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Validity Of Teaching Materials Based Project Based Learning On Renewable Energy For Phase E

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Abstract

Changes in learning demands over time mean that the curriculum in education also changes. The new curriculum currently being used is the Merdeka curriculum. This curriculum change requires educators to be prepared to prepare learning materials that are appropriate to learning objectives. This research purpose to develop based teaching materials project-based learning on phase E renewable energy materialsvalid. This research includes research and development research carried out through 4D models. This research was only carried out in three research stages, namely the define, design and development stages. Research have limitation in development stage to determine product validity. Validity analysis was carried out on four components which include appropriateness of content, language, presentation and graphics. The data collection instrument used was a validity assessment questionnaire using a Likert scale. Validity data analysis using the V'Aikens equation. The research results showed that based teaching materials project-based learning Phase E renewable energy material is considered to have high validity. So, the teaching materials developed are suitable for use in physics learning for class X high school renewable energy material.

Keywords ***:*** *Teaching Materials, Project-Based Learning, Renewable Energy*

INTRODUCTION

Human life is currently in a period of developing science and technology. This development has spread to various social, economic, cultural, political and educational aspects. The science and technology development is driving the education development in Indonesia. With the increasing development of technology in the 21st century, the learning process must adapt to these changes (Prihatmojo et al., 2019). The increasingly rapid science and technology development influences the education world in terms of improving the education quality, especially adapting the information and communication technology used to the education world, especially in the process of learning (Agustian & Salsabila, 2021)

Education in Indonesia aims to prepare a better generation of the nation (Sujana, 2019). These educational goals are national education purpose that must be achieved by all educational unit. One way to achieve this goal is to implement a curriculum that

encourages the achievement of national education goals. The curriculum is dynamic, meaning it always changes depending on educational conditions. One of the changes in the curriculum is influenced by conformity with current developments (Hidayat et al., 2020). Currently, developments are leading to digitalization of technology. Therefore, this digitalization has given rise to a new curriculum called the independent curriculum (Fikri et al., 2015).

Based on the current educational conditions and situation, an independent curriculum can be considered as an option to solve the problem of learning loss (Supangat, 2021). According to the decision of the Ministry of Education and Culture, Research and Technology number 56/M/2022 concerning the implementation of the curriculum in the context of learning recovery after the Covid-19 pandemic. The characteristics of the independent curriculum that differentiate it from the 2013 curriculum are project-based learning for the soft skills and character development according to the profile of Pancasila student which provides opportunities for students to explore knowledge and develop skills (Setyani et al., 2023)The independent curriculum is expected to improve literacy skills, namely critical thinking skills in solving problems and communication skills for students (Yamin & Syahrir, 2020).

For students to have literacy skills, appropriate teaching materials or books are needed in accordance with the current curriculum (Handoyo & Susilo, 2020). Teaching materials are a collection of learning materials or substances (materials for teaching) that are arranged systematically, presenting a complete picture of the competencies that students will master in activities of learning (Octariani & Rambe, 2018). Teaching materials are also needed by teachers to create effective learning for students so that they can increase performance from teacher in the process of learning (Yulia et al., 2018). Books are adapted to the applicable curriculum (R. Hasanah & Ernawati, 2020). In the 2013 curriculum, textbooks emphasize reading only, so textbooks contain more writing and fewer pictures. Apart from that, the assignments presented are more in-depth in the substance of the content, so they do not provide meaningful learning for students. (Jannah et al., 2022) The physics teaching materials used must be able to improve students' cognitive abilities. Teaching materials that involve students can make the learning process active. In the merdeka curriculum, the project-based learning model is one of the recommended learning models.

Project-based learning has become a widely used educational approach in recent years due to its student-centered learning (Tascı, 2015). Project-based learning is an inquiry-based teaching strategy in which students participate in knowledge production by completing meaningful tasks and developing real-world results (Brundiers & Wiek, 2013). Students participate in a project-based learning activity that results in a product. Student involvement begins with activity planning, design, implementation, and reporting of results in the form of products and implementation reports (Ayuni et al., 2022). Based on research (Ayuni et al., 2022), the project-based learning model is effectively used to improve high school student learning outcomes. The project-based learning model also has a positive and significant influence on increasing physics competence (Fadhila et al., 2016).

The results of preliminary research conducted through interviews with physics teachers conducted at SMAN 1 Banuhampu. The results of preliminary research which include the curriculum used is still newly implemented at SMAN 1 Banuhampu, namely the independent curriculum, the materials of teaching used are still in the shape of printed books in the public library and books provided by the government in general, and the use of teaching materials used by teachers are not yet project-based, especially regarding renewable energy materials. To address the problems found at SMAN 1 Banuhampu, teaching materials are needed to facilitate students for the Merdeka phase E curriculum in high school. The teaching materials developed must make students actively involved in the physics learning process, especially producing a product that provides a meaningful understanding of concepts. Based on the problems found in the field, this research purpose to develop materials of teaching based on project-based learning on phase E renewable energy materials that are valid to be used as physics teaching materials for class X high school.

METODS

The research type used in this research is research and development (Sugiyono, 2019). The model used in this research is the 4D development model who stated that, the research steps are Define, Design, Development, and Disseminate, or what is abbreviated as 4D (Okra & Novera, 2019) .To make products in the shape materials of teaching based on project-based learning on phase E renewable energy materials. Research stages shown in Figure 1.

Figures 1. 4D Research Stages

This research begins with the define stage. At this stage, initial-finish analysis, analysis of student, analysis of concept, and l objectives of earning formulation are carried out. The analysis was carried out to obtain initial information for carrying out research. The second stage carried out is design. At this stage, a teaching module design on renewable energy is created based on learning outcomes and learning objectives in accordance with the curriculum.

After the product has been designed, the research continues with the development stage. This stage is carried out to acquire an appraisal of the product's feasibility. The assessment of product feasibility was conducted by 3 FMIPA lecturers majoring in physics at Padang State University through a validity assessment questionnaire. The validity assessment components used consist of components of presentation, graphics, appropriateness of content, and appropriateness of language. Assessment was carried out using a Likert scale (Retnawati, 2016). The teaching materials developed will be improved according to the suggestions and input submitted by the validator to improve the quality of the product so that it is better for use as teaching materials based on project-based learning on phase E renewable materials at SMAN 1 Banuhampu. This

research have limitation in development stage to determine the feasibility of the product being developed.

The results of the validity assessment were analyzed through the validity index assessment proposed by Aiken. The validity test data obtained were analyzed using the Aiken's V index item validity index (V) formulated as follows.

$$V=\frac{\sum s}{n\,(c-1)}$$

s= r – l0

Where:

V= index of respondents' agreement on the items validity
s = score determined by the respondent minus the lowest score
l_0= lowest score in the scoring category (in this case = 1)
c = the categories number that respondents can choose
r = respondent choice category score
n = respondents number

Data obtained The respondents' agreement index is then interpreted using the categories in Table 1.

Table 1. Decisions Based on Aiken's V Index

Intervals	Category
≤ 0.4	Low
0.4 < V ≤ 0.8	Medium
0.8 < V	High

(Source: (Retnawati, 2016))

RESULTS AND DISCUSSION

According on the research that has been carried out, teaching materials have been produced based project-based learning in phase E renewable energy materials. This product was produced through the 4D research stages. The first result at the define stage was that the curriculum implemented in schools was still new, namely an independent curriculum which made it difficult for teachers to prepare learning materials, the physics teaching materials available in schools were still limited, and there were no teaching materials that used the project-based learning model. Based on these problems, research on the teaching-based materials development was carried out project-based learning on phase E renewable energy materials which are continued at the design stage.

At the design stage a product has been developed based onproject-based learningin phase E renewable energy material. The teaching materials developed consist of sections which include cover, foreword, table of contents, learning instructions, competencies achieved, learning materials, exercises, LKPD, evaluation, and bibliography. The material for teaching developed are in related with the guidelines

for developing materials for teaching in general (Depdiknas, 2008). The teaching materials developed are arranged based on syntaxproject-based learning. An example of a development design shown in Figure 2.

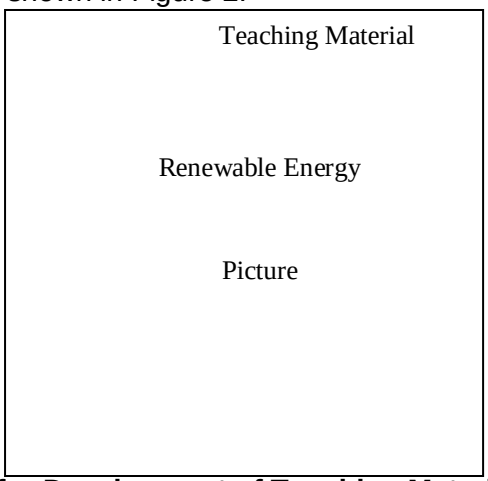


Figure 2. Design for Development of Teaching Materials Based on project-based learning on Phase E Renewable Energy

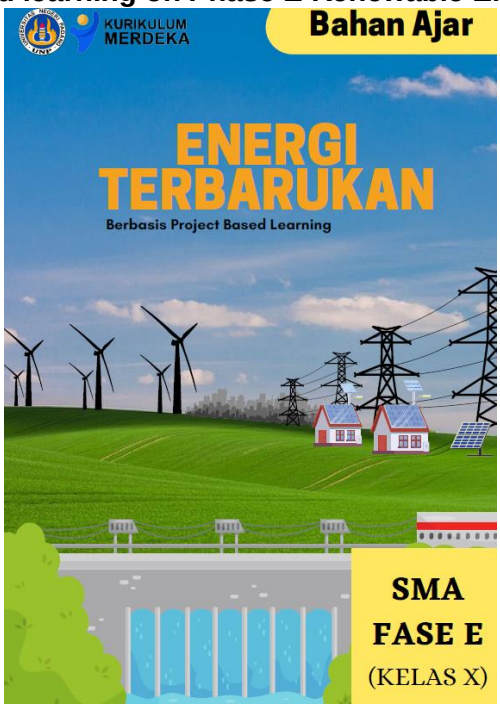


Figure 3. Display of Teaching Materials Based on project-based learning on Phase E Renewable Energy

Results from validity analysis of teaching materialsproject-based learning in Phase E Renewable Energy Materials, 4 validity assessment components have been carried out. These components include the components of content eligibility, language, presentation and graphics. The results of the first validity test are at component appropriateness of content. This component aims to determine whether the content contained in the teaching materials is based project-based learning in phase E renewable energy material is in accordance with the demands of the subject. ComponentThe feasibility of the content consists of 17 assessment indicators. The validity assessment results of the content feasibility component shown in Table 2.

Table 2. Results of Content Eligibility Component Validity Analysis

Indicator	V'Aiken Value	Criteria
1	0.75	Medium
2	0.75	
3	1.00	High
4	1.00	
5	0.91	
6	0.83	
7	0.91	
8	0.91	
9	1.00	
10	1.00	
11	1.00	
12	0.83	
13	0.91	
14	0.83	
15	0.91	
Average	**0.90**	**High**

Table 2 shown that the validation value for the content suitability indicator ranges from 0.75 to 1.00. Of the 15 assessment items, there are 2 validity assessment indicators which are classified as moderate, namely with a value of 0.75 and 13 validity assessment indicators which are classified as high, namely with values ranging from 0.83 to 1.00. The average validation score for the content suitability indicator is 0.90. The research results are in relevan with those explained by Andromeda 2023, explaining that the teaching materials developed are valid in terms of content suitability. (Norsanty & Chairani, 2016) To increase students' understanding according to indicators of achievement of learning outcomes, teaching materials must contain activities that students must carry out so that students discover the basic concepts of the material. This teaching material is packaged with problem-based learning syntax. So, this problem-based learning-based teaching material is considered feasible. With

the availability of good teaching materials, students can be helped to learn independently and in accordance with the implemented curriculum plan (Norsanty & Chairani, 2016). Learning through this model allows students to be able to analyze, design, make decisions, solve problems and draw conclusions, participants can work independently or in groups (Sholichah, 2018). Therefore, it can be stated that teaching materials are based project-based learning in phase E renewable energy material developed has high validity in terms of content feasibility components.

The results of the second validity test are on the linguistic component. This component aims to determine whether the language used in based teaching materials project-based learning on phase E renewable energy materials can be easily read and understood by users. The linguistic appropriateness component consists of 6 assessment indicators. The validity assessment results of the linguistic appropriateness component shown in Table 3.

Table 3. Validity Analysis Result of Language Components

Indicator	V'Aiken Value	Criteria
1	0.83	High
2	0.83	
3	0.83	
4	0.83	
5	0.83	
6	0.83	
Average	**0.83**	**High**

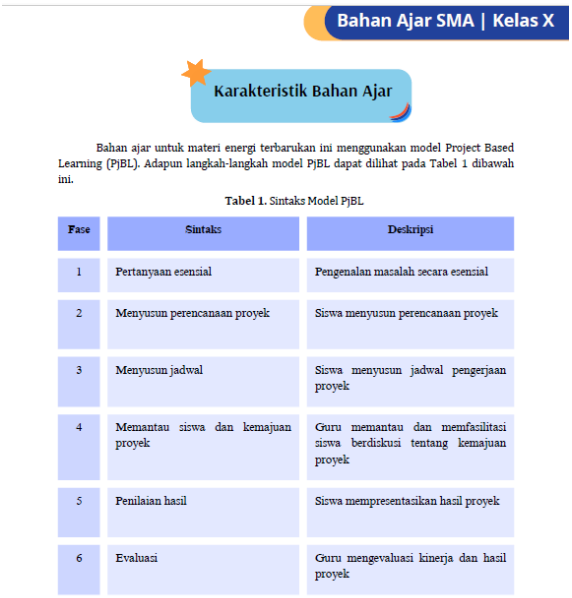
Based on Table 3, it can be seen that the validation value for the linguistic appropriateness component was achieved for 6 assessment indicators with the same value, namely 0.83, which is classified as a high validity criterion. The research results are in accordance with previous research (Rosyidah et al., 2013) explaining that the use of language in developing teaching materials using language includes word selection, use of effective sentences and the preparation of varied paragraphs. (Rosyidah et al., 2013) Using language that is easy and appropriate to the student's level of development will make it easy for students to understand the learning material. Therefore, it can be stated that materials of teaching are based project-based learning The phase E renewable energy material developed has validity in the category in high for language eligibility components.

The results of the third validity test are on the presentation feasibility component. This component aims to determine whether the teaching materials are basedproject-based learningThe phase E renewable energy material has provided the information needed for learning. The presentation feasibility component consists of 27 assessment indicators. The validity assessment results of the presentation feasibility component shown in Table 4.

Table 4.Results of Presentation Component Validity Analysis

Indicator	V'Aiken Value	Criteria
1	0.91	High
2	0.83	
3	0.83	
4	0.75	Medium
5	0.75	
6	0.75	
7	0.75	
8	0.83	High
9	0.83	
10	0.83	
11	0.83	
12	0.83	
13	0.83	
14	0.91	
15	0.83	
16	0.91	
17	0.91	
18	0.91	
19	0.91	
20	1.00	
21	1.00	
22	1.00	
23	0.83	
24	0.75	Medium
25	0.91	High
26	0.83	
27	1.00	
Average	**0.86**	**High**

Table 4 shown that the validation value for the presentation feasibility component ranges from 0.75 to 1.00. Of the 27 assessment items, there are 5 validity assessment indicators which are classified as medium, namely with a value of 0.75 and 22 validity assessment indicators are classified as high, namely with values ranging from 0.83 to 1.00. The average validation score for the content suitability indicator is 0.86 with high validity criteria. The results of this study are in accordance with the guidelines developed (Depdiknas, 2008). The presentation of teaching materials is adapted to the syntax of the project-based learning model as shown in Figure 4.



Bahan Ajar SMA | Kelas X

Karakteristik Bahan Ajar

Bahan ajar untuk materi energi terbarukan ini menggunakan model Project Based Learning (PjBL). Adapun langkah-langkah model PjBL dapat dilihat pada Tabel 1 dibawah ini.

Tabel 1. Sintaks Model PjBL

Fase	Sintaks	Deskripsi
1	Pertanyaan esensial	Pengenalan masalah secara esensial
2	Menyusun perencanaan proyek	Siswa menyusun perencanaan proyek
3	Menyusun jadwal	Siswa menyusun jadwal pengerjaan proyek
4	Memantau siswa dan kemajuan proyek	Guru memantau dan memfasilitasi siswa berdiskusi tentang kemajuan proyek
5	Penilaian hasil	Siswa mempresentasikan hasil proyek
6	Evaluasi	Guru mengevaluasi kinerja dan hasil proyek

Figure 4. Presentation of Teaching Materials Based on Project-based Learning Syntax

Therefore, based on the assessment results of the presentation feasibility component it can be stated that teaching materials are based project-based learning in phase E renewable energy material developed has high validity in terms of presentation feasibility components.

The results of the fourth validity test are on the graphic feasibility component. This component aims to determine whether the display is based on teaching materials project-based learning Users can enjoy phase E renewable energy materials. The graphic feasibility component consists of 7 assessment indicators. The validity assessment results of the graphic feasibility component shown in Table 5.

Table 5. Graphical Component Validity Analysis Results

Indicator	V'Aiken Value	Criteria
1	1.00	High
2	1.00	
3	1.00	
4	1.00	
5	1.00	
6	1.00	
7	1.00	
Average	1.00	High

Based on Table 5, shown that the validation value for the graphic component was achieved for 7 assessment indicators with the same value, namely 1.00, which is classified as a high validity criterion. The results of this research are clarified by research(Wahyuni & Arief, 2015) , where in making teaching materials a combination of colors and images are used and attractive and colorful images will attract more students' interest in reading so that students will be happier in the learning process and learning will not be boring. Therefore, it can be stated that teaching materials are based

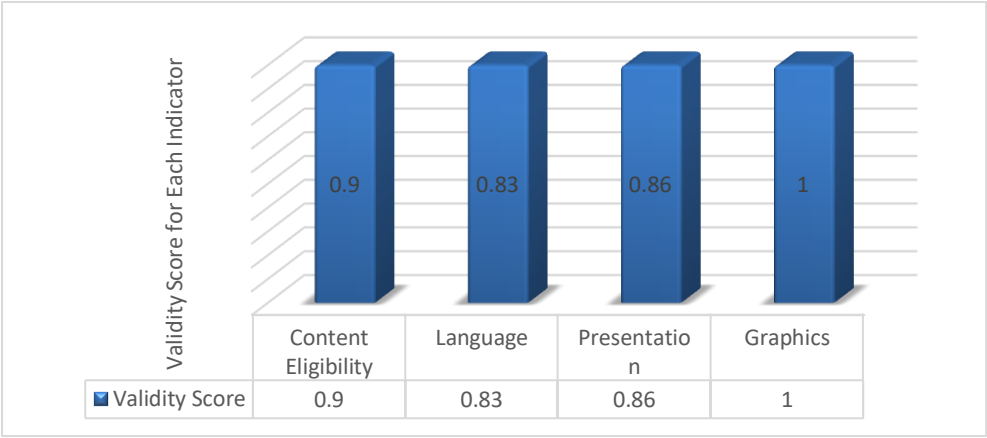


Figure 3. Validity Value of Teaching Materials Based on project-based learning on Phase E Renewable Energy Materials for Each Component

Figure 2 shown that the validity value for materials of teaching is based on project-based learning in phase E renewable energy materials for each indicator falls within the high validity criteria. The highest validity results were obtained in the graphic component with a maximum value of 1.00 and the lowest validity results were in the linguistic component with a value of 0.83. Based on the validity assessment results that has been conducted, the results of the validity assessment of the teaching materials are based onproject-based learningon phase E renewable energy materials, an average of 0.87 was obtained in the high validity criteria. The results of this research are in relevan with research conducted by (Novianto et al., 2018) where the teaching materials developed are valid in terms of content appropriateness, language, presentation and graphics. The results of this research are also supported by research (I. Hasanah et al., 2018) namely that the teaching materials developed are also valid in the aspects of material, media, learning and language. So, the conclusion is materials of teaching based project-based learning in phase E renewable energy material developed in this research has a high validity value, so it is suitable for use by teachers in providing learning and for students in class X high school renewable energy material. This research is still limited to developing problem-based learning materials for renewable energy materials and has reached the feasibility testing stage. Next researchers can carry out research similar to this research for other physics materials. Other researchers can also continue this research to the next research stage, namely dissemination.

CONCLUSION

Based on the research results that has been conducted, research results are obtained in the form of teaching-based materials project-based learning on renewable energy material phase E. Results of validity assessment of based teaching materialsproject-based learningon phase E renewable energy materials obtained an average validity value with a value of 0.85 in the high validity criteria. Teaching materials are declared valid for four aspects of validity assessment, namely content suitability, language, presentation and graphic components. Based on this validity assessment, the conclusion is teaching materials are based on project-based learning in phase E renewable energy material suitable for use in the physics learning process at school on renewable energy material for class X SMA.

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