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Development of Trainer Learning Media Kit Solar Cell Public Road Lighting System in Electrical Light Installation

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ABSTRACT

This research studies to develop instructors of electric lighting installation instructor media learns the feasibility of learning media for electrical installations trainers, learns the feasibility of worksheets for electric lighting installation learning media, and studies the effectiveness of learning media for electrical installations. Development (R&D) using the ADDIE model (analysis, design, development, implementation, evaluation). By citing: (1) Analyzing (containing: analysis of design and needs, analysis of learning, analysis of students and obtaining difficulties there is no learning media for electrical installations), (2) Design (includes: large component trainers of electric contents, electricity, and trainer design), (3) Development (including making learning media broadcast by media experts and material experts), (4) Implementation (including conducted in class XI TL 2 SMK Negeri 2 Kota Serang starting with a pretest to find out where to find students IPL and then apply the learning media that has been developed) and (5) Evaluation (provided: done by providing a post-test to determine the effectiveness of the media that has been made). Based on the results of research that has been done, obtained data on the feasibility of instructional media with an average score of 82 categories "Very Eligible" and a learning media worksheet with an average score of 78 in the category of "Very Eligible". Both of these learning media get a value of "Very Effective" for learning with an average n-gain calculation score of 0.76.

Keywords: *Learning Media, Electric Lighting Installation Trainer, ADDIE*

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INTRODUCTION

The development of technology from year to year the development is quite rapid impact on learning media. In the field of education gave birth to many new media developments to improve the quality of education in the learning process. Many educational institutions develop infrastructure for the use of technology in the field of education. Opportunities can also be utilized by educational institutions to develop learning media that support the learning process. This type of media certainly has a characteristic to be used in the learning process as a special attraction and can be understood by users both in media software or in the form of hardware (D.A. Pribadi, 2017).

Learning media is a vehicle for channeling messages and learning information to help students or students achieve their learning goals. Each type of media has characteristics, advantages and disadvantages. Then there needs to be a design for learning media (T. Nurseto,2018).The use of media should get attention in every learning activity. many types of media are selected, developed and utilized according to the conditions of time, cost and desired learning objectives and adapted to the conditions in the field for the process and achieve educational goals (I.Falahudin, 2014).

Standard learning facilities and infrastructure in schools such as furniture, educational equipment, educational media, etc. (Permenristekdikti,2015). Especially learning media and educational facilities that have not yet been fulfilled in the electric workshop. So the learning process uses only existing media in the learning process. While the development of science and technology continues to evolve, so electricity education must increase the number of sources and learning media, such as textbooks, modules, teaching aids, videos, slides, and other technologies that can be used as a means of delivering teaching materials to the maximum.

Vocational Education Curriculum is demanded to always adapt to the conditions, changes, and needs of the world of work that leads to knowledge-based industries. In order for curriculum changes to have a high impact on the impact of student learning outcomes, all teachers must be able to display good performance in conducting teaching and learning activities supported by high self competence, quality curriculum, advanced academic atmosphere environment, adequate facilities and infrastructure, abundant learning resources (P.Sudira, 2011). For example in the subject of Electrical Lighting Installation, this learning will be studied in a beginner level circuit to make a difficult circuit. Many competencies must be mastered by students with the limited subject time, making the delivery of material in learning activities less than the maximum. The following are the results of the interview with the teacher of electricity lighting installation subjects namely Mr. Sihana that:

"According to him there is still a lack of instructional media in the form of trainers so that in the learning process they still use practice on the table and he stresses that if in this class we use to practice, it seems rather troublesome, because why? This is a classroom that results in a long time. But after all the way students are not only given the material but students must also know in its application ". (Appendix 4, p. 107).

Therefore, in the teaching and learning process teachers needing subjects in electrical lighting installations need media that are capable of being students' aids in the learning process. The intended media is the component trainer that has been listed so that students know how to assemble simple models. In the learning process, subject-matter teachers can also control the mastery of student material in learning through appropriate models, methods and instructional media used by these subject matter teachers. Based on this, it can be stated about the current learning needed by students of class XI of Electrical Engineering Installation at SMKN 2 Kota Serang.

Thus, the researcher intends to conduct development research using the ADDIE Model with the title "Development of Learning Media for Solar Cell Trainer Kit Public Street

Lighting Systems in Electric Lighting Installation Subjects". Hopefully, this developed learning media can meet the competency standards in the Department of Electric Power Installation Engineering, especially in the subject of electric lighting installations.

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METHOD

His research uses research and development (Research and Development or R&D). with ADDIE research model consisting of five stages, namely: (1) Analysis, (2) Design, (3) Development, (4) Implementation, (5) Evaluation. The visit can be seen in the picture (R.M.Branch, 2009).

This research was also carried out on May 6, 2024, until June 21, 2024, in Class XI Electric Power Installation Engineering 2, SMKN 2 Kota Serang. For research subjects as respondents for data collection consisted of media experts and material experts and users. Answering as a media expert from two lecturers from the Electrical Engineering Vocational Education Study Program and one teacher from SMKN 2 Kota Serang. And for the respondents were 31 students of Electrical Power Installation 2 class at SMKN 2 Kota Serang. The research model that will be carried out is research, namely (1) analysis (analysis), (2) design (design), (3) development, (4) Implementation (Implementation) and (5) Evaluation (evaluation) (I.M. Tegeh, 2010).

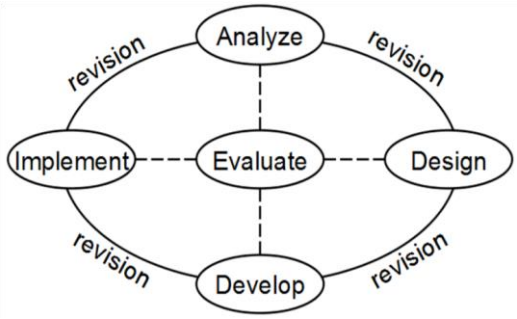

Figure 1. ADDIE Model

From the ADDIE model above then reduced as follows:

The first stage is that this analysis is carried out to find out what are the real problems that occur in the field, one of which is the problems found in SMK Negeri 2 Kota Serang, the initial step is taken is to carry out observes activities in the field by interviewing teachers to get accurate information and according to the needs of students as needed. The purpose of this analysis is to find out the syllabus and curriculum of electric lighting installation subjects used at SMK Negeri 2 Kota Serang.

In this stage, the researchers conducted observations and interviews with electricity teachers in March 2024. The results obtained from observations made were: (a) Learning Tools using the 2013 curriculum, (b) Learning media using wooden boards in practicum activities, (c) The learning method used is the lecture, discussion, and practicum methods, (d) The behavior of some students in practicum activities still does not understand the function and assembly of electrical installations. Needs analysis found that when learning in class requires learning media to support learning so that students are more understanding of learning.

The Second Stage is designed. Three stages will be carried out to make this instructional media product design, which is (a) designing the electrical installation learning media, (b) designing the electrical installation job sheet, (c) analyzing the needs to be made.

The first step is to make learning media according to the needs of students who are in charge of electric power installation subjects. The electric lighting installation trainer is designed to use an iron that is welded together so that it forms a rectangular frame in an upright position to stand firmly to support the acrylic that has been installed electric lighting installation components, there are 4 H iron bars to place the acrylic shaped hole.

The second step is to design a job sheet that will be used to complete the trainer because a trainer needs supporting material from a job sheet. Job sheets are also used to make it easier for users, both teachers, and students, to operate the learning media for electric lighting installations. In this job sheet there are also 5 jobs whose contents discuss the basic components of electrical and sensor lighting installations. And there is also a picture to support the instructions to be made on the job sheet.

The third step then calculates the costs and needs incurred. Costs incurred only include the cost of making learning media. Before making the media should first take into

account the needs of the media to be made such as the needs of components and so forth. The use of components must also be considered because to anticipate components that are damaged or error therefore the components are made more.

The third stage is the development (develop) At this stage of development learning media that have previously been determined, namely (a) making the design of learning media for electric lighting installation, (b) making a job sheet of learning practices for electric lighting installation, and finally, if the media is ready then the next process (c) due diligence. The following is an explanation of the 3 stages of development as follows:

a. Making learning media

The stages of making instructional media in the form of a trainer are carried out with 3 activities including (1) installation of components on acrylic, (2) making a framework or body of learning media, and (3) Merging of acrylic with the framework or body of learning media.

The step before the components are installed on the acrylic board is to make a design on CorelDraw X7 which will be cut with a laser cutting machine, the machine works if the design that has been made on the Corel draw is to be cut or cut or perforated on the acrylic. After the acrylic has been perforated then the design is also to make a sticker to be affixed to the perforated acrylic board, if it has been pasted the sticker to the perforated acrylic board then the next step is to install the components of the electric lighting installation. If all the steps have been done, then make a framework or body to adjust the size

b. Job sheet Making Learning electrical lighting installation

Making learning job sheets is made using Microsoft word for the writing and cover and series drawings from the job sheet created on Corel Draw X7. This job sheet is made like a book to add neatness and good aesthetic value so that it has a sale value and the order in each order in the job sheet is neatly arranged, the jobs contained in this job sheet are 5 jobs, but each title has different according to what will be practiced, The following is the sequence contained in the job sheet including (1) competence, (2) sub competence, (3) basic theory, (4) Tools and Materials, (5) Work Safety, (6) Work Steps, (7) Experiment Series, (8) Experiment results, (9) Discussion Materials.

c. Feasibility test The feasibility

Test is used to determine the feasibility of a learning media that has been made to be tested for eligibility by material experts and media experts. Validators from media experts numbered 4 examiners from different experiences and perspectives. Whereas for material expert validators there are 3 examiners from different experiences and perspectives so that the assessment, input, and advice given can vary.

The fourth stage is implementation. This application phase is carried out after the learning media for electrical installations and job sheets have been completed and are declared feasible by several media experts and material experts for later use. The next activity requires preparation by coordinating with the teachers in the subjects in the room. The learning media for electric lighting installation is applied to students who are in the

process of taking electric lighting installation subjects, especially in class XI of Electrical Engineering Installation in SMKN 2 Kota Serang.

The first step is to coordinate with the teacher in the room by providing an understanding of the learning media for electrical lighting installations and how to operate them following the job sheet that has been created. Then prepare students by providing explanations and understanding related to the procedures for using instructional media for electric lighting installations following the manual before using these media and job sheets, so that in this study there are no obstacles or obstacles in any case.

Before using the media students are given a pretest, the purpose of holding the pretest is to measure the extent to which students before using the learning media whether the student has previously understood or otherwise has not understood the subjects of electric lighting installations. Furthermore, researchers provide direction in advance to students before using the learning media by referring to the manual book that has been made this is due to avoid things that are not desirable and researchers practice a basic job for the introduction of the job before going to the next job. If directives have been given and practiced 1 job, then students conduct job trials that are 2 to job 5 with learning media and by following the directions on each job in the practice job sheet that has been created.

The fifth stage is evaluation (evaluate). The purpose of the evaluation phase with the ADDIE model is to assess the quality of teaching products and processes, both before and after being tested on students (R.M.Branch, 2009). The evaluation procedure includes: (1) determine evaluation criteria, (2) select an evaluation tool, and (3) conduct an evaluation. And there are three levels according to Branch (2009: 154), namely (1) evaluation of perception, (2) evaluation of learning, (3) evaluation of performance/ability.

The criteria to be evaluated by researchers are by evaluating learning by looking at increasing students 'abilities from before and after the use of learning media for electric lighting installations, learning evaluation tools selected to measure students' abilities after using learning media for electrical lighting installation and practical worksheets through posttest.

The data in this study were taken using interview techniques, documentation and instruments in the form of questionnaires obtained from media experts, material experts, and users, namely students.

The media feasibility test instrument consists of several aspects, namely the quality of the media, its operation, and the usefulness of the media. the instrument for the feasibility test on the material that is on the contents of the job sheet is aspects of the quality of the material and instructional quality, and instruments for learning media users as well as the job sheet which consists of aspects of the quality of the material, operation, and learning. Of the three instruments assessed by media experts, material experts and users, students are used to determining the level of appropriateness of the media and materials in the product development of learning media for electric lighting installation. The instrument or questionnaire used in data collection uses a Likert scale with four choices. To assess this questionnaire is also based on the theory that is to interpret the measurement

results required a criterion which criteria depend on the scale and number of items used. For example, using a Likert scale with four choices (D.Mardapi, 2011).

Table 1 classification of the feasibility level of learning media and material on the contents of the job sheet which consists of categories of very feasible, feasible, not feasible, very improper.

No	Student scores	Eligibility Category
1.	$x \geq \overline{x}$ + 1. SBx	Verry eligible
2.	$\overline{x}$ + 1. SBx > x ≥ $\overline{x}$	Eligible
3.	$\overline{x}$ > x≥ $\overline{x}$ - 1. SBx	Not Eligle
4.	X < $\overline{x}$ - 1. SBx	Verry Not Eligle

Information :

$\overline{x}$ = Average overall score of students in one class

=(1/2). (Maximum score + minimum score)

SBx = Standard deviation of overall scores of students in one class

=(1/2). (Maximum score + minimum score)

X = score achieved

To calculate the effectiveness of instructional media and jobsheets when used the learning process can be calculated with the following formula:

$$\text{n - gain} = \frac{(skor\ postest - skor\ pretest)}{(skor\ maksimal - skor\ pretest)}$$

FINDING AND DISCUSSION

Results of the design of the development of learning media for electric lighting installation are in the form of electrical components consisting of components namely single push, serial switch, exchange switch, light sensor.Authors and Affiliations

Figure 2 and Figure 3

Figure 2. The form of learning media for public street lighting installation

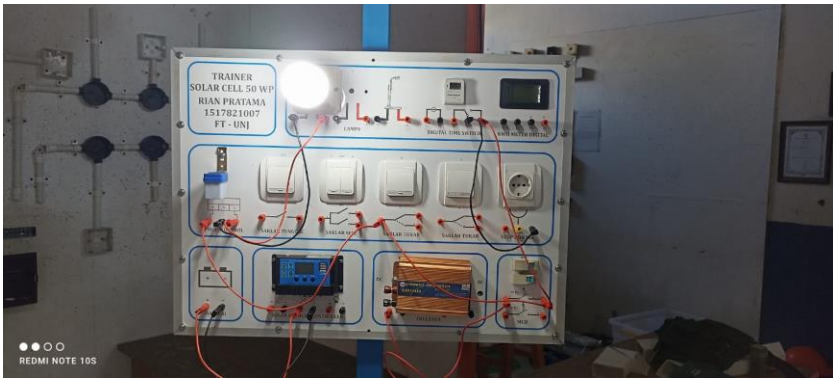

Figure 3. Design solar cell

to design media and solar cell designs made on correl draw x7 software and to connect the electrical lighting installation media using a 10-meter long cable.

Figure 4, 5 and figure 6

Figure 4. Cell Surya

Figure 5. Research in SMK 2 Kota Serang

Figure 6. Student are working on pre – test questions

The results of this study obtained some feasibility in a learning media and also the material on the job sheet which was assessed by several instructional media experts and material experts on the job sheet and also users namely students as follows:

The Feasibility of Learning Media and Job sheets Viewed from the results of the Materials and Media Experts

1. Expert Material Assessment

The assessment conducted by learning media experts amounted to 2 people, 1 from a lecturer and 1 from 2 Pandeglang SMKN schools. from the results of the assessment, it was obtained several suggestions and input for improving the job sheet to be better. Material experts assess various aspects, namely aspects of material quality, and aspects of instructional quality. Rating scores given by material experts can be seen in Table 2.

Table 2. Results of material expert validation

No	Responden	Qualitaty Materi	Quality Instruksional	amt	Ket
1.	Materi Expert 1	58	19	77	Very Decent
2.	Materi Expert 2	59	20	79	Very Decent
	Average Skor			78	Very Decent

Based on the data obtained, the category of eligibility by material experts from the quality of material and instructional quality with a total score of material expert 1 is 77, and the total score of material expert 2 is 79. The results of the total score of 2 material experts then averaged score to determine the feasibility of a media expert with a result of 78. It's in Figure 6

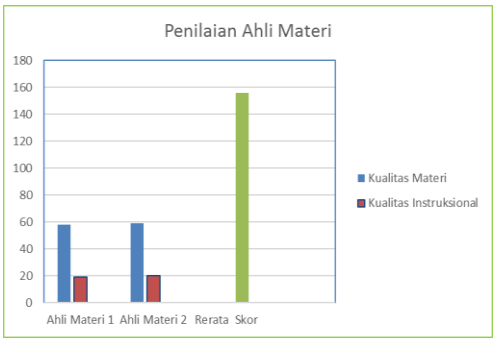

Figure 6. The score of the material expert validation results

Figure 6 explains the results of the assessment of the two learning material experts in the jobsheet is 78. So that it can be seen in the range of scores the value of 78 is in the interval x ≥ 63 which means it is in the category 1 that is "Very Eligible". Learning materials in the electrical lighting installation jobsheet all aspects of the quality of the material and the quality of instructional very feasible to be used in student learning.

2. Expert Media Assessment

The assessment conducted by learning media experts amounted to 3 people, namely 1 person from the lecturer and 2 people from the school, namely SMKN 2 Kota Serang. from the results of the assessment, it was obtained some suggestions and input for better media improvement. Media experts assess various aspects, namely aspects of media quality, aspects of operation, and aspects of media use. Rating scores given by media experts can be seen in Table 3.

Table 3. Results of media expert validation

No.	Responden	Quality Teknis	Quality Operation	Quality of use	Amt	Category
1.	Media Expert 1	20	30	21	71	Very Decent
2.	Media Expert 2	22	38	23	83	Very Decent
3.	Media Expert 3	24	40	28	92	Very Decent
	Average Skor				82	Very Decent

Based on the data obtained from Table 22, the eligibility category obtained by media experts from technical quality and technical quality with the total score of media expert 1 is 71, the total score from media expert 2 is 82 and the total score from media expert 3 is 92. The results of the total scores of 3 media experts are then obtained by the average score to determine the feasibility of the media expert with a result of 82. There is in Figure 7.

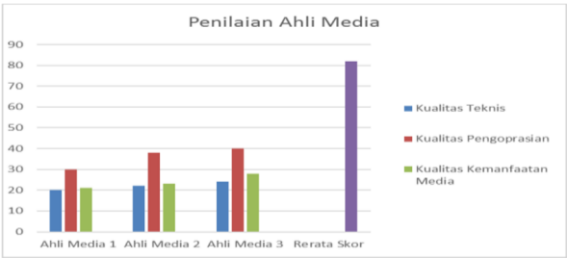

Figure 7. The score of the media expert validation results

From the average results of the assessment of the three instructional media experts is 82. So that it can be seen in the range of scores the value of 82 is in the interval x ≥ 72 which means it is in the category 1 which is "Very Eligible". This electrical installation learning media from all aspects of the media both technical quality and the quality of the technique, its operation, and the usefulness of the media are very appropriate to be used for learning for students.

3. The level of effectiveness of learning media and learning jobsheets

The effectiveness level of learning media for electrical installations can be measured using student learning outcomes in the form of pretest and posttest questions. Learning media and electrical installation jobsheets are said to be effective if the majority of students get better assessment results than before, and are said to be less effective if there is no increase in the assessment results in student learning outcomes. The following are the results of tests that have been carried out can be seen in Figure 8.

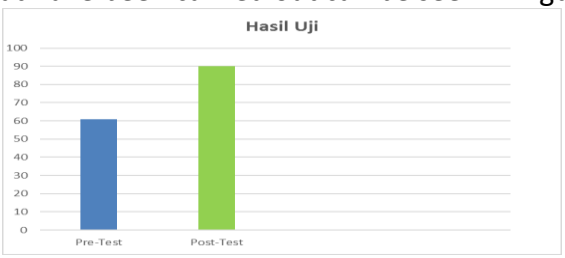

Figure 8. Comparison of pretest-posttest scores

From the results of research subjects that have been carried out on students of XI TKL 2, the Department of Electric Power Installation Engineering has 33 students. generate data from the results of Pretest and Posttest. The results of the data show that students before and after using learning media experienced a very significant increase in results. The average value obtained from the pretest is 61.28 while the average posttest value is 84.28. If it is calculated using the formula [9] to find out the effectiveness level of the Electrical Installation learning media, the score is 0.76. If seen from Table 4. Interpretation of the correlation coefficient is stated to have very high effectiveness.

The results of research conducted by researchers are certainly in line with other studies by obtaining an effectiveness value with a gain value of 0.49 (C.A.Kusuma, 2017) and pretest results obtained before using the media 59% and after using the media or practice 78% and the effectiveness results with a gain value of 0.50 (A.Efendi, 2011). Then it can be concluded that being able to increase understanding, ability, motivate, pay attention to how to combine knowledge according to learning objectives and also make it easy for students to practice.

Table 4. The effectiveness of microcontroller learning media

Average skor	Category
0,76	Very Decent

Furthermore, to find out suggestions and input on learning media that have been used by users, questionnaire sheets are given. the questionnaire sheet rating scale uses a Likert scale with grades 1-4. The average score obtained that is equal to 76 included in the category "Very Eligible". Suggestions and input are clear on the test, adding components, and the media are reproduced. These suggestions and input can be used to continue developing the next learning media. The results of the media feasibility test on students can be seen in Table 5.

Table 5. The results of the feasibility test of learning media on students

Average skor	Category
76	Very Decent

CONCLUSION

Based on the results of research and the results of the development of learning media for electrical installations along with practical worksheets, it can be concluded as follows:

1. This learning media product in the form of a trainer and electrical installation jobsheet was developed based on the Research and Development method with the ADDIE development model (Analyze, Design, Development, Implement, Evaluate). The manufacturing process starts from (a) determining the design, (b) installing components on the acrylic, (c) making the framework or body of the acrylic, (d) developing the jobsheet. The products that have been made are trainers and electrical installation learning media jobsheets which are then validated by media experts and material experts before being used by students at school.
2. The feasibility level of learning media for electrical installations gets a score of 105 which is in the "Very Eligible" category at SMK Negeri 2 Kota Serang.
3. The feasibility level of the electrical installation learning jobsheet gets a score of 95.75 which is in the "Very Eligible" category in SMK Negeri 2 Kota Serang.
4. The level of effectiveness of instructor learning media and electrical installation jobsheets in SMK Negeri 2 Kota Serang is very significant. The results of the average assessment of students showed a value of 50.56 before using instructional media and electrical installation jobsheets and a value of 85.92 after using instructional media and electrical installation jobsheets, n-gain to determine the effectiveness of the electrical installation learning media, obtained scores the value of 0.715 at SMK Negeri 2 Kota Serang.

REFERENCES

D. A. Personal. (2017) Media and Technology in Learning. Jakarta: kencana.

T. Nurseto, (2018). Making Interesting Learning Media. J. Ekon. Educator., Pp. 19–35.

I. Falahudin. (2014). Utilization of Media in Learning. Widyaiswara Netw. J., pp. 104–117

Permenristekdikti. (2005) Standards of Learning Facilities and Infrastructure. kopertis III.

P. Sudira. (2011). Vocational Education and Training and Vocational Training Welcoming the Skill of the Future. Yogyakarta State University, pp. 1–24.
R. M. Branch. (2009). Instructional Design ADDIE Approach. London: Springer Science.
I. M. Tegeh. (2010) Development of Teaching Materials with Educational Research Methods ADDIE Model, Ganesha Education. pp. 12–26.
D. Mardapi. (2012). Measurement of Assessment and Evaluation of Education. Nuha Medika.
R. R. Hake. (2018). Analyzing change / gain score.
C. A. Kusuma. (2017). Development of Robot Full Learning Media Using Wireless Communication for Microcontroller Programming Competencies. J. Progr. Stud Educator Tech. Mechatronics, pp. 442–449.
A. Efendi. (2018). Media Development' AGUS TRAINER 'for Robotics Learning. J. Ilm. Edutic, pp. 32–38.