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## Development of Electrical Circuit Display Panel for Light Vehicle Turn Signal Lights as a Learning Media for Vocational School Students

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**Abstract:** This research aims to develop a demonstration panel for the electrical circuit of light vehicle turn signal lights as a learning medium. The purpose of making this demonstration panel is to describe the process of making a demonstration panel for the electrical system of turn signal lights on light vehicles, to describe the feasibility test of the electrical circuit demonstration panel for light vehicle turn signals and to describe students' responses to the electrical system demonstration panel for turn signal lights on light vehicles. This research uses the Research and Development method. The subjects in this research are material experts and media experts as well as students, and the objects are teaching materials and students. The instruments used are: observation, questionnaires and documentation. Research procedures include potential and problems, data collection, product design, design validation, design improvement, and product testing. The data analysis technique used is a descriptive analysis technique by explaining the results of making the product in the form of a learning media display panel, testing the validity and suitability of the product to be implemented in lighting systems and light vehicle instrument panels. 1) The results of the process of making electrical circuit display panels for light vehicle turn signal lights as a learning medium have been successfully described in detail, including the steps and components used. 2) The results of the demonstration panel feasibility test after being validated by material expert I scored 93.75%, and material expert II gave a score of 96.87%. Meanwhile, the feasibility results of the media expert panel I gave a score of 100%, and media expert II gave a score of 95.83%. 3) The results of students' responses to the demonstration panel received a very good response, the overall score obtained was 90.38%, which is very suitable.

**Keywords:** display panels, electrical circuits, turn signal lights, light vehicles.

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### INTRODUCTION

Learning is the process of interaction between students and educators and learning resources in a learning environment (Santrock, 2011; Wolfolk, 2016). Furthermore, learning can also be interpreted as a process carried out to help students experience changes in behavior well (Dasopang et al., 2022; Lubis, 2023; Silvia et al., 2023). The

learning process is experienced throughout a human's life and can occur anywhere and at any time (Elisyah et al., 2024; Schunk, 2012). The success of the learning process can be influenced by many factors, one of which is facilities and infrastructure (Lubis & Lubis, 2024; Nurliza et al., 2024). Facilities and infrastructure are tools or objects that can support the learning process. One form of learning facilities and infrastructure is learning media (Lubis & Wangid, 2019; Ningsih et al., 2023). The reasons researchers are interested in conducting this research are as follows. Firstly, there is no special demonstration panel learning media regarding the electricity of turn signal lights when carrying out electrical practice on lighting systems and instrument panels. principles in applying learning media. Second, in the learning process of providing basic electrical material on turn signal lights for light vehicles, class The three students did not focus when practicing using full electrical trainees because the material presented was still at a basic stage while the equipment owned by the electrical trainee school was full, thus affecting the learning process. Based on these problems, the author feels it is necessary to conduct research related to electrical equipment for turn signal lights, to overcome the problem of the unavailability of special equipment during the learning process. So to overcome this problem, namely by making an electrical display panel for light vehicle turn signal lights.

Learning media is media that acts as an intermediary educational tool that can be used to increase effectiveness in the active learning process and efficiency in achieving learning goals that can be understood by students (Arsyad, 2011; Kimianti & Prasetyo, 2019; Lubis et al., 2021, 2022 ). The broad definition of learning media is a method, a tool for conveying information between the source and the recipient (Nurliza et al., 2024; Portanata et al., 2017; Putra, Supriadi, et al., 2023; Zulkan, 2023). The benefits of learning media include being able to improve the quality and quantity of education by increasing learning speed and learning accuracy (Absa et al., 2023; Lubis & Dasopang, 2020; Rachmawati et al., 2021; Sinaga et al., 2024), helping teachers in using students' learning time well, reducing the burden on educators in presenting information and making educators' activities more structured to increase interest in learning (Rohmantoro et al., 2020; Wahyuningsih, 2012).

Arsyad (2011) explains that in general learning media can be grouped into four, namely as follows: 1) Media resulting from print technology is learning media produced through a mechanical or photographic printing process, some learning media included in print technology results are text, graphics, and photos. 2) Media produced by audio-visual technology is learning media that is used to convey material using hardware devices, such as film projectors, tape recorders and visual projectors, so that the material is absorbed by students through the senses of sight and hearing. 3) Media resulting from computer technology is learning media in which the delivery of learning material comes from microprocessor-based sources. 4) Combined media is media that is delivered using a combination of several media controlled by a computer.

Furthermore, Manshur & Ramdlani (2019) also explained that there are four functions of learning media, namely as follows. 1) Attention Function; The attention function is the core of attracting and directing students' attention to concentrate on learning content related to the visual meaning displayed or accompanying the text of the lesson material. 2) Affective Function; The affective function of visual media can be seen from students' level of enjoyment when learning (or reading) pictorial texts. Images or symbols can arouse students' emotions and attitudes, for example information related to social or racial issues. 3) Cognitive Function; The cognitive function of visual media can be seen from research findings which reveal that visual symbols or images facilitate the achievement of the goal of understanding and remembering the information or message contained. 4) Compensatory Function; The compensatory function of learning media can be seen from research results that visual media which provide context for understanding texts helps students who are weak in reading to organize information in the text and recall it.

In other words, learning media functions to accommodate students who are weak and slow to accept and understand lesson content presented with text or presented verbally (Dasopang & Lubis, 2021; Muhardini et al., 2019; Putra, Maulana, et al., 2023 ). Based on the function of learning media, it can be concluded that apart from clarifying teaching materials, media also plays an important role in the world of education in providing information to students. Without learning media, students will have difficulty capturing or receiving scientific information.

Visual aids are a form of visual media that is used as a learning aid to demonstrate lesson material so that the learning material is easier to understand (Wulandari et al., 2023). Teaching aids play an important role in creating a learning process, such as the use of aids being prioritized to speed up the teaching and learning process and help students grasp the understanding given by the teacher. The difference between media and teaching aids lies in their function, media has a major role in the success of education while teaching aids only act as intermediaries in facilitating the delivery of information from teachers to students. Based on its function, learning media can take the form of teaching aids and learning tools, while the main function of the teaching aids themselves is to clarify the abstractness of the concepts given by the teacher so that students are able to understand the meaning of these abstract concepts more easily (Yulyani, 2020).

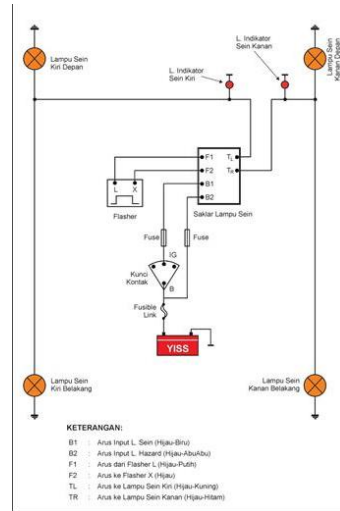
It is hoped that the use of the turn signal electrical system demonstration tool will encourage students' understanding in following the electrical practice of lighting systems and instrument panels. because students directly observe the components in the turn signal system so that it can help provide a strong memory for the practice of lighting systems and instrument panels. After practicing the electrical system, lighting materials and instrument panels using the developed teaching aids, it is hoped that the quality of student learning will be more effective.

Electricity is an important component of a system to produce electric current that can be used as a power source. Therefore, electricity can be said to be one of the main things in cars. Without electricity, of course it cannot run (Djollong, 2019). The basic concepts of electrical systems include electric current, electric voltage, Ohm's law and current and voltage resistance in circuits. Electric current is a number of electrons that flow every second in a conductor. Current flows from the positive terminal of the current source through the load and back to the negative terminal of the current source. The number of electrons flowing is determined by the push given to the electrons and the conditions of the paths these electrons travel. The amount of current flowing in all parts of the electrical circuit is the same. Electric current is symbolized by the letter  $I$  and is measured in Ampere units (Adam, 2016). Electric voltage is the electric force that drives current to flow along an electrical circuit. The unit for electric voltage is the volt, with the symbol. Ohm's law can be used to determine a voltage  $V$ , current  $I$  or resistance  $R$  in electrical circuits, such as in lighting, charging and ignition circuits. In one electrical circuit found on a motorbike, more than one electrical resistance or load is usually combined. Several electrical resistances may be connected in one circuit.

Turn signal lights and hazzard lights are two different signal systems, but use the same components. This system consists of four yellow lights, namely: 2 rear light bulbs and 2 front light bulbs each right and left. In order for this sign system to function properly, these lights must be able to light and flash perfectly, namely for 1 minutes is 60 flashes. This can happen if the current entering the light bulb is intermittent current obtained from the flasher. If the turn signal switch is operated to the left or right, only the left or right lights will flash. The switch is usually located under the steering wheel and is assembled on the steering column. When the hazzard light switch is operated or enabled, the lights that flash are left and right simultaneously. The hazzard light switch is usually located at the front of the steering column. The difference between the two systems is in their function, the turn signal lights are used when the vehicle is about to change direction or turn, while the hazard lights are used when there is a danger. For example, a car is

towing or being towed by another car, the car makes an emergency stop because there is damage (Windasari et al., 2023).

The series of turn signal and hazard lights starts from the battery, passes through the fuse to the ignition key then to the flasher, from the flasher it is then divided into the turn signal switch and the hazard switch, then from these two switches it is then transferred to the load. The flow can be seen in the image below:



**FIGURE 1.** *Electrical Circuit for Light Vehicle Turn Signal Lights*

## METHODS

This research uses the Research and Development method. Research and development methods or Research and Development are research methods used to produce certain products, and test the effectiveness of these products. According to (Sugiyono, 2016). This model includes 1) Potential and problems, 2) Data collection, 3) Product Design, 4) Design Validation, 5) Design Revision, 6) Product Trial, 7) Product Revision, 8) Usage Trial, 9) Product Revision, 10) Mass Products. However, in this research, we only carried out up to the sixth stage according to the needs and efficiency of the researcher's time, energy and funds. The subjects in this research are material experts and media experts who are teachers who have expertise in the field of Light Vehicle Electrical Class XI TKR at State Vocational High School 7 Lhoksemawe. Furthermore, the target subjects (objects) in this research were the teaching materials used in learning Light Vehicle Electrical Maintenance, as well as 18 class XI TKR students.

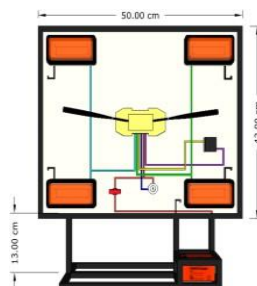
Next are the tools and materials used in making electrical display panels for light vehicle turn signal lights XI SMK Negeri 7 Lhoksemawe.

**TABLE 1.** *List of Tools and Materials*

No	Tools	Materials
1	Key ring	Turning Lights
2	Grinding machine	Cable
3	Cutting Grinder	Battery
4	Meter	Ignition Key
5	Welding machine	Sitting Plank
6	Marker	Switch
7	File Machine	Fuse
8	Welding wire	Connector
9	Glasses	flasher
10	Screwdriver (-)	Relay

- 11 Screwdriver (+)
- 12 Gloves

In the process of designing the frame for mounting the electrical circuit display panel components for the turn signal lights, the assembly process requires making a sketch using Sketchup.



**FIGURE 2.** *Product Design View*

Furthermore, this research and development uses 2 methods of data collection. The method used is the observation method and questionnaire. The data analysis technique used in this research is a descriptive analysis technique by explaining the results of making products in the form of learning media display panels, testing the validity and suitability of the product to be implemented in lighting systems and light vehicle instrument panels.

Instrument validation shows that the results of a measurement describe the aspect or aspect being measured. Construct validation testing can be carried out by holding consultations with experts (Sugiyono, 2014). Instrument validation is carried out until agreement is reached with the experts. Instruments were consulted regarding the aspects to be measured based on certain theories which were consulted with experts in the field of education, namely lecturers in Mechanical Engineering Vocational Education at Malikussaleh University and Light Vehicle Engineering Teachers at State Vocational School 7 Lhoksemawe.

Next, material expert validation is carried out with the aim of testing the feasibility of the product in terms of the depth of material coverage reached by the product being developed. Questionnaire data for each used in these categories can be shown in the previous table.

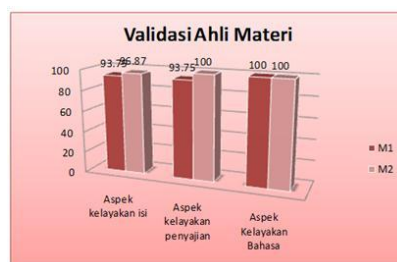
## **RESULTS**

Module validation in this research was obtained from material expert lecturers as the 1st validator (M1) and teachers at SMK Negeri 7 Lhoksemawe as the 2nd validator (M2), with the aim of carrying out validation to obtain information, direction, guidance, criticism and suggestions. The results of the material expert feasibility validation test from validators I and II can be seen in full in the following table.

**TABLE 2.** *Material Expert Validation Results*

No	Aspect	M1	M2
1	Content Feasibility Aspect	93,75	96,87
2	Aspects of Feasibility of Presentation	93,75	100
3	Language Eligibility	100	100
<b>Total number</b>		<b>287,5</b>	<b>296,87</b>
Overall Average		95,83	98,95
Overall Percentage Value		95,83%	98,95%

The average percentage of the two validators showing the "Very Suitable" category in the form of a diagram can be seen in the figure below.



**FIGURE 3.** Material Expert Validation Results

Validation of teaching aids in this research was obtained from media expert lecturers as validator one (M1) and teachers at SMK Negeri 7 Lhoksemawe as validator two (M2), with the aim of carrying out validation to obtain information, direction, guidance, criticism and suggestions. Criticism and suggestions from validators become input for improving the demonstration panel before it is tested on students. The results of the media expert eligibility validation test from validators I and II can be seen in full in the following table.

**TABLE 3.** Media Expert Validation Results

No	Aspect	M1	M2
1	Aspects of learning media	100	91.66
2	Ergonomic aspects	100	91.66
3	Aesthetic aspect	100	100
4	K3 aspects	100	100
<b>Total number</b>		<b>400</b>	<b>383,32</b>
Overall Average		100	95,83
Overall Percentage Value		100%	95,83%
Interpretation of the Demonstration Panel's Assessment Manual		Excellent	Excellent

The next section is a calculation of the results of the students' responses to the demonstration panel being taught with the following results.

**TABLE 3.** Student Response Test Results

No	Student	Score	Value	Percentage
1	MRA	38	86.36	86.36%
2	MRF	38	86.36	86.36%
3	NPR	39	88.63	88.63%
4	TAZ	39	88.63	88.63%
5	HFH	41	93.18	93.18%
6	ABH	38	86.36	86.36%
7	PCA	41	93.18	93.18%
8	TMY	39	88.63	88.63%
9	HBI	41	93.18	93.18%
10	MQS	44	100	100%
11	AZY	39	88.63	88.63%
12	NRN	40	90.90	90.90%
13	ZUD	40	90.90	90.90%

<b>Number of Scores Obtained</b>	<b>517</b>
Total Score	572
<b>Final Score Percentage</b>	<b>90,38%</b>
Display Panel Response Qualification	Excellent

## DISCUSSION

The development of the electrical circuit display panel for turn signal lights was carried out with the aim of meeting the need for teaching materials that can help and make it easier for students to understand learning materials other than the textbook teaching materials provided by the school. By using display panels as an innovation in the learning process that can attract students and encourage students to be independent and confident in being able to explain learning concepts in a way that they understand.

Before the demonstration panel in this research was explained to students, several tests were carried out on the instruments to determine the suitability of the instruments used in the research. And the material expert validation results were obtained at 95.83% by validator 1 and 98.95% by validator 2 with the assessment aspect of content suitability at 93.75% and 96.87%, presentation feasibility aspect at 93.75% and 100%, as well as for the language feasibility aspect of 100% and 100%, with the results criteria

'Strongly Agree' from both validators. Likewise, the media expert validation results obtained were 100% by validator 1 and 95.83% by validator 2, with the criteria for learning media aspects being 100% and 91.66%, ergonomic aspects 100% and 91.66%, aspects aesthetics 100% and 100%, K3 aspects 100% and 100% and interpretation of 'Strongly Agree' by both validators.

The responses or results of students' responses to the teaching aids after the calculations were carried out resulted in a total student response score of 517 out of 572 total. with a final score percentage of 90.38% and the demonstration panel response qualification developed was 'Very Suitable'..

## CONCLUSION

The results of the process of making electrical circuit display panels for light vehicle turn signal lights as a learning medium have been successfully described in detail, including the steps and components used. So the display panel circuit looks very simple and is very easy for students to understand by using colored circuit paths that look attractive and the components and symbols are clearly visible.

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