

# Developing Learning Media Based Project Board in Electronic Materials to Improve the Analysis Capability and Skills for the Cadets of PIP Semarang

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## Developing Learning Media Based Project Board in Electronic Materials to Improve the Analysis Capability and Skills for the Cadets of PIP Semarang

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**Abstract:** Electronics is one of the most widely used materials on board, but in reality, the cadets still have difficulty in understanding the concepts, solving problems and making electronic circuits. The media used today have a significant risk, such as a short circuit or electric shock. There are several problems that the authors get in this study, they are; how is the learning media for electronic practice used today, how to design an appropriate media for learning electronics practice with project board.

In this study, the method used Research and Development (R&D). It is a research method used to produce certain products, and test the effectiveness of these products. In producing certain products, the researchers used needs analysis. The final results of this study will produce the electronic learning media.

From the results of the learning model design and testing of the Analog Experimenter ASH tool, there are a number of things that can be concluded: The electronic learning media used today is still not effective and efficient because the cadets have to buy the practical materials, while in terms of safety, it is very lacking. The design of instructional media made is more effective, efficient and safer than the methods currently used. This is proven by testing the ASH Analog Experimenter with a multimeter and Oscilloscope.

**Keywords:** Learning Media Development, Project Board, Electronic.

### 1. INTRODUCTION

PIP Semarang organizes three departments, namely Nautical, Technical and Port Shipping management. In carrying out education and training in Semarang PIP, it is supported by adequate facilities and infrastructure. Percentage of education and training activities for cadets is 40% in teachings implemented in the classroom (theory) and 60% cadets conducted at the Laboratory and Simulator (practice). Cadets not only read textbooks, but also are accompanied by observations and experiments in the laboratory and simulator. Both the nautical, technical and Port Shipping management programs are all supported by adequate laboratory infrastructure and simulators.

Electronics is one of the subjects in the technical department. In this electronic subject, the cadets will have the knowledge of the electronic components and how to assemble the electronic circuits. Also, the lecturers not only guide the cadets in terms of the theory but also have to lead the cadets in carrying out practical work in the laboratory.

Electronics is one of the materials used on board, but in fact, the cadets have still difficulties in understanding the concepts, problems solving and even construct the circuits. Therefore, it is needed to increase the means of practice to facilitate the mastery in the concept of electronics through learning involved cadets directly.

In needs analysis, the researchers found some questions during laboratory experiments. Observation will be carried out by observing the experimental process in technical class either in semester 3 or 7 at PIP Semarang. It held in Electronic class by practical activity. The researchers found the problems in the initial observations included:

- a. When the cadets used the available tools, they require a long time in preparing the electronic circuit. For example, in constructing the electronics circuit in series or parallel properly, the cadets need a long time in each.
- b. The cadets have still difficulties in getting practical materials (components), because the need to buy outside the campus.
- c. There is a risk of short-circuiting or electrical short-circuiting or shock for the cadets.

Based on the background of the problems mentioned above, in this research is how can the learning media (practical) currently used and how plan the appropriate design for electronic media practical learning with project board media.

## 2. NOTATION

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Learning media development is a process or activities carried out to produce a learning media based on existing development theories. The media is learning media. So, the development theory used is learning development theory. In addition, in teaching and learning process, the teachers are also required to use the lesson plan which is a reference plan of activities that will be carried out during the learning process. Assessment tools also need to see the extent of the achievement of objectives by the students. Thus, the development of instructional media is also equipped with lesson plans and learning outcomes tests as a condition in a learning process.

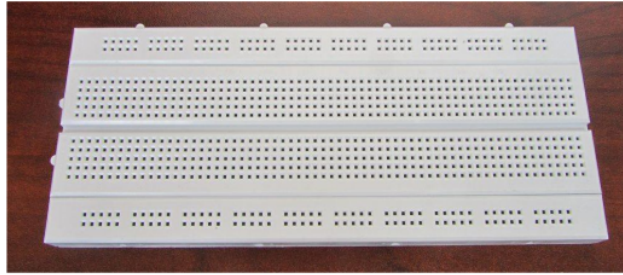
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Educational media play an important role in the learning process. The use of educational media can assist the lecturers in delivering materials. The success of learning is largely determined by two main components, namely the teaching method and learning media. These two components are interrelated and cannot be separated. The use and selection of one particular teaching method has consequences for the use of appropriate types of learning media. The function of the media in the learning process is to increase the stimulation of students in learning activities. Ali, M (2005) stated that the use of computer-aided learning media has a significant influence on the attractiveness of the students to learn the competencies being taught. The use of instructional media can save time on preparation for teaching, increase the student motivation, and reduce misunderstanding, the students' explanations given by lecturers.

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**Learning media** can also be interpreted as anything that can be used to deliver the messages, stimulate students' thoughts, feelings, concerns, and wishes so that they can encourage the learning process. The forms of instructional media are used to enhance the learning experience to be more concrete. Learning by using learning media is not just using words. Thus, we can expect the learning experiences to be more meaningful for students (Sumiati, 2008).

**Learning media** is an integral part of the learning system. Many kinds of learning media can be used. The use of instructional media must be based on proper selection. So, it can enlarge the meaning and function in supporting the effectiveness and efficiency of the learning process. Learning media are expected to provide benefits, among others (Sumiati, 2008):

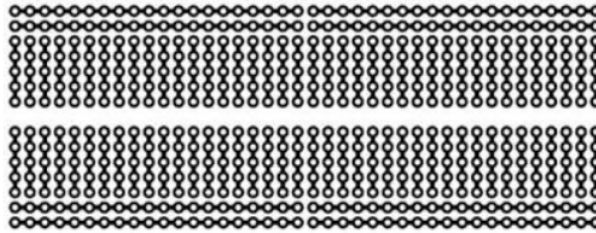
- a. Clarifying the message to be written;
- b. Overcoming the limitations of space, time, energy and sense of power;
- c. Leading to enthusiasm for learning, more direct interaction between students and learning resources;
- d. Enable the students to learn independently according to their talents and visual, auditory & kinesthetic abilities;
- e. Giving the same stimulation, equalizing experience & giving rise to the same perception.

Project Board or often referred to as Breadboard is the basis of the construction of an electronic circuit and is a prototype of an electronic circuit. In modern times, the term is often used to refer to certain types of boards where components are assembled, wherein this board does not require a soldering process (plug in).



Picture 1. Project board

Because this solderless board, it does not require soldering so it can be reused, and can be used for temporary prototypes and helps in experimenting the design of electronic circuits. Various electronic systems can be prototyped using breadboards, ranging from small analog and digital circuits to making centralized processing units (CPUs).



Picture 2. Layout project board

Explanation:

- a. 2 Attach the Up and down lines connected horizontally to the middle of the breadboard. Usually this path is used as a power path or signal path that is commonly used such as a clock or communication line.
- b. 5 holes component in the middle is a place to arrange components. The paths to the 5 holes are connected vertically to the middle of the breadboard.
- c. The breadboard middle divider is usually used as a place to plug the IC components.

### 3. METHODOLOGY

Basically, R&D research has the characteristics of the products produced from its research. The resulting product begins with an analysis of the needs of the research location. In the field of education, the products produced are generally in the form of learning media. However, in other fields can be a product that is considered more efficient than existing products. In general, the R&D model has been developed by a number of experts, one of them is the model developed by Bolt and Gall who developed the R&D model through several stages, namely:

- a. Research & Information Collecting
  1. The first step taken is a needs analysis, review related literature and small scale research.

#### Need analysis

This step is by finding information related to problems faced by the location or region targeted for product development. In addition, looking for information or data related to what is needed to resolve the problem at the location. For example, if you are going to develop a product in a school, the researchers first find out the learning

problems faced by teachers and students. Then, the researchers also began to identify what things or products might solve the learning problems in the school.

2. Review related literature study

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Relating to the search for information and empirical data through theory and relevant research related to the product to be developed. This will guide the researchers in developing products that will be produced.

3. Small-scale research.

This is intended as a result of the identification that has been done by researchers related to the product if it is needed to ascertain whether the product that the researcher will develop can really be a product that can solve the problem at the place or school.

b. Research Plan (Planning)

Planning in R&D research includes: formulating research objectives, estimating the things needed in research, formulating researchers' qualifications and forms of participation in research.

c. Develop Preliminary of Product

These stages include:

1. Making a product design that will be developed,
2. Determining the facilities and infrastructure needed during the study
3. Determining the stages of design testing in the field.

d. Preliminary Field Testing

This stage relates to:

1. Carry out initial testing of product designs,
2. Testing is limited,
3. Field test are carried out many times in order to get a design that suits your needs. During this test, the information was collected through observation and interviews.

e. Revising Main Product Revision Results.

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This stage is an improvement from the results of the initial field test. At this stage of initial product improvement, more is done with a qualitative product approach.

f. Main Field Testing.

This stage deals with product testing more broadly, which includes:

1. Testing the effectiveness of product design,
2. Testing the effectiveness of the design using the repetition model experimental technique,
3. Field test results are an effective design, both in terms of substance and methodology. Data related to product usage is collected to see the effectiveness and efficiency of the product.

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g. Operational Product Revision

This stage is the second improvement after a broader field test. Completion of the product at this stage will further strengthen the product to be developed. Refinement at this stage is not only based on the quality aspect but also its quantity based on student learning outcomes which is in the learning process have been tested to use the products developed.

h. Operational Field Testing

This stage deals with testing the effectiveness and adaptability of product designs involving product users. This test is carried out using interviews, observations, questionnaires, and then the results are analyzed.

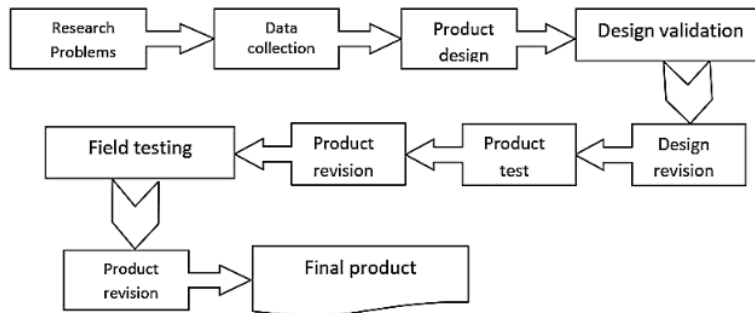
i. Final Product Revision

This revision is based on input from due diligence. This step will further enhance the product being developed. Improvement of the final product is deemed necessary for the accuracy of the product being developed. At this stage, a product whose level of effectiveness can be accounted for has been obtained

j. Dissemination and Implementation

Publishing the results of products developed so that they can be implemented in general or in a broader scope.

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The steps of research and development can be shown in the following figure:



Picture 3. Reserch and development flowchart

a. Potential and Problems

A study can depart from the potential or problem. Potential is everything that when utilized will have added value (Sugiyono, 2009: 409). The development model of electronic practice learning media becomes a potential for research and development because the electronic practice learning media does require a high understanding in its completion. The problem is the deviation between the expected and what happened (Sugiyono, 2009: 409). The model of practical learning media becomes a problem so this can be overcome through research and development so that an effective and integrated model, pattern, or handling system can be found that can be used to overcome the problem.

b. Information Collection

The information collection process is carried out factually and can be used as material for the planning of certain products that are expected to overcome. Factual information collected is in the form of facts in the field which shows that the electronic learning media model requires research and development because stringing skills are skills that require the understanding of an electronic circuit. Facts in the field also show that the electronic learning media practice model conducted in the Laboratory is considered to be less practical and too risky.

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c. **Product Design**

The products produced in this research and development is expected to increase educational productivity, especially in the skills of making electronic circuits. In designing a practice media tool, the researcher first collects his reference sources, including examples of some practical media used in other institutions.

d. **Design Validation**

Design validation is a process to assess the product design, in this case the design of electronic media learning practices. Product validation is done by asking the lecturers who are experts in the field of Electronics with various considerations to assess the learning media. Analysis based on theory is also considered in developing this practice media. Analysis of these practical devices includes the availability of DC and AC voltages as well as the Function Generators, as well as potentiometers of 1 K $\Omega$  and 10 K $\Omega$ . So, the practice media made can be used for learning the Electronic Practicum.

e. **Design improvements**

After the product design of instructional learning media is assessed by experts, the weaknesses can be identified. The experts will correct the deficiencies of the practice media. If there is a correction from the circuit, it will be repaired and then redesigned. From the results of logical analysis and design improvements, then the researcher will get an electronic practice learning media in accordance with the learning material.

f. **Product Test**

After the instrument is validated, the practice media can be directly tested on a predetermined research sample. Trials can be done many times in accordance with needs and analysis obtained from previous trials. The researchers plan to conduct trials to get maximum results.

g. **Product Revision**

At this stage the researcher improved the practice media that did not meet the learning criteria for electronic practice. If there are still deficiencies in the product, the improvements will be made. The product revision was carried out after conducting a trial in a limited circle; in this case a trial was carried out in one sample class, namely the technical class.

h. **Usage Trial**

After testing the product successfully and a revision of the product are carried out, then further testing is carried out in a broader scope. This is done so that the product in the form of electronic learning media practices must still be assessed shortcomings that arise for further improvement.

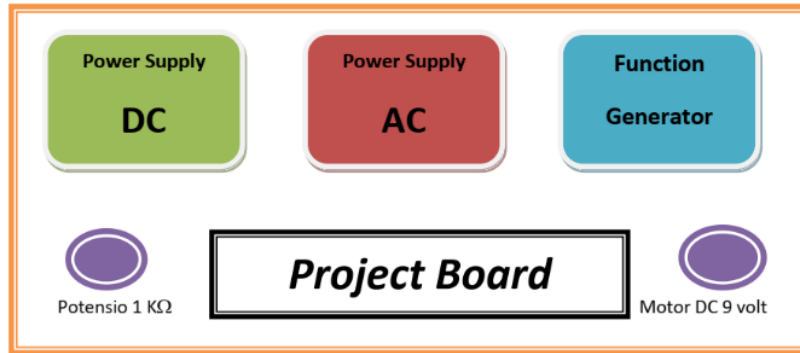
i. **Phase Two of Product Revision**

This product revision is done, if in a wider testing there are shortcomings and weaknesses. In the usage test, the product is always evaluated to find out the weaknesses in the product so that improvements can be made in the manufacture of further products.

#### j. Product Manufacture

After the stages are made in making practice learning media products, then the product is declared effective in a number of tests, the product in the form of a set of practical learning media can be applied and produced into an electronic practice learning media tool.

The concept of developing electronic learning media can be seen in the image below:



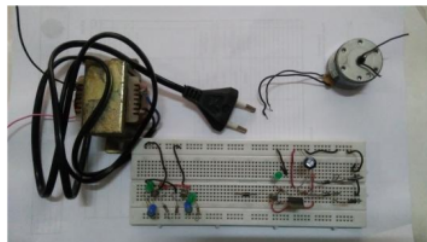
Picture 4. Concept design product analog experimenter

The learning media consists of: DC Power Supply, AC Power Supply, Function Generators, Potentiometers and Project Boards. DC power supply is provided to meet the needs of DC voltage sources. AC power supply is prepared for the need for AC voltage. Function Generator produces various types of waves while the project board is provided as a place to assemble components.

#### 4. CASE STUDY

##### a. Current Learning Media

Electronic learning media currently used are still separate from one another, making it less effective in practical learning. Besides, in terms of security it is still lacking, because the practice material used is still active, so the cadets or students can be at risk for being electrocuted or short-circuiting can occur during stringing. For practice materials, the cadets must also buy outside campus, so it takes a quiet of time because the cadets can only leave campus on Saturdays and Sundays. The following electronic practice materials are used today:



Picture 5. Current learning media



b. **Development Design Based Project Board**

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The results of the development of project board-based learning media (ASH Analog Experimenter) to support the learning of electronics practices at PIP Semarang can be seen in the picture below:



Picture 6. Development design based project board

ASH Analog experimenter with a more attractive design and complete facilities for the practice of electronics, after testing using a multimeter and oscilloscope, the practice media works properly.

1. **Power Switch**

The Power Switch is an ON and OFF button and the functions are to turn on and off the voltage source from the ASH Analog Experimenter.

2. **DC Power Supply**

DC Power Supply is part of an experimenter that generates DC voltage. The resulting DC voltage is 0 Volts up to +15 Volts and 0 Volts up to -15 Volts. The function of this DC voltage source is to provide a DC voltage flow to the circuit to be made on the Project Board from 0 volts to a maximum of 30 volts.

3. **AC Power Supply**

AC Power Supply is part of an experimenter produced AC voltage. The resulting AC voltage is 0 Volts up to +15 Volts and 0 Volts up to -15 Volts. The function of this AC voltage source is to provide AC voltage to the circuit that will be made on the Project Board from 0 volts to a maximum of 30 volts.

4. **Project Board**

Project Board or often referred to as Breadboard is the basis of the construction of an electronic circuit and is a prototype of an electronic circuit. Project Board is a board where components are arranged, where this board does not require a soldering process (plug in).

5. **Potentiometer 1 K $\Omega$**

Potentiometer is one type of variable resistor. This component is used for the need to make a circuit on the project board.

6. **Motor DC 9 Volt**

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Motor DC 9 Volt is a component prepared for the needs of electronics practice on the project board.

7. **Function Generator**

Function generator is a tool that can produce sinusoidal, square and triangle waves. This tool is used for the cadets' learning in understanding the types of electric current waves. The waves generated from the function generator can be seen using a device called an Oscilloscope.

## 5. CONCLUSION

From the results of the design of the learning model and testing of the ASH Analog Experimenter tool, there are several things concluded:

- a. Electronic practice learning media used today are still ineffective and inefficient because the cadets have to buy their own practice materials. While in terms of security (safety) is very lacking.
- b. The design of instructional media made is more effective, efficient and safer than the methods currently used. This was proven by testing the ASH Analog Experimenter with a multimeter and Oscilloscope.

## 6. ACKNOWLEDGMENT

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