Jurnal E-Komtek
Vol. 6, No. 1 (2022) pp. 139-149
https://jurnal.politeknik-kebumen.ac.id/index.php/E-KOMTEK
p-ISSN : 2580-3719 e-ISSN : 2622-3066

The Development of Electricity Board Learning Media with Running Light System Starter for Learning in Vocational High School

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https://doi.org/10.37339/e-komtek.v6i1.927

Published by Politeknik Piksi Ganesha Indonesia

Artikel Info
Submitted:
07-06-2022
Revised:
11-06-2022
Accepted:
11-06-2022
Online first :
30-06-2022

Abstract

The students of grade XI of the Motorcycle Business Engineering of Vocational High School, who have learned productive subject matter in Motorcycle Engineering and Business, often experience difficulties when directly confronted with motorcycle practice media because the components are closed and hidden by the motorcycle's body cover. Therefore, a learning media which is easy to be learned by the students is essential. It means that all components can be observed clearly, and the material can be understood easily, both in theory and electrical practicum of the motorcycle starter system; the students will better understand the theory and assemble the motorcycle starter system circuit. The learning media for the motorcycle starter system is an electrical board with LEDs that can light up continuously or alternately, so it simulate the workings of the motorcycle starter system. In addition, the running LED simulation makes it easier for students to assemble a starter system. It also makes it easy and fast for students to identify, understand how it works, assemble a motorcycle starter system, and later, when facing practical materials in the form of motorbikes, students will be quicker to apply the material that they acquired from the learning media, so that, in practicum, students will work faster and minimize damage to motorcycles.

Keywords: *Electricity board, Running light, Starter system, Vocational High School*

Abstrak

Siswa Sekolah Menengah Kejuruan kelas XI Teknik Bisnis Sepeda Motor, yang di awal telah menerima materi pelajaran produktif Teknik dan Bisnis Sepeda Motor, banyak yang mengalami kesulitan jika langsung dihadapkan dengan media praktik sepeda motor karena komponennya yang masih tertutup dan tersembunyi oleh tutup bodi sepeda motor. Maka, diperlukan media pembelajaran yang memudahkan siswa. Artinya, seluruh komponen dapat dilihat dengan jelas, dan materi bisa dipahami dengan mudah, baik dalam teori maupun praktikum kelistrikan sistem starter sepeda motor, siswa akan lebih memahami teori dan merangkai rangkaian sistem starter sepeda motor. Media pembelajaran sistem starter sepeda motor berupa papan kelistrikan dengan LED yang dapat menyala secara berjalan atau bergantian sehingga dapat mensimulasikan cara kerja dari sistem starter sepeda motor. Selain itu, simulasi LED yang berjalan memudahkan siswa dalam merangkai sistem starter. Dengan adanya media ini, siswa akan lebih mudah dan cepat mengidentifikasi, memahami cara kerja, dan merangkai sistem starter sepeda motor dan nantinya, saat menghadapi bahan praktik berupa sepeda motor, siswa akan lebih cepat mengaplikasikan materi yang sudah didapat dari media pembalajaran, sehingga dalam praktikum, siswa akan lebih cepat, dan meminimalisir kerusakan pada sepeda motor.

***Kata-kata kunci**: Papan kelistrikan, Lampu berjalan, Sistem starter, Sekolah Menengah Kejuruan*

1. Introduction

At the secondary education level, especially at Vocational High Schools that belong to vocational education institutions, the graduates are expected to have competencies in accordance with their Expertise Competencies; vocational education aims to produce Vocational High School graduates with the skills, knowledge, and expertise according to the needs of the labor market or also the demands of the business world of work [1]. Therefore, Vocational High Schools are expected to produce output by having knowledge, professional attitudes, and skills and develop creativity so that they are ready to face the business world of work.

The use of learning media in the teaching and learning process, especially in practicum, makes the desire and enthusiasm of students to learn increase, and it is possible to learn independently so as to increase abilities in accordance with the goals to be achieved because learning something without being interested in the material, topic or object studied, will not provide best result. Therefore, to increase students' motivation and interest in learning can be done by providing different applications in the learning process, namely, by using media in the learning process or practicum.

In the basic competence of maintaining the starter system periodically, one of the basic competencies contained in the Automotive Engineering Expertise Program of Motorcycle Engineering and Business Skills Competency, which can be considered difficult for students to understand as well as the overall motorcycle electrical material, is basic skills of periodic maintenance of the starter system, which consists of materials on how to understand, maintain, inspect, assemble, test, diagnose damage and repair the starter system. This is also in line with the assessment format for the Motorcycle Engineering Vocational Competency Examination and Business Skills released by the National Education Standards Agency. Motorcycle Engineering Vocational Competency Examination assessment tool for the topic of motorcycle electrical maintenance includes an assessment of the process of inspection, installation, testing, repair and diagnosis of damage to the motorcycle electrical lighting system [2].

Errors or inaccuracies in assembling the starter system circuit on a motorcycle will result in inconvenience, and passenger safety can be threatened by a short circuit, which can cause component damage and fire. The hidden components of the starter system along with the cable circuit make it difficult for students to find the right circuit path so that it makes them doubt and fear because it can be fatal, namely, a short circuit or an electric current that can cause a fire in the circuit, if the process series do not follow the Standard Operational Procedure or the provisions that have been set.

In practicum activities in workshops, there are still many students who are less motivated as a result of the lack or lack of facilities and infrastructure in the form of trainers to support learning activities, especially in practicum so that teachers must innovate in learning so that students' motivation, interest and learning outcomes increase [3]. In addition, to eliminate doubt and fear so that later students

are expected to have a sense of optimism and confidence in electricity learning, especially in maintaining the starter system periodically. In Vocational High Schools trainers are included in practical learning which functions to determine understanding of the material that has been conveyed by the teacher so that mastery of the material can be achieved optimally. Trainers are real objects or model objects that are very similar to real objects, which will provide a very important stimulus for students in learning tasks involving psychomotor skills [4].

To overcome the existing problems, the development of an electricity board learning media with a running light starter system or a starter system learning media is made so that it is expected to increase understanding and skills of the motorcycle starter system. The use of learning media plays a very important role in transforming material that is not real into real material, so that students understand more easily. The use of learning media makes learning that was originally a teacher as a center to become a student who becomes the center of learning, because students will play a more active role in utilizing learning media. Furthermore, it can replace the right learning media to meet the needs of the current curriculum.

2. Method

This study develops learning media in the form of an electric board that uses a running light for learning at SMK Negeri 1 Kamal, using research and development methods in the field of education. Research and development method, or in English Research & Development, is a research method used to produce certain products and test the effectiveness of a product [5]. Research development in education is a process used to develop and validate educational products, namely, the process of creating, developing, and validating educational products [6]. This research was conducted by designing, creating, and testing the correctness of learning media for motorcycle starter system material on motorcycle engineering and business skills.

The subject of this research is a practicum learning media for teachers and students of class XI Motorcycle Business Engineering I at SMK Negeri 1 Kamal Bangkalan as users. The research was conducted in the even semester (January-March) of the 2021-2022 academic year at SMK Negeri 1 Kamal Bangkalan. One of the teaching materials development designs that is often used is the ADDIE Model of which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The development process requires several times of testing by a team of experts, individual research subjects on a limited or broad scale, and revisions to improve the final product so that although the development procedure is shortened, it includes a testing and revision process so that the product developed has met the criteria for a good

product, was empirically tested, and there were no more mistakes. This ADDIE model designs an instructional system using a systems approach. The essence of the systems approach is to divide the learning planning process into several steps, organize the steps into logical sequences, then use the output of each step as input for the next step. In order to be clearer and more coherent, the authors develop a development procedure following the flow diagram of the ADDIE model [5]. Design ADDIE development procedure is presented in Figure 1.

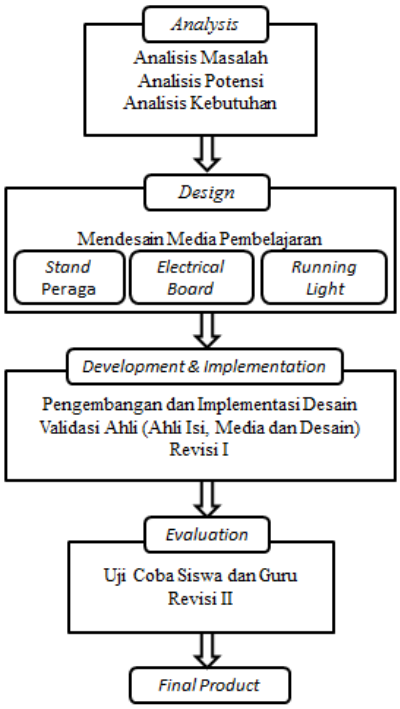

Figure 1. Design ADDIE Development Procedure

In the analysis step, there are three stages carried out as a preliminary study. First, to determine the problems encountered in the starter system practicum. Secondly, the potential with the existence of an effective media to support the practicum of the motorcycle starter system independently. Third, the subject of electricity, especially the basic competence of the basic system is a difficult material, so it is necessary to have supporting media to make it easier to learn. The author conducts a learning analysis devoted to learning the motorcycle starter system material for motorcycle electricity lessons in class XI Motorcycle Business Engineering SMK Negeri 1 Kamal Bangkalan.

The design stage is designing the concept of learning media products in the form of electric panels with a running light activation system [7]. The steps for making the product start with designing the framework in the form of 2D images, designing the layout of the electrical components of the startup system, designing a circuit diagram of the lighting system, and

finally making the design visible, drawing a 3D image that covers the entire circuit. The need to make an Electricity Board with Running Light starter system includes **Table 1**.

Table 1. Requirements for Making Electricity Board with Running Light Starter System

No	Component Name	No	Component Name
1	Acrylic	10	Banana Jacks
2	Batteries	11	Insulating Board
3	Fuse	12	Hollow Iron
4	Ignition	13	Part name sticker
5	Relay starter	14	Pilox
6	Starter switch	15	LED
7	Starter motor	16	Module/Light ignition regulator
8	Wires 18 Crocodile clips	17	Adapter
9	Tin	11	Insulating Board

The next phase of development and implementation. The development phase is the phase where the conceptualized design is realized. Validation tools are developed by academics and practitioners for the media validation process. The steps in the development phase include:

a. The stage of forming the frame or holder of the Electricity Board with the Running Light starter system by cutting the material and welding.
b. Painting the Electricity Board frame with Running Light.
c. The component installation stage is in accordance with the layout that has been designed.
d. Installation stage of the motorcycle starter system electrical circuit.
e. The trial phase of the Electricity Board with the Running Light starter system to test whether the learning media is functioning properly
f. Validation test stage for academics and practitioners
g. The revision stage is the result of input from academic experts and practitioners in the field of practice

The implementation stage was verified by expert lecturers with a review on theoretical and practical matters, consisting of material expert lecturers, media expert lecturers, and design expert lecturers. Finally, for the evaluation phase, it was tested in a limited way with respondents or teachers and students, designed to test the use of a power board versus a running light activation system, and to see how respondents responded to the media developed using a questionnaire. The results of this limited trial become a reference for the next revision to evaluate the data obtained from the pilot campaign.

From the results of quantitative data analysis, recommendations, and questionnaires, the authors examined the suitability of the learning media material, the feasibility of learning media, and the readability of learning media [8]. In addition, the learning media developed on the basis of suggestions or comments written on the questionnaire were revised. The revision was made to produce learning media that met the needs of the students and undoubtedly was better and more practical than before.

This research trial took place at SMK Negeri 1 Kamal Bangkalan, East Java, in class XI Motorcycle Business Engineering I Academic Year 2021/2022 in February-April 2022 with a total of 28 students. The population and sample used in the research on the development of the starter system learning media are 32, namely material expert of 1 lecturer, learning design expert of 1 lecturer, learning media expert of 1 lecturer, users of 1 teacher and 28 students. The use of instruments in the form of questionnaires containing information on various aspects is designed to determine the validity of the electricity board learning media with a running light starter system. The material validation questionnaire contains 14 points, the learning design validation questionnaire contains 14 points, the media validation questionnaire contains 9 points, and the interview guide instrument for teachers and students contains 18 points.

Data were obtained from the assessment of the validation results by the validator and questionnaire responses from teachers and students. The instruments used were in the form of a validation sheet for learning media and a response instrument for learning media using a Likert scale. For the validation of the material aspect, it consists of assessing the structure of the material, the media aspect consisting of the media display, the learning design consisting of the learning design aspect, while in the teacher and student interview instruments, namely the material, ease of access, and clarity of the message conveyed.

Qualitative descriptive analysis and quantitative descriptive analysis are analytical techniques used in this study. Qualitative research data is descriptive, not numerical. Data can be in the form of symptoms and events, and then analyzed in the form of categories. Qualitative descriptive analysis analyzes or processes data in the form of categories about objects by systematically arranging objects in the form of sentences/words, until finally arriving at a conclusion. Qualitatively, it can be concluded that this qualitative descriptive analysis technique was used to process review/validation data from material experts, learning design experts, learning media experts, and student and teacher test panels [9].

This data analysis technique groups information in qualitative data in the form of input, suggestions for improvement, and comments contained in the research questionnaire, which in the end, the results were used to modify the developed product to become a better and more practical learning media.

The following analysis technique was used to manage the data from the questionnaire in the form of a descriptive percentage [3].

$$P = \frac{\sum ?}{N} x\ 100\%, \qquad NA = \frac{\sum ?}{n}$$

Information:

P = score percentage

NA = final value

N = maximum score

n = number of questions

In determining the level of validity, the following qualification criteria is presented in Table 2.

Table 2. Validity group.

Percentage (%)	Validity	Level Description
6 – 100	Valid	Eligible/no need to be revised
51 – 75	Sufficiently Valid	Sufficiently worthy/partial revision
26 – 50	Invalid Less	Feasible/partial revision
< 26	Invalid	Not eligible/total revision

3. Results and Discussion

The following are the results of each stage of the research [5].

a. Analysis (Analysis)

In the analysis step, there are three stages carried out as a preliminary study. First is to determine the problems encountered in the starter system practicum. Second is the potential with the existence of an effective media to support the practicum of the motorcycle starter system independently. Third is the subject of electricity, especially the basic competence of the basic system is one of the difficult materials, so it is necessary to have supporting media to make it easier to learn.

b. Design

This step refers to a product concept design on learning media in the form of an Electricity Board with a Running Light Starter System. The steps for making the product start with designing the framework in the form of a 2D image, designing the layout of the electrical

components of the startup system, designing a circuit diagram of the lighting system, and finally, making the design visible, drawing a 3D image that covers the entire circuit.

Based on the results of the analysis, a learning media was made for starter system practicum that is effective and more interesting [10]. The concept includes components and circuits that will be added, as stated in the chart in Figure 3.

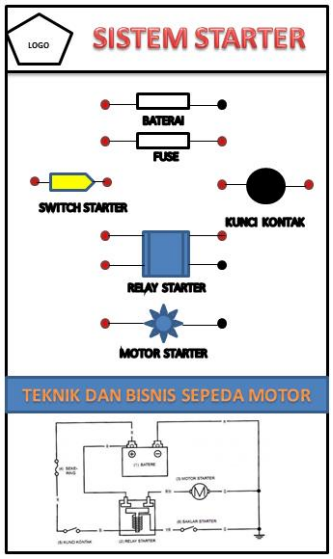

Figure 2. Front view of electricity board with running light system starter

c. Development

The development of the electricity board learning media with a running light starter system is made according to the design. The results of the making of the learning media is presented in Figure 3.F3

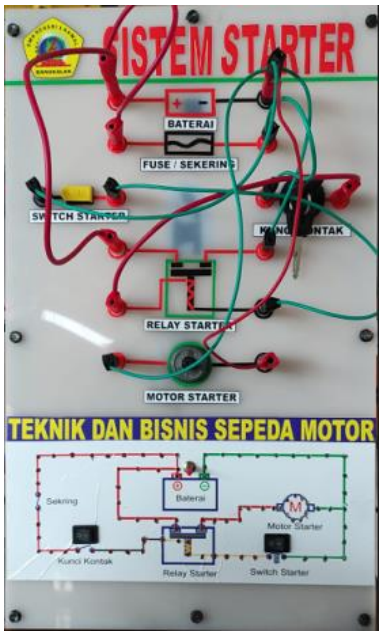

Figure 3. Learning Media electricity board with running light starter system

d. Implementation

The implementation stage is the verification of the product by expert lecturers with theoretical and practical considerations, where expert lecturers consist of content or material expert lecturers, media expert lecturers, and design expert lecturers.

The results of the assessment are as follows: 3.4.1. Validation of Content or Material Expert Lecturers Validation aims to measure the level of feasibility of learning media with content or material. The results of the validation of the learning media by content or material experts obtained the following results. First, from the content or material expert's questionnaire, it scored 61 of the maximum score 70. Then, the results or percentage of eligibility by content or material experts is 87%, with this product can be used by teachers and students without revision.3.4.2. Media Expert Lecturer Validation

Validation aims to measure the level of feasibility of the learning media with the material. The results of the validation of learning media by material expert lecturers were obtained from the media expert questionnaire, 43 of the total maximum score of 45. Then the value or percentage of the media expert's feasibility test resulted in 95.5%, and the product was ready to be used by educators and students without modification.

e. Design Expert Lecturer Validation

Validation aims to measure the level of feasibility of learning designs with modules and worksheets. The results of the validation of learning designs by design experts were obtained from a design expert's questionnaire, of 70 of the maximum score of 70. Then, the value or percentage of the results of the feasibility test by design experts obtained 100%, with this product can be used by teachers and students without revision.

f. Evaluation (Evaluation)

From the results of all validators, the learning media was declared feasible, and before being used for learning activities, the evaluation step continued, namely the assessment by class XI Motorcycle Engineering and Business 1 students and productive teachers of Motorcycle Engineering and Business SMKN 1 Kamal Bangkalan in the form of trials, namely individual trials, small group trials, field trials, and teacher trials with response questionnaires covering the material aspects of seven questions, easy access of four questions, and clarity of messages by seven questions.

a) Individual trial

This trial serves to identify the shortcomings of the initial product that has been designed and assessed by expert lecturers based on user views. This trial was given to three students individually, selected based on abilities above moderate, moderate, and below moderate, so that a representative sample was obtained. The individual trials resulted in an average percentage of 88.8%.

b) Small group trial

Furthermore, trials in small groups with a bigger number of students were given to 5 to 10 students, in this study, it was done by five students, with the results of the assessment test showing an average percentage of 87.5%.

c) Field trial.

It is the final stage of formative evaluation with 15 to 30 students. The aim is to determine whether the produced learning media can be used in practicum. In this study, it was given to 20 students, with the results of the assessment test showing an average percentage of 90.73%.

d) Teacher test

Given as a test of the use of learning media in accordance with real class conditions given to a productive teacher of Motorcycle Engineering and Business at SMK Negeri 1 Kamal, the results were 90%.

The results obtained from the percentage of individual trials, small group trials, field trials, and teacher tests show that the Electricity Board learning media with Running Light starter system is practical and has an attractiveness so that it can be used as a learning medium in motorcycle starter system practicum activities **[7]**.

4. Conclusion

From the results of the research and discussion, it can be concluded that the development of the Electricity Board learning media with the Running Light starter system on Motorcycle Engineering and Business expertise competencies in vocational high schools can be done using the Research and Development method with the ADDIE model development procedure [8]. The results of the validation test by material expert lecturers obtained a percentage of 87%, with this product can be used by teachers and students without revision. In the aspect of media feasibility by media expert lecturers, it obtained a percentage of 95.5% with this product can be used by teachers and students without revision. In the aspect of

media feasibility by design expert lecturers, it obtained a percentage of 100% with this product can be used by teachers and students without revision. Based on the results of the validation test by expert lecturers, the learning media was declared feasible, practical, and effective for application in practicum.

References

[1] Ariyanti Dwi, "Pengembangan Multimedia Interaktif Berbasis Ispring Suite 8 Pada Materi Ekonomi Bagi Kelas X SMA Negeri 1 Dawarblandong Mojokerto." Tesis Program Pascasarjana UNIPA Surabaya., 2020.

[2] Wahyono Sukma Tjatur, *Modul Pelatihan Guru Perawatan Berkala Sistem Kelistrikan*. Malang: PPPPTK Malang, 2016.

[3] Arikunto, Suharsimi, *Prosedur Penelitian Suatu Pendekatan Praktek*. Jakarta: Rineka Cipta, 2010.

[4] Anderson, A., *Pemilihan dan Pengembangan Media untuk Pembelajaran*. Jakarta: PT Raja Grafindo Persada, 1994.

[5] Sugiyono, *Metode Penelitian Kuantitatif Kualitatif dan R&D*. Bandung: Alfabeta, 2011.

[6] S. Parenrengi, A., M. T. Ali., and Jumadin, "Media Pembelajaran Praktik Sistem Kelistrikan Teknologi Sepeda Motor," pp. 287–293, 2019.

[7] D Jatmoko and Y Setyo, "Development of The Learning Sign System Media to Improve The Result Learn of Students Light Vehicle Engineering Competence," *Int. Conf. Educ.*, 2017.

[8] Sudjana, Nana., *Dasar-Dasar Proses Belajar Mengajar*. Bandung: Sinar Baru Algensindo, 1995.

[9] M. Wirawan and D. Widjanarko, "Pembuatan Alat Peraga AC Split 1 PK Sebagai Media Pembelajaran Mata Kuliah Sistem Pendingin di Universitas Negeri Semarang," vol. 9, no. 1, pp. 58-63., 2000.

[10] Arsyad, A., *Media Pembelajaran*. Jakarta: Rajagrafindo Persada, 2011.