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Development of Learning Media of Motorcycle Brake Light Electrical Systems for Motorcycle Business Engineering Students

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A B S T R A C T

Making this learning media aims to determine the results of the manufacture and feasibility of learning media for electric motorcycle brake lights. This study uses the Research and Development (R&D) method. The subjects used were media experts and material experts consisting of two lecturers and two automotive engineering experts. The object of this research is students and the media of electrical circuits. Data collection techniques in this study used the methods of observation, interviews and questionnaires. The study was conducted at SMK Negeri 7 Lhokseumawe with a periods of 6 months. Based on the results of data analysis carried out, the results of the study are in the form of the potential to make an electrical circuit for a motorcycle brake light system. The validation of learning media in this study obtained the average percentage value of the two validators of media expert I 100% and media expert II 90%. Furthermore, validation of the guidebook obtained the average value of the two validators material expert I 87% and material expert II 82%. In addition, the results of student responses with an average percentage value of 85%. Based on the four validators and student responses, it was shown that the electric motorcycle brake light learning media with the category was very feasible to use.

INTRODUCTION

Education is an important aspect for the development of human resources, because education is a vehicle or one of the instruments used not only to free humans from backwardness, but also from ignorance and poverty (BP et al., 2021; Manurung et al., 2021; Mulyadi et al., 2019; Nurjanah & Sofiawati, 2019; B. I. Permana & Mursidi, 2020; Rafika et al., 2020). Vocational High School is a formal educational institution that has a special training pattern to direct students to become graduates who are ready to enter professionally and participate in the business or company world (Agusvianto et al., 2020; Aida, 2020; Fardani et al., 2022; Ipikasari et al., 2020; Otara & Omolo, 2021; Purwaningtyas et al., 2021; Rismawati et al., 2019). As explained in the Law of the Republic of Indonesia Number 20 of 2003 concerning the national education system, Article 15 explains that "vocational education is secondary education that prepares students especially to work in certain fields".

The success of learning in a vocational school cannot be separated from the completeness of learning resources and adequate learning media (Nagara et al., 2020; Saepulloh et al., 2020; F. I. Sari et al., 2020). Students can study with a variety of available learning resources, both printed and electronic (Irfan & Wulandari, 2019; Kusuma et al., 2021; Priambodo & Arifin, 2019; N. Sari et al., 2021; Suyitno et al., 2020). One of the important learning resources for students is in the form of modules, books, handouts, or magazines.

The availability of adequate textbooks according to students characteristics is very important to accommodate student learning needs (Fransisca et al., 2019; Marpanaji et al., 2018; Prasasti et al., 2019; Silvana et al., 2021; Wahjusaputri et al., 2020). Teachers are required to develop textbooks according to student competencies, as well as material competencies that are easily understood by students (Akbarini et al., 2018; Dwijayani, 2019; Prastiyo et al., 2018; Suyitno et al., 2020). With this learning resource, a mutually supportive learning atmosphere will be created.

In addition, a teacher must be able to build a conducive learning atmosphere in the school environment. A

conducive learning atmosphere can be realized by selecting the right teaching methods and materials in accordance with the competencies and characteristics of students (Baharuddin & Daulay, 2017; Kusuma et al., 2021; Prasasti et al., 2019). Learning resources in the form of textbooks in the form of text books have now developed into electronic books (e-books) (Fransisca et al., 2019; Hamid et al., 2020; Ninghardjanti et al., 2021). Various facilities for students and teachers to access e-books that can be used independently, anywhere and anytime. However, school books should be available in an electronic version to make it easier to use with various platforms and not burden students with carrying printed versions of books every day. However, e-books are still very limited in many schools. Like only at SMKN 7 Lhokseumawe.

Textbooks are learning media that absolutely must be available in schools (Kusmawati et al., 2019; D. Permana & Utomo, 2021; Pratikno et al., 2020; Suwanto & Purba, 2021). Various studies have been conducted on the importance of learning media for the success of the learning process and increase student motivation in learning (Wahyunungsih et al., 2020). Learning media can encourage students' curiosity about something (Pratikno et al., 2020). If the teaching media is monotonous, conventional then the enthusiasm of students to know something will decrease. Student performance in learning will be boosted if the school has a variety of textbooks, both content and novelty of the book (Ahyar & Edyansyah, 2021; Albariki et al., 2020; Warsodirejo & Budianto, 2020; Yunus & Mukhtar, 2020). Therefore, it is very important for schools to provide textbooks that are varied, and in accordance with the characteristics of the material.

Learning materials or teaching materials in learning in vocational schools can be interpreted as anything that can be used to help teachers and students in the learning and teaching process (Albariki et al., 2020; Fefiani, 2019; Ilma et al., 2020). These teaching materials can be in the form of textbooks, workbooks, cassettes, CD-rooms, videos, photocopies of handouts, newspapers, paragraphs written on the board; everything that presents or informs about the material that can be studied (Suwanto & Purba, 2021; Wahyunungsih et al., 2020). There are six main factors that must be considered in developing a teaching material for students such as 1) students; 2) curriculum and context; 3) sources and facilities; 4) the level of personal self-confidence and teacher competence; 5) copyright complaints, and 6) time.

Several previous studies have found that learning media is the main key to increasing students' motivation to learn (Chrisdian et al., 2020; Ilma et al., 2020; Irfan & Wulandari, 2019; Saifullah & Qohar, 2020; Sasih et al., 2020; Sukariasih et al., 2019). The material presented is more interesting and will make it easier for students to understand between concepts, procedures and other skills. In line with research (Akmalia et al., 2021; Hazrati et al., 2020; Kusuma et al., 2021; Prasasti et al., 2019; Purba & Situmorang, 2020) learning outcomes are better than using conventional media. The improvement in the quality of learning rose significantly compared to conventional material that watched (Momani & Rababa, 2022; Romadhoni et al., 2020; Soimah et al., 2020; Winiasri et al., 2020). Students prefer to learn using textbooks that have attractive designs, simple and understandable language (Hendratno & Yermiandhoko, 2020; Pratikno et al., 2020; Wahyunungsih et al., 2020). Therefore, learning media is the main factor determining student interest in learning and improving the quality of learning.

Another factors that encourages students to learn is the language used by the book is simpler, explanation after explanation is presented with various illustrations between concepts (Ahyar & Edyansyah, 2021; Iqrammah & Rijanto, 2019; D. Permana & Utomo, 2021). Abstract concepts must include concrete illustrations so that students can easily understand them. The teacher's role is also more important in providing reinforcement between concepts. Teachers are required to be professional in using teaching materials and teaching strategies. Another study (Ahyar & Edyansyah, 2021; Mashuri, 2021; Nuraina & Mursalin, 2018) also shows that the methods, models used by teachers must be supported by relevant learning media.

SMK Negeri 7 Lhokseumawe is one of the educational institutions that aims to produce graduates who are devoted, intelligent, competent, and ready to face the demands and challenges of technological issues that can develop at any time and are able to fill the first-level workforce. SMK Negeri 7 Lhokseumawe on the competence of Motorcycle Business Engineering expertise has a vision of creating competent graduates in the motorcycle field accompanied by faith and devotion to God Almighty and professional at work. Motorcycle electrical system is one of the subjects in the Motorcycle Business Engineering (TBSM) competency and is an important part of a vehicle, whether it's a motorcycle or a car.

Based on the results of observations at SMK Negeri 7 Lhokseumawe on April 9, 2021, in the electrical system practice room at SMK Negeri 7 Lhokseumawe learning media already exist, but the learning media for the motorcycle electrical system is only available in its entirety (complete) and there is no user manual. learning media for motorcycle electricity so that students have difficulty understanding the electrical flow on a motorcycle. Students' learning motivation is also still low and tends to be silent when learning motorcycle electricity. In addition to making observations, the researchers also conducted interviews with teachers in the field of study in the class XI motorcycle electrical system lesson at the school. In the interview, it was found that students of class XI Motorcycle Business Engineering (TBSM) still had difficulty

understanding electricity on motorbikes during practice, because the media used was too complete so it was very difficult for students to understand.

Based on the description of the background of the problem above, the researcher concludes that in order to be more effective in learning motorcycle electricity, there must be a learning media in the form of a motorcycle electrical trainer separately from the easier part. Researchers want to make a motorcycle electrical system media, namely the brake light electrical system using a manual. The formulation of the problem that will be discussed in this study is how the process of making learning media for the electrical system of brake lights on motorcycles is, and how is the feasibility of learning media for the electrical system of motorcycle brake lights for class XI students at SMK Negeri 7 Lhokseumawe. The aim of this research is to describe the process of making learning media for the electrical system of motorcycle brake lights. To describe the feasibility of learning media for motorcycle brake light electrical systems for class XI students of SMK Negeri 7 Lhokseumawe.

METHODS

This study used research and development or Research & development (R&D). namely the approach used to produce products as learning media. This study refers to the Borg & Gall (1983) development model as stated by Sugiyono (2018: 298). This model includes: 1) Potentials and problems, 2) Data collection, 3) Product Design, 4) Design Validation, 5) Design revisions, 6) Product trials, 7) Product revisions, 8) Usage trials, 9) Product revisions, 10) Mass Products. However, in this study, in this study, only carried out until the sixth stage according to the needs and efficiency of the time, energy and funds of the researchers.

Scope of Research

The subjects in this study are material experts and media experts who are teachers and lecturers who have expertise in the field of motorcycle electrical maintenance at SMK Negeri 7 Lhokseumawe. The object of this research is the students of class XI Motorcycle Business Engineering (TBSM) and the learning media used in learning motorcycle electrical maintenance.

Research design

The data collection technique that will be used in this study is to use 3 ways, namely observation at SMK Negeri 7 Lhokseumawe aims to determine student activities during the learning process, interviews with teachers majoring in Motorcycle Business Engineering (TBSM) aims to find out the problems faced by students and a questionnaire for media experts, material experts, and student responses. The number of experts also consists of various criteria, consisting of 2 media experts, 2 material experts, and responses from all students. This research uses research and development or Research & development (R&D). namely the approach used to produce products as learning media. This study refers to the Borg & Gall (1983) development model as stated by Sugiyono (2018: 298). This model includes 1) Potentials and problems, 2) Data collection, 3) Product Design, 4) Design Validation, 5) Design revisions, 6) Product trials, 7) Product revisions, 8) Usage trials, 9) Product revisions 10) Final Product.

Research Procedure

This study will be conducted at SMK Negeri 7 Lhokseumawe, Aceh Province. Implementation is carried out in the odd semester of the 2021/2022 Academic Year. Sugiyono (2018:298) suggests that the research and development steps referring to the Borg and Gall model will be explained as follows:

1). Potential and problems, Potential and problems are everything that when utilized will have added value, problems are deviations between what is expected and what happens. 2). Collecting data, then it is necessary to collect various information that can be used as material for planning certain products that are expected to overcome the problem. 3). Product design, Product design must be embodied in drawings or charts, so that it can be used as a guide for assessing and making it. 4). Design validation, Design validation is an activity process to assess whether the product design is more effective than the previous product. Validation can be done with several experienced experts to assess the shortcomings of the newly designed product. 5). Design improvement, After the product design, is validated through discussions with experts and other experts, it will be able to identify the shortcomings. These deficiencies are then tried to be reduced by improving the design. 6). Product trial, The product design that has been made cannot be directly tested first. But it must be made first, produce a product, and the product is tested.

Data Collection and Data Analysis

a. Validation test analysis technique

The analysis of the validation sheet is done by giving responses strongly agree, agree, disagree, and strongly disagree to analyze the validator's answers, the researcher uses an analytical rating with the percentage calculation as in (**table 1**).

Table 1. Validation test analysis techniques

Alternative answers Score	**Scores**
Strongly Agree (SA)	4
Agree (A)	3
Disagree (DA)	2
Strongly Disagree (SD)	1

Souces: Sugiyono (2018:94).

The scores obtained from all aspects assessed are then converted into percentages with the following formula (Arikunto, 2009:35).

Validity value = $(\sum x)/(S) \times 100\%$

Information:

x: Score obtained

s: Maximum score

Table 2. Eligibility Criteria by Validation Experts

Percentage	Eligible Category
< 21 %	Very Not worth it
21 %-40 %	Not feasible
41 %-60%	Decent enough
61%-80 %	Worthy
81%-100%	Very Worthy

b. Student response analysis techniques

Analysis of student responses was carried out on the questionnaire sheet obtained after being tested on students. Student response data obtained by determining by the (**Table 3**).

Table 3. Student responses analysis techniques

Alternative answers Score	Scores
Strongly Agree (SA)	4
Agree (A)	3
Disagree (DA)	2
Strongly Disagree (SD)	1

The scores obtained from all aspects assessed are then converted into percentages with the following formula (Arikunto, 2009:35).

Validity value = $(\sum x)/(S) \times 100\%$

Information:

x: Score obtained

s: Maximum score

Table 4. Eligibility Criteria by Validation Experts

Percentage	Eligible Category
< 21 %	Very Not worth it
21 %-40 %	Not feasible
41 %-60%	Decent enough
61%-80 %	Worthy
81%-100%	Very Worthy

RESULTS AND DISCUSSIONS

Results

a. Learning media design

The learning media for the motorcycle electrical circuit in this study, especially on the electrical material for the motorcycle brake light system, was made based on observations on April 9, 2021 at SMK Negeri 7 Lhokseumawe. Making learning media for a series of motorcycle brake light electrical systems produces a teaching aid/trainer and book guide. Write down the title of the table here according to the format that has been determined.

The resulting trainer is also equipped with a user manual to facilitate the operation and maintenance of the trainer.

b. Media feasibility testing (Validation of media experts and material experts)

Media Expert Validation

Table 5. Results of the validation of the media expert I and the media expert II

Rated of aspects	Media expert I	Media expert II
Aspects of learning media	1	1
Ergonomic aspects	1	1
Aesthetic aspects	1	0.87
Aspect (K3)	1	0.75
Total number	4	3.62
Overall average	1	0.9
Overall percentage score	100%	90%
Interpretation of learning media assessment	Very worth it	Very worth it

Source: Research Data (2021)

The diagram of the results of the validation of learning media by the two media experts can be seen in **Figure 1.**

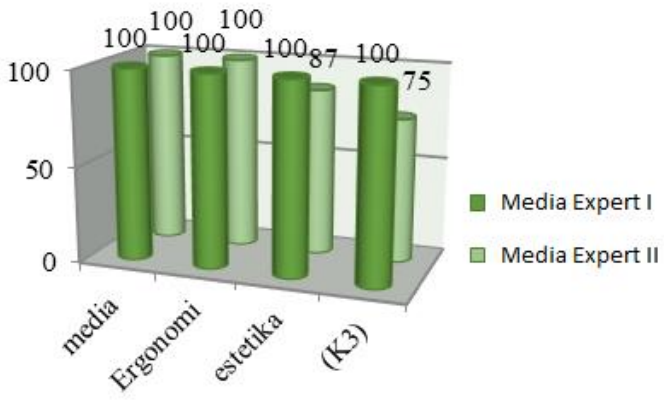

Figure 1. Results of media expert validation I and II

Material Expert Validation

Table 6. Results of the Feasibility Test of Material Experts I and II

Rated aspect	Media expert I	Media expert II
Content Feasibility Aspect	0,88	0,86
Aspects of Feasibility of Presentation	0,87	0,75
Aspects of Language Eligibility	0,86	0,86
Total number	2,61	2,47
Overall Average	0.87	0.82
Overall Percentage Value	87%	82%
Usage Book Assessment Interpretation	Very worth it	Very worth it

Source of research results (2021)

The diagram of the results of the validation of the manual by material experts can be seen in **Figure 2**.

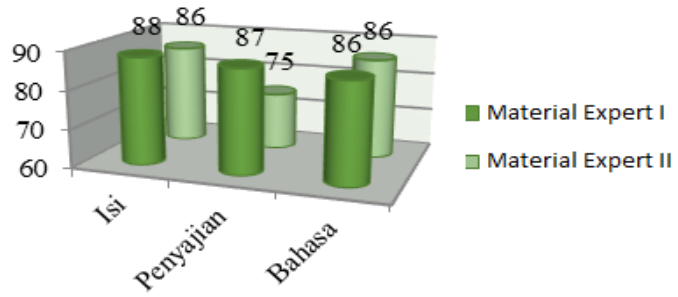

Figure 2. Results of material expert validation I and II

Student response

Table 7. Results of student responses

No.	Name	Class	Score Total	Score percentage
1	AP	TBSM	40	100%
2	AZ	TBSM	32	80%
3	AM	TBSM	30	75%
4	FZ	TBSM	30	75%
5	HS	TBSM	31	77%

A diagram of the results of student responses after being tested using learning media for a motorcycle brake light electrical system circuit can be seen in **Figure 3.**

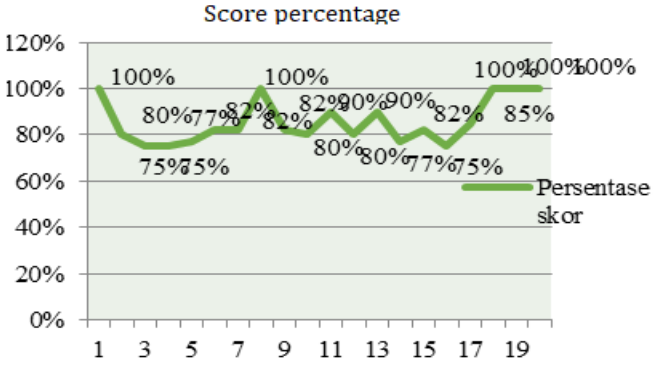

Figure 3. Results of scores percentages

Result subtitle 1

1. Making an electrical circuit for a motorcycle brake light system. Includes welding of iron rods for frames with a height of 70 cm, length of 65cm and width of 50cm, painting of the frame, Installation of electrical components such as batteries, fuses/fuses, ignition keys, front brake light switches, rear brake light switches, brake lights, and connecting cables on plywood board. The tools used are cutting grinding machines, hand drilling machines, welding machines, multitester, welding gloves, sunglasses, white glasses, cutting pliers. The results of the performance test of this electrical circuit, carried out by measuring the voltage and continuity on all components worked well and all components were still functioning.

Result subtitle 2

2. The results of the feasibility test for the electrical circuit of the motorcycle brake light system, using an assessment sheet of two media experts and two material experts. From the results of the feasibility test of learning media, Media Expert I gave an average score with a percentage of 100% and Media Expert II gave an average value with a percentage of 90%. Meanwhile, from the results of the feasibility test of the manual, Material Expert I gave an average score with a percentage of 87% and Material Expert II gave an average score with a percentage of 82%. After validation from media experts and material experts is complete, then it is tested on students. The results of student responses give an average value with a percentage of 85%. This proves that the learning media and manuals for the use of motorcycle electric trainers are very feasible to use.

Discussions

Learning media for motorcycle brake light electrical circuits

Electrical circuit learning media that is made as a student facility in learning. The purpose of this research is to make a demonstration of a motorcycle brake light electrical system circuit to make it easier for students to understand. Research and design procedures using the Research and Development (R&D) Borg and gall model, the results of making learning media for motorcycle brake light electrical system circuits that have been carried out show that learning media for motorcycle brake light electrical system circuits is very feasible to use. according to Sugiyono's explanation (2018).

The feasibility of learning media for motorcycle brake light electrical circuits

After making the learning media for the motorcycle brake light electrical system circuit, it is necessary to test the feasibility of the media as one of the requirements for the motorcycle brake light electrical system circuit to be used as a learning medium. Validation is one way to conduct a feasibility test, test the feasibility of a motorcycle brake light electrical system circuit using 4 experts, consisting of 2 Lecturers as Media Experts and Material Experts and 2 Motorcycle Business Engineering Teachers (TBSM) as Media Experts and Experts circuit material for motorcycle brake light electrical system. In accordance with Sugiyono's explanation (2018).

CONCLUSION

Based on the results and discussion, it can be concluded that; 1). Users are expected to check that all components of the brake light electrical system are in good condition before use. Then connect the cable between a component to

another component according to the path that has been provided correctly before turning on the electrical circuit of the motorcycle brake light system so that the circuit works normally. After using the trainer, unplug the connecting cable as before to keep the battery stable. 2). It is expected to use fuses/fuses that are in accordance with their respective specifications and functions so as not to damage the electrical components on the motorcycle. 3). It is hoped that the school should increase the number of motorcycle electrical system trainers and manuals, so that the teaching and learning process can be carried out efficiently and the media used is easy to understand by students, resulting in the achievement of maximum learning outcomes.

Author's Contributions

All team members contributed equally in the writing of this article. They carry out collaborative activities according to the tasks and functions that have been mutually agreed upon, from research planning to writing articles for journals.

Conflict of Interest

All authors in this manuscript have no conflict of interest. All team members work professionally according to their expertise.

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