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DEVELOPMENT OF *E-MODULES* BASED ON PROJECT BASE LEARNING (PjBL) IN THE SUBJECT OF APPLICATION OF ELECTRONIC CIRCUITS

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Abstract

SMK Negeri 2 Solok has implemented an independent curriculum. The change in the curriculum from 2013 to the Independent Curriculum has affected various aspects. One of the problems of the Merdeka curriculum is the emergence of differences in material in the subject, namely the Application of Electronics Circuits in the Department of Audio Video Engineering.The method used for the development of this learning media is Research and Development (RnD). Research and development (RnD) is a research strategy or method that is quite effective in improving practices. The research model is adapted to 4-D models. The Teaching Module trial was obtained from the practicality questionnaire of student responses with a practicality percentage of 85.75% with the category of very practical. Thus, in the development research that has been carried out, it is concluded that the development of the teaching module for the Subject of Electronic Circuit Application Class XI Audio Video Engineering at SMKN 2 Solok has proven to be valid and practical to use.

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Key Words

E-Moduls, RND, 4-D models, Electronic Circuit Application.

I. INTRODUCTION

Regarding the development of quality human resources, it is explained that the development of human resources has a very important role in realizing advanced and independent Indonesian people so that they are able to be competitive in the era of globalization [1].

the relationship between education and the quality of human resources, it can be explained that education is synonymous with human resource output, and quality human resources can only be formed when there is a quality education process. Therefore, improving the quality of human resources can be pursued through a quality education process [2].

SMK Negeri 2 Solok has used the ISO 9001: 2008 management quality standard that SMK Negeri 2 Solok is a school that implements quality management is the essence of quality education management and is expected to create and improve quality human resources. SMK Negeri 2 Solok has implemented an independent curriculum. The change in the curriculum from 2013 to the Independent Curriculum has affected various aspects. One of the problems that arises with the existence of the Merdeka curriculum is the emergence of differences in material in the subject, namely the Application of Electronics Circuits in the Department of Audio Video Engineering SMK Negeri 2 Solok

Teaching modules are learning tools or learning designs based on the curriculum that is applied with the aim of achieving the competency standards that have been set [3]. In an effort to increase the effectiveness of learners in learning, learning media is needed whose content is more detailed and according to competence in this case in the form of E-Modules.

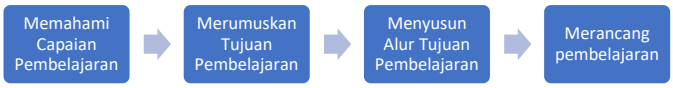
At SMKN 2 Solok there are several trainers that have existed for a long time, which have not been used in learning because the E-Module is not yet available. Based on the author's observation, when PLK, the tool was only used as a teaching tool for teachers but could not be used by students for practice.

The Merdeka Curriculum is a curriculum with diverse intracurricular learning where the content will be more optimal so that students have enough time to explore concepts and

strengthen competencies. Teachers have the flexibility to choose various teaching tools so that learning can be tailored to students' learning needs and interests. The Merdeka Curriculum provides flexibility to educators to create quality learning that suits the needs and learning environment of students. The curriculum structure in secondary education consists of two phases, namely phase E (for class X) and phase F (for class XI and class XII).

In terms of content, this profile project must refer to the achievements of the Pancasila profile according to the student phase. Then in terms of implementation time, the profile project can be implemented by summing up the allocation of lesson hours from each subject. Each level has a percentage to allocate around 30% of the total JP per year at the intermediate level [4].

The process of designing activities in Independent Curriculum It is carried out in several stages, which are as follows:



Picture 1.Stages of Independent Curriculum Planning

Teaching modules are learning tools or learning agendas that are arranged extensively and systematically with reference to learning principles applied by teachers to students [5].

According to the structure of the Electronics Engineering curriculum, Maata Lessons on the Application of Electronic Circuits are given to grade XI students as C3 subjects for the basic vocational competency scope of the subject scope of the Applied Electronics Circuits subject.

Learning outcomes	**Purpose of Teaching**		**Criteria for Achievement of Learning Objectives**
At the end of phase F, students are able to understand analog electronics circuits; understand sensors and transducers; understand power electronics circuits; create power supply circuits; understand *Uninterruptible Power Supplies* (UPS) circuits; install solar power generation systems (PVCs); create electronics-based safety systems	2.1	Understand analog electronics circuits, sensors and transducers, power electronics, power supply circuits, *Uninterruptible Power Supplies* (UPS),	2.1.1. Able to understand analog electronics networks 2.1.2. Able to understand the sensor and tranducer circuitry 2.1.3. Able to understand power electronics circuits 2.1.4. Able to understand the power supply chain 2.1.5. Able to understand the UPS network

Table 3. CP application of Electronic Networks

Learning media is tested for validity by validators who are experts in their fields, in this case validators who are material experts and media expert validators. The analysis of the validity of the expert was carried out to determine the validity/validity of the teaching module that had

been designed. Validity is carried out in two areas, namely the validity of subject matter experts and the validity of media experts [6].

One of the learning media that can be used as a solution to the above problems is to develop an E-Module for learning. The use of Teaching Modules is one of the learning strategies that can be used by teachers in a practical learning activity at school, especially in the subject of Electronics Series. Therefore, in this study, a Teaching Module for the practice of Electronics Series will be prepared as a practical learning medium for grade XI students at SMK N 2 Solok. So that students will be required to be creative and innovate on their own in accordance with a little direction from the Teaching Module. Broadly speaking, the flow of the researcher's frame of mind in the research on the development of the Learning Teaching Module is illustrated as shown in the image below:

Picture 2. Thinking Framework Chart

II. METHOD

A. Teaching Module Development Methods

The method used for the development of this learning media is Research and Development (RnD). Research and development (RnD) is a research strategy or method that is quite effective in improving practices.

The research model is adapted to Thiagarajan, et all., (1974: 5) i.e. 4-D models. The four stages in the 4-D models are: (1) Define, which includes the initial analysis stage, student and curriculum analysis and formulating learning objectives. (2) Design which includes the stage of preparing benchmark reference tests, media selection stages, format selection, and making initial designs. (3) The development stage (Develop) which includes the expert assessment stage and development trials. (4) The stage of dissemination (Disseminate) is the stage of dissemination of the product. The dissemination stage is carried out in a limited manner, namely by providing products from development to schools.

Thiagarajan, et al., (1974:5). In this development research, it refers to the development research procedure according to Sugiyono which is adjusted to the needs of researchers. The development research procedure according to Sugiyono can be seen in Figure 3.

Picture 3. Research and Development Procedures

In this study, the researcher limited it to 4 steps of development of the teaching module to be developed, namely (1) resistant to definition, (2) design stage, (3) development stage, (4) dissemination stage.

1. Definition stage

The define stage aims to gather various information related to the product to be developed. The define stage includes three steps, namely:

a) Initial analysis

The initial analysis or identification of needs aims to establish the basic problems that will arise in the learning of the Application of Electronic Circuits. Preliminary analysis to obtain an overview of the facts, expectations, and solutions to the underlying problem. The result that can be achieved at this stage is that Student Practical Learning worksheets of the Independent Curriculum book are not in accordance with school infrastructure facilities with the absence of teaching modules. Learning activities become more inclined to theory and less practice so that the information students get is less. The lack of practical activities results in students being bored and bored.

Based on the overview of the facts of the problems that occur in the field, it is necessary to develop a Teaching Module for the Application of Electronic Circuits so that it is hoped that the teaching module can improve the quality of the teaching and learning process.

b) Curriculum analysis

The curriculum used at SMK Negeri 2 Solok is an independent curriculum so that student learning is required to refer to the approach of talents and interests. Where student activity is a priority. This is a reference for the selection of learning media in accordance with the curriculum at school. The curriculum analysis stage is the stage of studying student characteristics that will be used as a reference in determining the right learning model/approach/media.

c) Formulating goals

The formulation of objectives is used to determine the behavior of the research object. The formulation of objectives is the basis for compiling or designing practical learning tools, which are then integrated into the Teaching Modules that will be developed by researchers. This is to limit the researcher so that it does not match the original goal.

2. Design Stage

The goal at this stage is to find a more effective and efficient way to develop the initial product design. Steps to take at this stage:

a) Instrument arrangement

The instrument in question is a validation instrument for the Teaching Module for the application of electronic circuits and a product trial evaluation instrument. The validation instrumentation of the Teaching Module for the application of electronic circuits is used to assess the feasibility and effectiveness of the Teaching Module for the Application of Electronic Circuits which will be developed through an assessment questionnaire for expert lecturers and teachers on the Application of Electronic Circuits. Meanwhile, product trial instrumentation is used to measure students' process skills and social skills when using the Teaching Module on the application of electronic circuits in learning. The assessment score on each instrument is based on the guidelines and rubrics of each aspect of the assessment

b) Media selection

The selection of media is adjusted to the material and learning objectives that have been formulated. The purpose of this activity is to identify relevant learning media. The media selection process is adjusted to the results of assignment analysis, concept

analysis, and student characteristics analysis. This aims to help students achieve the competencies that have been formulated

c) Format selection

The selection of the form of learning presentation is adjusted to the basic principles of making Teaching Modules. The selection of formats in developing the Teaching Module is intended to design a presentation that meets the criteria of the Teaching Module that is good, interesting, and easy in practical learning.

3. Development Stage (Develop)

The development stage is the stage to produce development products. The purpose of this stage is to produce the final form of the learning tool after going through revision based on input from validators and data from development trial results. At the development stage through 3 steps, namely: (1) Reviews supervisor followed by revision, (2) expert assessment, namely expert lecturers in the field and teachers of Electronic Series Application which are also followed by revision and, (3) development trials. Here is an explanation of each step.

a) Review by the supervisor

This stage is carried out after Draft I and product instruments are obtained which will be addressed to the validator as an initial draft by consulting the Supervisor so that input, suggestions, and criticism are obtained that help achieve a better Electronic Series Application Teaching Module product. The results of the revision of this phase were assessed by the supervisor and the teacher of the Application of Electronic Circuits

b) Validation by supervisor

Validation by supervisors and teachers of the application of electronic circuits Validation is the stage of testing the feasibility of products by supervisors and teachers of the application of electronic circuits. The purpose of validation is to obtain input and justification from experts related to the truth of the material and the delivery strategy of the material contained in the Teaching Module for the Application of Electronic Circuits that was developed.

The results of validation from experts are used as the basis for the revision and improvement of the Teaching Module for the Application of Electronic Circuits that meet the didactive requirements or feasibility of content/material, constructive requirements, and technical requirements. The results of qualifying as a final product which will then be used for field trials/development trials

4. Disseminate Stage

This stage is the final stage of development research which aims to disseminate the Teaching Module for the Application of Electronics Circuits that has been developed. In this study, the researcher limited the development research only to the limited dissemination stage to supervisors and teachers of the Application of Electronics Series at SMK Negeri 2 Solok and has not been disseminated outside the school where the research was conducted.

B. Research instruments

Learning media is tested for validity by validators who are experts in their fields, in this case validators who are material experts and media expert validators. The analysis of the validity of the expert was carried out to determine the validity/validity of the teaching module that had been designed. Validity is carried out in two areas, namely the validity of subject matter experts and the validity of media experts (Nadzif et al, 2022).

Validation by the two experts aims to obtain input, improvements and corrections related to the media that has been designed. This interactive learning media will be validated by 4 experts divided into 2 material experts and 2 media experts. At the validation stage, there are two possibilities that will be generated, namely valid and invalid.

1. Valid, if the media is declared valid, there are still two possibilities that will arise, namely whether the media needs revision or not. If the media needs revision, small revisions will be made to improve the learning media in accordance with expert input. If the media does not need revision, then the media is worth using.
2. Invalid, if the media is declared invalid, major revisions and revalidation will be carried out. This activity will continue to be repeated until the designed learning media is declared valid by experts.

Validai involves 4 experts consisting of material experts and media experts, the explanation can be seen in the following description:

1. Validation by Subject Matter Experts

Validation by a meter expert is a correction stage carried out by a material expert to obtain data in the form of media feasibility reviewed from the aspect of the content of the material and elements used in the designed media. Validation by material experts was carried out by 1 Electronics Engineering Lecturer FT-UNP and 1 Electronics Engineering teacher of SMK Negeri 2 Solok. The data obtained will then be analyzed and used for the revision of the developed Teaching Module.

2. Validation by Media Experts

Validation by media experts is a correction stage carried out by media experts to obtain data in the form of media feasibility reviewed from the quality of the media and the appearance of the designed media. Media expert validation was carried out by 1 Lecturer of Electronics Engineering FT-UNP and 1 Electronics Engineering teacher of SMK Negeri 2 Solok. The data obtained will then be analyzed and used for the revision of the developed Teaching Module.

The research instrument used is a validation questionnaire that will be given to material experts and media experts. The questionnaire data obtained will later be used to determine the validity of the media that has been designed. The instrument of the material expert is in the form of a questionnaire or assessment of the material on the truth of the material in the learning media. Media expert instruments in the form of questionnaires or media expert assessments related to the quality of the designed learning media.

No	Aspects	Indicator	Grain
1	Content eligibility	Subject TP and ATP suitability	2,3
		Fit with student needs	6
		Suitability with teaching needs	1
		Truth of material substance	4,7
		Benefits for additional insights and skills	5
2	Educational	Provide learning opportunities	5
		Compatibility with students' thinking	6,8
3	Language	Readability	9
		Clarity of information	10
		Conformity with Indonesian rules	11
4	Serving	Clarity	12,13
		Communicative (stimulus and respondent)	14,15,16
		General construction clarity	17

Table 4. Grid Questionnaire validation test by Subject Matter Expert

In their research, Sumiati and Asra explained that the validation questionnaire for material experts aims to get feedback from experts regarding the content and structure of the material developed. This process is important to ensure that the material is in accordance with educational standards and can meet the needs of the learner.

No	Aspects	Indicator	Grain
1	Aesthetic	Font size and Shape/typeface	8,9
		Color composition of writing and images	10
2	Technical	Ease of use	1,2,3
		Consistency and Format	4
3	Graphics	Color	6
		Layout,layout	7
		Picture	11,12,13
		Display design	5
		Illustrations, graphics	14,15,16

Table 5. Grid Questionnaire validation test by Media Experts.

Pudji Mulyono also emphasized the importance of involving experts in the validation process to ensure the accuracy of the information and methodology used in the teaching materials. This validation is carried out by circulating questionnaires containing questions about various aspects of the material, such as clarity, relevance, and ease of understanding. The results of this validation will be used to revise and refine the material before it is applied in learning.

The data analysis technique in this study is descriptive analysis, which is by calculating the percentage of the value of the validation results.

$$presentase = \frac{skor\ yang\ diperoleh}{skor\ maksimum} \times 100\%$$

The feasibility of learning media from the research can be seen based on the percentage of scores. The greater the percentage of scores that analyze the data, the higher the level of feasibility of the media. The criteria for making learning media validation decisions can be seen in Table 6 below.

Score	Criterion
0% - 20%	Very Unworthy
20,01% - 40%	Not Eligible
40,01% - 60%	Quite Decent
60,01% - 80%	Proper
80,01% - 100%	Highly Worth It

Table 6. Validation Eligibility Criteria

1. Practicality test questionnaire by students

After a questionnaire of material experts and media experts, a respondent questionnaire is also needed as supporting data intended for students, to find out the opinions of students if

applied in learning activities. This instrument will cover several aspects, namely: (1) ease of use of the module, (2) time required, (3) ease of interpretation, (4) having the same equivalent. The grid of instruments to be used to respond to the student responses addressed in the table :

No	Aspects	Indicator	Number
1	Ease of use of modules	The module cover is designed with an attractive appearance	1
		The stages of the teaching module can motivate in solving the summative questions given	2
		Instructions for using jobsheets in the teaching module make it easier to do all practical activities	3
		Solving problems on jobsheets can be easily understood through teaching modules.	4
		Jobsheets in teaching modules use easy-to-understand language	5
		The teaching module uses attractive images, drawings and colors.	6
2	Time required for implementation	The use of teaching modules is in accordance with the learning time provided	7
		Teaching modules using correct correct spelling (EYD)	8
3	Ease of interpretation	The presentation of the material in the module is clear and easy to understand	9
		Formative questions in learning activities can help in solving problems and understanding the material.	10
		The teaching module material is easy to understand	11
4	Have the same equivalent	The material in the teaching module is equivalent to other teaching materials	12
		Teaching modules can stimulate thinking because attractive images and colors are available	13
		Teaching modules can increase motivation and interest in learning.	14

Table 7. Practicality Questionnaire Grid from students

The observed score was a score filled in by 20 students in the TAV department of SMK Negeri 2 Solok in filling out the questionnaire. Percentage search is intended to find out the status of something that is percentaged and presented remains in the form of a percentage. The rules for giving eligibility scores from this media use the Likert scale, as shown in the following table:

Score	Criterion
5	Excellent
4	Good
3	Keep
2	Bad
1	Very bad

Table 8. Product Practicality Assessment Scale

The data analysis technique used in this study is descriptive analysis, namely by calculating the percentage of practicality results.

$$persentase = \frac{skor\ yang\ diperoleh}{skor\ maksimum}\ X\ 100\%$$

The level of practicality of the product results of development research is seen by the percentage of scores. The greater the percentage of the score from the data analysis results, the better the feasibility level of the product from the development research results. The criteria for decision-making in the practicality of interactive learning media can be seen in table 8.

No.	Achievement rate (%)	Category
1.	0% - 25%	Impractical
2.	25,01% - 50%	Less Practical
3.	50,01% - 75,%	Quite Practical
4.	75,01% - 100%	Very Practical

Table 9. Categories of Practicality

III. RESULTS AND DISCUSSION

A. Media Creation Results

The creation of this E-Module refers to the 4D development procedure, namely Define, Design, Development, and Disseminate.

1. Definition Stage

At this stage, the goal is to obtain information that meets the needs of the products produced and to know the various aspects that are the basis for the importance of learning media production, namely the E-Module on the Subject of Electronic Series Application.

a. Initial analysis

At the initial stage of analyzing the condition and needs of students, information was obtained that the materials used in learning were not available properly, before this students only sourced from instructions given by the teaching teacher.

Based on the above description, it is necessary to create an E-Module that is able to direct students independently and be more effective in motivating students to understand the subject matter. The chosen media is the E-Module on the Subject of Electronic Network Application. The e-Module that is made contains a series of real actions in learning, materials with an attractive appearance, jobsheets in accordance with the learning material and in the form of summative questions that can direct students to learn independently and arouse interest in learning.

b. Student and curriculum analysis

At this stage, information was obtained based on the experience of PLK carried out at SMK N 2 Solok. The characteristics of students are more active and enthusiastic in practical activities. The curriculum that is applied is the Independent Curriculum. This stage is obtained learning outcomes for students who are able to understand analog electronics series with a time allocation of 2 meetings with each meeting of 6 X 45 minutes.

2. Formulating goals

Learning objectives are based on indicators derived from learning outcomes in terms of skills in the jobsheet. The purpose of the defense of this element is outlined in the form of a teaching module. This can be seen in table .10

Meeting to	Learning objectives
Sunday 2nd	1. Students can apply a series of analog electronic passive components 2. Students can test a series of passive components of analog electronics. 3. Students can understand the characteristics of SCR FIR 3D
Sunday 3rd	1. Students can understand how to use ***Eagle*** software to design analog circuits. 2. Students can string a series of automatic garden lights using SCR FIR 3D. 3. Students can design PCB paths using Eagle.

1. Design Stage

The media designed in this study is the Teaching Module on the Subject of Electronic Series Application. This design stage is carried out to compile the content framework of the E-module to be created. The E-Modules presented in each sheet consist of Cover, Learning Outcomes, Material Content, Jobsheet and Assessment.

a. Cover

The cover made contains the title of Subject, UNP logo,. The cover is made more colorful and equipped with images so that it attracts students in learning the content of the media. The cover shape of the media is shown in Figure 4.

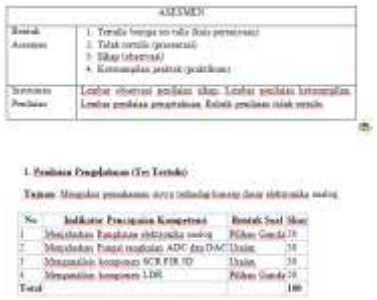
Picture 4. Cover Display

b. Learning Outcomes (CP)

Learning outcomes are an overview of the material to be studied. Learning Outcomes are learning competencies that must be achieved by students at the end of each phase. This learning achievement can be seen in the teaching module for the initial part.

c. Assessment tools

Assessments in the media can be presented in the form of different multiple-choice questions in the learning material, so that they can make students better and active in the learning process. Assessment is a means to evaluate students' understanding of the material that has been given. The assessment tool in the media is adjusted to the CP in the syllabus, so that it can assess the achievement of learning objectives. The display of the assessment device can be seen in the Teaching Module, this is one of the display of the assessment device can be seen in Figure 5.



Picture 5. Display of Learning Material Content

d. Material

Learning materials are a form of materials or a set of learning substances to assist teachers/instructors in teaching and learning activities that are systematically arranged in order to meet the set competency standards. The meeting material is used to be a theoretical guideline in a learning for each meeting. The display of meeting materials can be seen in the Teaching Module, this is one of the display of meeting materials that can be seen in Figure 6.

Picture 6.Learning Material Display

e. Job Sheet

Jobsheet is a practical work procedure in the form of sheets that include the purpose of the practicum, as well as practicum assignments with the aim that students can learn independently without the guidance of the teacher as a handle for students during practicum. Jobsheets in the media can be presented so that they can make students better and active in the learning process. The jobsheet view can be seen on the E-Module, this is one of the jobsheet views can be seen from Figure 7.

Picture 7. Jobsheet View

2. Development

At this stage, it is to produce the final form of the teaching module after revision based on input and comments from validators by media experts, validators by material experts

a. Validation Results

Expert validation is carried out to assess the media design. The validator provides criticism and suggestions for the shortcomings of the media and then the researcher uses it

to improve the media. After the media is corrected, it is consulted back to the validator to find out that the revision results are correct and correct according to expert advice

Media that has been revised is assessed by validators by filling out the examination sheet on the questionnaire that has been prepared. Media validation and research consist of two validations, namely the validation of material experts and media experts.

1) Validation by a subject matter expert

The validator assesses from 4 aspects, namely the feasibility of content, educational, linguistic, and question presentation. The validation of the material was carried out by 2 people, namely a lecturer of Electronics Engineering Education and a teacher of the subject of the Application of the Electronics Series of SMK Negeri 2 Solok.

Media Member	Validation Assessment Aspects										Category
	Content Eligibility		Educational		Language		Serving		Total		
	Score	Percentage-rate	Score	Percentage-rate	Score	Percentage-rate	Score	Percentage-rate	Score	Percentage-rate	
Member 1	31	89%	13	87%	15	100%	27	90%	77	91 %	Highly Worth It
Member 2	30	86%	13	87%	12	80%	26	87%	72	85 %	Highly feasible
Average Percentage										**88 %**	**Highly feasible**

Table 11. Material Expert Validation Results

Table 11 displays the results of the validation of material experts on aspects in 4 aspects which include the feasibility of content, language and visualization, evaluation questions by 2 validators. In the feasibility aspect of the content consisting of 7 items with a maximum score of 35, it can be seen that validator 1 gave a score of 31 with a percentage of 89% and validator 2 gave a score of 30 with a percentage of 86%. The educational aspect is divided from 3 items with a maximum score of 15, it can be seen that validator 1 gives a score of 13 with a percentage of 87% and validator 2 gives a score of 13 with a percentage of 87%. The linguistic aspect consists of 3 items with a maximum score of 15, it can be seen that validator 1 gives a score of 15 with a percentage of 100% and validator 2 gives a score of 12 with a percentage of 80%, The aspect of presentation questions consists of 6 items with a maximum score of 30, it can be seen that validator 1 gives a score of 27 with a percentage of 90% and validator 2 gives a score of 26 with a percentage of 87%.

The total score of validator 1 on the whole aspect is 77 with a percentage of 91% and the total result of validator score 2 is 72 with a percentage of 85%. The data from the assessment results of each validator is in the score range of 81%-100% which is included in the very Feasible category. The total average percentage achieved from the assessment of 2 validators on all aspects is 88% and is categorized as "Very Feasible".

2) Validation by media experts

Validators provide assessments, inputs, and suggestions to the media. This validation was carried out by 2 validators, namely a lecturer of Electronics Engineering Education and a teacher of the subject of Electronic Electronics Implementation of SMK Negeri 2 Solok.

Media members	Validation assessment aspects								Category
	Aesthetic		Technical		Graphic		Total		
	Score	Percentage-rate	Score	Percentage-rate	Score	Percentage-rate	Score	Percentage-rate	
Member 1	14	93%	20	100 %	43	96%	77	96%	Highly feasible
Member 2	15	100 %	19	95%	39	87%	73	91%	Highly feasible
Average Percentage								94%	**Highly feasible**

Table 11 shows the results of media expert validation on 3 aspects including aesthetics, technical, and graphic by 2 validators. In the aesthetic aspect consisting of 3 items with a maximum score of 15, it can be seen that validator 1 gives a score of 14 with a percentage of 93% and validator 2 gives a score of 15 with a percentage of 100%. The technical aspect consists of 4 items with a maximum score of 20, it can be seen that validator 1 gives a score of 20 with a percentage of 100% and validator 2 gives a score of 19 with a percentage of 95%. The graphing aspect consists of 9 items with a maximum score of 45, it can be seen that validator 1 gives a score of 43 with a percentage of 96% and validator 2 gives a score of 39 with a percentage of 87%.

The total score of validator 1 on the whole aspect is 77 with a percentage of 96% and the total result of validator score 2 is 73 with a percentage of 91%. The data from the assessment results of each validator is in the score range of 81%-100% which is included in the very feasible category. The total average percentage achieved from the assessment of 2 validators on all aspects is 94% and is categorized as "Very Feasible".

b. Product Revision

1) Validation revision results by subject matter experts

When validating to material experts, the researcher receives comments and suggestions from material expert validators. The researcher then revised it based on comments and suggestions from surveyors. Revisions are made to improve the E-Modules that will be applied in learning. The revised section can be seen from the following table:

Suggestion	Revision
Fix the marked typo and retype the formula in the screenshot. Use language that is easy to understand at SMK.	Correct incorrect/erroneous sentences or language, and retype formulas.
Adding some important points that are missing in the preparation of the teaching module	Add some important points suggested by experts such as; Learning assessment
Spruce up and enhance the look of the E-module cover	Rearrange and design the cover appearance on the E-module

Table 14. Revision by material experts

The following is a view of the teaching module before and after conducting revision based on suggestions from material expert validators. The results can be seen in the following table:

Views before revision	Post-revision view
	

Table 15. A pre- and post-revision view based on the advice of a subject matter expert validator

2) Validation revision results by media experts

When validating media experts, the researcher receives comments and suggestions from media expert validators. The researcher then revised based on comments and suggestions from media experts. Revisions are made to improve the Teaching Module that will be applied in learning. The revised section can be seen in the following table:

Suggestion	Revision
Fix cover for front back see references on canva	Fixed cover for a more attractive front back

Table 16. Revision by material experts

The following is a view of the teaching module before and after doing the revision based on suggestions from media expert validators. The results can be seen in the following table:

Views before revision	Post-revision view
	

3. Disseminate

The dissemination stage is carried out after the completion of product repairs that were previously assessed or tested for validity by material and media experts. At this stage of deployment, before the use of the product that has been developed, a practical test of the product is carried out first. Where this practicality test was carried out by 20 students,

namely students majoring in Audio Video Engineering at SMK Negeri 2 Solok. The results of this practicality test can be seen from table 12.

NO	Practicalization Assessment Aspects								Category
	Ease of use of modules		Ease of interpretation		Have the same Equivalent		Total		
	Score	Percentage rate (%)	Score	Percentage rate (%)	Score	Percentage rate (%)	Score	Percentage rate (%)	
1	32	80%	8	80%	19	76%	59	79%	SP
2	33	83%	7	70%	21	84%	61	81%	SP
3	35	88%	7	70%	20	80%	62	83%	SP
4	40	100%	10	100%	25	100%	75	100%	SP
5	26	65%	5	50%	19	76%	50	67%	SP
6	38	95%	9	90%	21	84%	68	91%	SP
7	31	78%	8	80%	20	80%	60	80%	SP
8	27	68%	3	30%	13	52%	41	55%	SP
9	32	80%	6	60%	18	72%	56	75%	SP
10	33	83%	7	70%	21	84%	61	81%	SP
11	28	70%	5	50%	16	64%	44	59%	SP
12	29	73%	4	40%	17	68%	50	67%	SP
13	35	88%	9	90%	21	84%	65	87%	SP
14	30	75%	6	60%	20	80%	56	75%	SP
15	36	90%	9	90%	24	96%	69	92%	SP
16	33	83%	6	60%	23	92%	62	83%	SP
17	38	95%	10	100%	23	92%	69	92%	SP
18	38	95%	8	80%	24	96%	70	93%	SP
19	36	90%	9	90%	24	96%	68	91%	SP
20	32	80%	8	80%	21	84%	61	81%	SP
21	40	100%	10	100%	24	96%	74	99%	SP
22	29	73%	7	70%	20	80%	56	75%	SP
23	37	93%	8	80%	24	96%	70	93%	SP
24	37	93%	10	100%	23	92%	70	93%	SP

Table 12. Results of Practicability of 20 Students

Based on table 12, it can be seen from the students
The results of the calculation of the practicability test above can be calculated on average from 20 students per aspect can be seen in table 13.

No	Aspects	Total Score	Percentage (%)	Category
1	Ease of use of modules	805	82%	Very Practical
3	Ease of interpretation	179	72%	Very Practical
4	Have the same equivalent	501	80%	Very Practical
Average Percentage			**77%**	**Very Practical**

Table 13. An average of 20 students

The total score of 20 students in the aspect of ease of use of the module is 805 with a percentage of 82%. In terms of ease of interpretation, the total score was 179 with a percentage of 72%. From the aspect of having the same equivalent, the total score is 501 with a percentage of 80%. The data from the trial results for 24 students is in the score range of 70% - 100% which is included in the very practical category. The total average percentage achieved from the students' assessment of the overall aspect is 77% and is categorized as "Very Practical".

B. Discussion

Based on the results of the research that has been explained above, it can be seen that the development process of the Teaching Module for the Subject of Electronic Circuit Application Class XI Audio Video Engineering at SMK N 2 Solok is in accordance with the development stages with the 4D model.

(1) The definition stage consists of the initial analysis stage, student analysis of the curriculum and and formulating learning objectives (2) The design stage consists of the preparation of the benchmark reference test, the media selection stage, the format selection, and making an initial design. (3) At this stage, the validity test carried out by material and media experts on the developed Teaching Module and the revision of the teaching module product. Teaching Module Practicality test. (4) The dissemination stage is carried out to test

the practicality of the teaching module and is limited by providing the product of development to SMK N 2 Solok.

The development of the teaching module for the Subject of Electronic Circuit Application Class XI Audio Video Engineering at SMK N 2 Solok is good and suitable for use in the learning process. This can be seen from the results of the validity test of material experts, and media on the product In the results of the validity test of material experts, validation results were obtained with a validity percentage of 88% with a very valid category. In the results of the validity test of media experts, validation results were obtained with a validity percentage of 94% with a very valid category. Thus, the results of the validity of the Teaching Module product were obtained with an average validation result with a validity percentage of 91.% with a very valid category which means that the Teaching Module can be used as a learning medium for the subject of the Application of Electronic Circuits Class XI Audio Video Engineering.

In accordance with the previous research in his research with the title "Development of Electronic Workshop Work Engineering Teaching Module as a Practical Learning Media for Class X Students at SMK Negeri 2 Wonosari Gunung Kidul" is the same type of research and media products, namely research and development and Teaching Module media, using the 4-D model development model according to Thiagarajan. Research using 2 material experts and 2 media experts and 32 students showed that the Teaching Module was feasible to use. Based on the assessment of the experts, the Teaching Module received an average score of 99.5 with a percentage of 80% (feasible). Based on the assessment of media experts, the Teaching Module received an average score of 87.5 with a percentage of 87.5% (very feasible).

Furthermore, the teaching module was tested, namely to find out the level of practicality of the Teaching Module developed. This can be seen from the results of the student response questionnaire. The Teaching Module trial was obtained from the practicality questionnaire of student responses with a practicality percentage of 85.75% with the category of very practical.

IV. CONCLUSION

Thus, in the development research that has been carried out, it is concluded that the development of the teaching module for the Subject of Electronic Circuit Application Class XI Audio Video Engineering at SMKN 2 Solok has proven to be valid and practical to use. So this shows that the application of the Subject Teaching Module on the Application of Electronic Circuits for Class XI Audio Video Engineering is very good and worthy of being used as one of the innovations in the learning process so that learning becomes more fun and can meet the source of information for students to understand the material being studied.

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