported by suitable supporting components. Those components include the selection of teaching methods suitable for the materials, as well as the available equipment in the laboratory.

In reality the laboratories in many vocational schools do not have practicum units for digital electronics due to some factors, such as finance, room availability, practicality, and incomplete practicum units as teaching media to achieve the expected competence.

It is stated in www.ditpsmk.net that "In supporting the improvement of the quality of the vocational schools, the government will provide the equipment to meet the demanded competence and the the development of science and technology." (Departemen Pendidikan Dasar dan Menengah, 2013). The equipment for the vocational schools are expected to be local products or substitution technology.

Concerning the background, the researchers conducted a study related to "Integrated Briefcase Model as Teaching Media in the Digital Electronics Practicum", equipped with a module for the digital electronic practicum.

Sadiman (2003:6) explains that 'media' comes from the word 'medium' which literally means mediator or the message channel from the sender to the message receiver. From the definition, teachers, books, modules, practicum equipment, and the environment where the teaching learning process takes place can be considered as media (Sadiman, 2003).

Arsyad (2003:4) states that media are learning sources which contain instructional materials around students which can stimulate them to learn (Arsyad, 2003). Further, it is explained that teaching media are anything which is used to send messages and can stimulate thinking, feeling, attention, and motivation of the learners to make the teaching learning process to happen intentionally, purposefully and under control. Based on those ideas, it can be concluded that teaching media are anything that can be used to send messages from teachers to students to stimulate the students' thinking, attention, and motivation in joining the lessons.

AECT (Association for Educational Communication and Technology) www.aect.org differentiates six kinds of learning resources that can be employed in the learning

process, namely (1) message, including curriculum and subjects, (2) people, including teachers, parents, experts, etc., (3) materials, a format used to keep the teaching messages, (4) equipment; the facilities (instrument, hardware) to present the materials in item 3 above (5) technique; the procedure used in teaching to achieve the instructional objectives, (6) setting; including the room layout, lighting, etc.

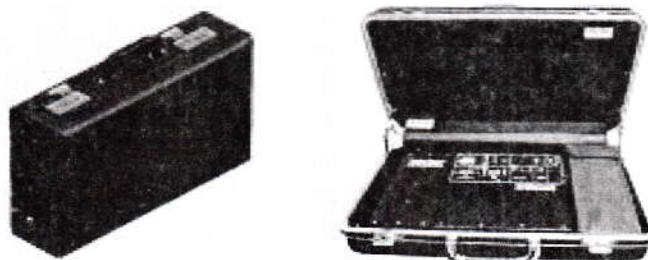
Nana Sudjana and Ahmad Rivai (1991:5) propose a number of criteria in selecting media, namely: (1) Do they meet the teaching objectives? (2) Do they support the teaching materials? (3) Are they easy to get? (4) Do teachers have the skills in using them? (5) Are they suitable to students's level of thinking? (Sudjana & Rivai, 1991)

Integrated Briefcase is teaching media designed for the digital electronic practicum. It consists of all units which are designed to achieve the teaching objectives of the digital electronic practicum. The units available in the integrated briefcase are expected to help teachers in teaching the digital electronic practicum. The Integrated Briefcase is shown in the picture below.

2. Method

This study is classified as a research and development (R&D) study. The object of the study was the teaching media for the digital electronic practicum by using an integrated briefcase equipped with a module as a

Figure 1: The Briefcase before being used as an Integrated Teaching Media Unit



practicum module for the digital electronic practicum subject. The steps in this study were conducting a need analysis, designing, and testing.

In this step the process of identifying the needs was conducted. The need is adjusted with the need of practicum which can support the achievement of the students' competence, in line with the materials in the basic competence of understanding the concepts of digital electronics.

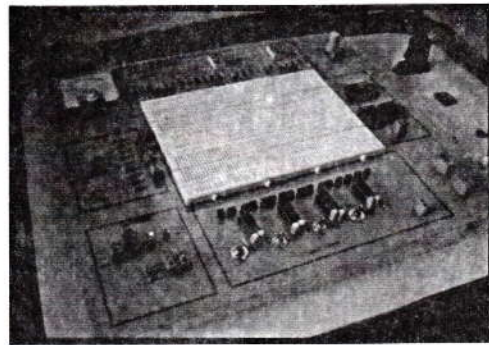
In this stage the design of the teaching media was produced. The media was designed to be flexibly used for various logic circuit. The units available in the integrated briefcase were arranged as follows: a) Input Unit, b) Display Unit, c) Experiment Unit, d) Power supply unit, 5) Clock Generator Unit, 6) Analog to Digital Converter (ADC) Unit, 7) Digital to Analog Converter (DAC) Unit, 8) Connector Unit, 9) Meter Unit, 10) Potensiometer Unit.

In this implementation stage, the design was realized into the real circuit. The result of designing the teaching media put in the integrated briefcase is shown in Figure 2.

The data were collected in the two following stages. Firstly, testing and observing were intended to get the results of what the digital teaching media in the integrated briefcase can perform. Secondly, questionnaires were employed to determine the feasibility of the teaching media to be used in the teaching of digital electronic practicum subject. The results were then tabulated and analyzed.

To obtain the data of the testing and observing Multimeter and Oscilloscope were

Figure 2. The Result of Designing the Teaching Media Put inside the Integrated Briefcase



used as instruments. To identify the feasibility questionnaires were used as instruments. This instrument consisted of 2 aspects, the content of the materials and the display of the teaching media in terms of the technical aspect.

To determine the feasibility category of the digital teaching media, Likert Scale was used. The obtained data in the form of numbers can then be interpreted qualitatively (Sugiyono, 2006).

Further, the feasibility of the teaching media in this study was classified into five categories of feasibility by using the scale. The scale used, according to Suharsimi Arikunto (2004:18), belongs to the quantitative criteria without any consideration. the feasibility scale is shown in Table 1 (Arikunto, 2004).

3. Findings and Discussion

The following are the data of the test result and performance measurement. The

Table 1.
Category of Feasibility Percentage

| Number | Score in percent (%) | Feasibility Category |
|--------|----------------------|----------------------|
| 1 | < 20% | Very unfeasible |
| 2 | 21% - 40% | Not feasible |
| 3 | 41% - 60% | Quite feasible |
| 4 | 61% - 80% | Feasible |
| 5 | 81% - 100% | Very feasible |

The formula of the final score of the indicator (Arikunto, 2004:21), is $NI = \frac{BSI \times NSI}{JB}$

- NI = the score of the indicator
- BSI = the weight of the subindicator
- NSI = the score of the subindicator
- JB = the sum of the weight

Power Supply Circuit was tested. The measured voltages were 0 V, 4.8 V and 12 V. The power supply in the teaching media can produce the voltage required to supply the circuit in the teaching media.

The circuit in the input unit was tested. It was intended to make sure that the output unit would produce a 5 V when the switch was on, and would produce a 0 V when the switch was off. And the LED display circuit was tested, it was intended to ensure that LED could be on when given the 5 V input and could off when given 0 V. Another circuit is the 7-segment display circuit, it was tested to ensure that all segments were on when given the input voltage. The test was done by giving 5 V. The test result showed that all segments were on. The teaching media can be used in the practicum for the logical circuit with four input and eight output terminals, and also the seven segment display output which can display the two digit numeration. The last testing was the clock generator circuit. The test was intended to find out the output frequency. The test was carried out by using LED and oscilloscope. The frequencies produced were 2 Hz, 4 Hz and 40 Hz.

The following are the data of the validity test result. The validity level of the media for the teaching of the digital electronics by using the integrated briefcase was tested through the validity test which included content validity and construct validity. The

data of the content validity were obtained from an expert of teaching material. He was the teacher of the digital electronic practicum subject in State Vocational 2 Yogyakarta. The data of the construct validity were obtained from an expert of teaching media. He was a lecturer of teaching media. The result of the content validity test can be seen in the Table 2.

The content validity and construct validity were based on Expert Judgment. The judgment was from the experts of material and media. The expected level of the content validity was using the scoring ranging from 1 to 5. The result was 90%, and it could be classified as very feasible.

The result of the construct validity test is presented in the Table 3. The result of the construct validity was 80% and it could be classified as feasible.

The feasibility test of the teaching media was carried out by trying it out to the vocational school students. The number of the students under observation was 24 (N=24). The result of the feasibility test in term of its technical aspect the result is presented in Table 4.

In terms of the material aspect which includes the material suitability, sequence, depth, difficulty level, way of presentation, clarity, the feasibility test showed the score as high as 68.42% which could be classified to be feasible.

Table 2.
The Expert Judgment of the Teaching Material

| Number | Indicator | Mean Score | Σ The Highest Score | Percentage (%) |
|--------|--------------------|------------|---------------------|----------------|
| 1 | Material relevance | 4,5 | 50 | 90 |
| | Total | 4,5 | 50 | 90 |

Table 3.
The Expert Judgment of the Teaching Media

| Number | Indicator | Mean Score | Σ The Highest Score | Percentage (%) |
|--------|------------------|------------|----------------------------|----------------|
| 1 | Technical aspect | 4 | 50 | 80 |
| | Total | 4 | 50 | 80 |

Table 4
The Feasibility Test Score in Terms of its Material Aspect

| Number of Indicator | Σ Score 1 | Σ Score 2 | Σ Score 3 | Σ Score 4 | Σ Score 5 | Final Score (%) |
|---------------------|------------------|------------------|------------------|------------------|------------------|-----------------|
| 1 | 0 | 1 | 8 | 11 | 4 | 75.00 |
| 2 | 1 | 1 | 8 | 10 | 4 | 72.50 |
| 3 | 0 | 1 | 10 | 12 | 1 | 70.83 |
| 4 | 1 | 2 | 18 | 2 | 1 | 60.00 |
| 5 | 1 | 3 | 12 | 8 | 0 | 62.50 |
| 6 | 2 | 5 | 4 | 11 | 2 | 65.00 |
| 7 | 0 | 1 | 8 | 12 | 3 | 74.17 |
| 8 | 1 | 5 | 6 | 10 | 2 | 65.83 |
| 9 | 0 | 1 | 9 | 12 | 2 | 72.50 |
| 10 | 1 | 3 | 9 | 10 | 1 | 65.83 |
| | Mean | | | | | 68.42 |

The Result of the Feasibility Test in Terms of the Technical Aspect. The result of the feasibility test is shown in the Table 5.

In terms of the technical aspect which includes the comprehensiveness of the module, the lay out, the ease, the suitable

Table 5.
The Final Scores of the Feasibility Test in Terms of the Technical Aspect

| Number of Indicator | Σ Score 1 | Σ Score 2 | Σ Score 3 | Σ Score 4 | Σ Score 5 | Final Score (%) |
|---------------------|------------------|------------------|------------------|------------------|------------------|-----------------|
| 11 | 1 | 2 | 7 | 14 | 0 | 68.33 |
| 12 | 0 | 3 | 10 | 10 | 1 | 67.50 |
| 13 | 1 | 1 | 7 | 12 | 3 | 72.50 |
| 14 | 0 | 3 | 7 | 14 | 0 | 69.17 |
| 15 | 0 | 2 | 9 | 8 | 5 | 73.33 |
| 16 | 3 | 2 | 8 | 9 | 2 | 64.17 |
| 17 | 1 | 1 | 9 | 6 | 7 | 74.17 |
| 18 | 1 | 1 | 11 | 5 | 6 | 71.67 |
| 19 | 0 | 3 | 6 | 10 | 5 | 74.17 |
| 20 | 2 | 3 | 11 | 5 | 3 | 63.33 |
| | Mean | | | | | 69.83 |

size, the ease of storing, the obtained score was 69.83% which could be classified to be feasible.

4. Conclusion

The media for teaching the digital electronic practicum using the integrated briefcase have been designed and met the demand of competence of the digital electronic subject.

The validity test viewed from its relevance to the materials showed the score as high as 90%, and it can be categorized as feasible. The construct validity test viewed from the technical aspect showed the score of 80%, and it can be categorized as feasible.

The feasibility test seen from the aspect of the material showed the final score score as high as 68.42%. Then, it can be stated that the media used in the teaching of the digital electronic practicum by using the model of the integrated briefcase worth using.

The score obtained from the feasibility test seen from the technical aspect was 69.83%. So, it can be stated that the teaching media used in the digital electronic practicum by using the briefcase model worth using.

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