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## THE DEVELOPMENT OF ETHNOSCIENCE BASED HIGH SCHOOL PHYSICS ENRICHMENT BOOK IN THE TRADITIONAL PROCESSING OF NUR KERINCI COFFEE

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### *Abstract*

*This research is development research that aims to develop an ethnoscience-based high school physics enrichment book on the traditional processing of Nur Kerinci coffee and to find out the students' perceptions about the enrichment book. The subjects of this study were material experts, media experts, and class XII MIPA 1 student of SMAN 11 Kota Jambi, totaling 24 students. The instruments used in this study were observation sheets, interview sheets, expert validation sheets, student perception questionnaires, and documentation. The resulting data are in the form of qualitative and quantitative data. Qualitative data were analyzed descriptively and quantitative data were analyzed using descriptive statistics. Local wisdom in the form of traditional processing of Nur Kerinci coffee is used as a context for the problem to explore scientific concepts, especially physics concepts. The results of the material expert validation obtained an average score of 93.33% with the "very good" category and the media expert at 93.33% with the "very good" category. Meanwhile, the results of the student perception trial obtained an average score percentage of 89.53% in the "very good" category.*

**Keywords:** *enrichment book, ethnoscience, local wisdom, Nur Kerinci coffee*

### 1. INTRODUCTION

Kerinci is a regency in Jambi province that has abundant natural resources and local wisdom. One of the superior commodities from Kerinci is coffee. There is one coffee business that is quite famous and legendary among the Kerinci-Sungai Penuh community, namely Nur Kerinci coffee. Nur Kerinci coffee is a form of Jambi local wisdom. Local wisdom is a local tradition or culture that has been passed down from generation to generation by the local community (Jufrida, et al., 2018). The process of Nur Kerinci coffee is quite unique because it still uses traditional tools, such as a coffee bean pounder, a water wheel, a traditional roaster, and a traditional stove. Nur Kerinci coffee is the only coffee business in Kerinci that the processing is still using traditional methods, while other coffees business have been processed in modern ways.

The people of Jambi, especially in Kerinci regency, are believed to have indigenous knowledge of the traditional coffee processing process. This is evidenced by one

of the results of an interview by coffee owner Nur Kerinci who said that coffee processing using traditional tools is believed to produce coffee with a distinctive aroma and taste compared to coffee processed using modern tools.

Nur Kerinci coffee processing can also be studied through the field of ethnoscience studies, where ethnoscience itself is a field of study to reconstruct people's indigenous knowledge of local wisdom into scientific knowledge (Yuliana, 2017). The activity of linking local wisdom with science learning is very suitable to be applied in the learning process so that students can get to know and preserve local wisdom in their area. Asbanu & Babys (2015) also state that ethnoscience-based physics learning is able to encourage students to increase their appreciation of community culture so that this culture is not swallowed up by the times.

However, there are several schools in Jambi province such as SMAN 11 Kota Jambi and SMAN 8 Muaro Jambi that haven't linked science learning, especially physics learning,

with Jambi local wisdom, especially in the traditional processing of Nur Kerinci coffee. This is evidenced by the diagnostic tests that have been carried out, that is as many as 86.1% of students experienced difficulties in explaining the physics concepts in the traditional processing of Nur Kerinci coffee. Based on this explanation, it can be concluded that the students' ability to apply physics concepts is still low. According to Krathwohl (2002) the ability of students based on the revised Bloom taxonomy is divided into 6 levels, they are remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6). This shows that 86.1% of students are still at the C2 ability level, namely understanding the concept. Only 13.9% of students are at the C3 and C4 ability levels, namely applying and analyzing concepts. Even though based on the motivation questionnaire trial, it was found that as many as 69.7% of students had good enthusiasm for learning physics.

In addition, based on the results of needs analysis through interviews with physics teachers at SMAN 11 Kota Jambi and SMAN 8 Muaro Jambi, it was found that students used textbooks more often than non-textbooks. Textbooks are books which are mandatory reference sources in the learning process. Meanwhile, non-text textbooks are supporting books that have functions as materials for enrichment, guidance, and references for teachers and students in the learning process. The material presented in non-text books tends to be more flexible. Therefore, non-text books can be used by readers from various circles. One example of a non-text book is an enrichment book (Fikri, et al., 2019).

The enrichment book is a teaching material that aims to increase creativity, knowledge, and insight for students. Moreover, enrichment books can also increase student personality and independence. This is because the enrichment book contains broader and more complete information also can improve students' skills to think more creatively (Oktavianie, et al., 2018). The advantage of an enrichment book is that it has a wide range of material so that readers can more easily understand the topic being studied. Furthermore, the distribution period of the enrichment book is not too short so that users can use the book for a long period of time. The

enrichment book also has a clear focus or discussion topic, so that readers don't get confused when using the book (Alfarisi & Suseno., 2019).

Based on the results of interviews with physics teachers at SMAN 11 Kota Jambi and SMAN 8 Muaro Jambi, it was found that enrichment books were widely available in school libraries. The enrichment book has also been linked to daily life, but there are no enrichment books related to local wisdom, especially in the traditional processing of Nur Kerinci coffee.

According to Ningrum, et al (2017) local wisdom-based learning is very important to be implemented. Through learning, students are able to think well because they are supported by learning materials and directions from the teacher about local wisdom. Ufie (2013) also states that the activity of applying the noble values contained in the local culture of the community into education is a very appropriate step. This is because education is a process that aims to shape the character and behavior of students from an early age to become the next generation in the future. This step also aims that students can get to know and preserve local wisdom in their area. If students are not introduced to local wisdom from an early age, this will threaten the identity of students. Moreover, it is worried if students will be easily influenced by foreign or western cultures.

There are several relevant studies related to this research, one of them is a research by Damayanti, et al. (2013) which states that learning associated with local wisdom can increase students' affective value, namely love for surrounding culture. In addition, a research conducted by Sari, et al. (2018) by developing science worksheets based on local wisdom in the form of coffee on business and energy materials in junior high schools. The worksheets were stated to be effective in increasing students' ability to think critically.

The fundamental difference between previous research and this current research is in the teaching materials and objects of local wisdom being studied. This research contains of the reconstruction of the community's indigenous knowledge about the traditional processing of Nur Kerinci coffee into scientific knowledge, especially physics knowledge. In

addition, the integration of local wisdom in learning physics in schools is also carried out with the context of local wisdom in the traditional processing of Nur Kerinci coffee which is packaged in a teaching material in the form of an enrichment book.

## 2. RESEARCH METHOD

The type of this research is a development research with the 4D development model adapted from Thiagarajan (1974). The 4D model consists of 4 stages, namely *define*, *design*, *develop*, and *disseminate*. However, this research was only conducted in 3 stages, they are *defined*, *design*, and *develop*. In the first stage "*define*", it consists of beginning-end analysis, student analysis, task analysis, concept analysis, and analysis of learning objectives. In the second stage "*design*", it consists of compiling a benchmark reference test, selecting the media, selecting the format, and the initial design. While, in the last stage "*develop*", it consists of expert validation and development trials.

The subjects of this study were material expert validators, media expert validators, and 24 students of class XII MIPA 1 SMAN 11 Kota Jambi. The type of data obtained is in the form of qualitative data and quantitative data. Qualitative data were obtained from the results of the assessment by expert validators, that is in the form of input, criticism, and suggestions for the products produced before being tested in the field. Meanwhile, quantitative data were obtained from the results of score assessments by expert validators and the results of questionnaires on students' perceptions of the products being developed. The research instruments used consisted of 5 types, including:

1. Observation sheet. This sheet contains a list of questions to find information about a student's problem. In addition, this observation sheet also aims to assess students' initial abilities and attitudes in the learning process.
2. Interview sheet. This sheet contains a list of questions that will be addressed to community leaders who are experts in their fields, such as the coffee owner Nur Kerinci who knows about the processing of Nur Kerinci coffee. The interviews were also conducted with physics teachers at SMAN 11 Kota Jambi and SMAN 8 Muaro Jambi to determine the teaching methods, the learning media used, and the availability of books in the library.
3. Expert validation sheet. This sheet is used to obtain data about expert assessments of the developed enrichment book teaching materials. The aspects assessed include the feasibility of content, presentation, language, and graphics.
4. Questionnaire students' perceptions. This instrument is used to determine student responses to the developed enrichment book teaching materials.
5. Documentation. This instrument is used as a complement to the data needed by the researcher. Documentation is also used as evidence that researchers can use to prove the research being carried out.

Qualitative data were analyzed descriptively using the Miles and Huberman model, which is a qualitative analysis model through three activity streams including *data reduction*, *display data*, and *verification* (Jufrida, et al., 2018). Meanwhile, quantitative data were analyzed using descriptive statistics. Quantitative data analysis using the scale *Likert* can be calculated with the percentage of score formula as follows:

$$\text{Persentase} = \frac{\text{Skor Total}}{\text{Skor Maksimal}} \times 100 \%$$

Furthermore, the data will be interpreted as a conclusion regarding the physics enrichment book products which will be categorized as very good, good, good enough, bad, or very bad.

**Table 1.** Interpretation Criteria Percentage

No.	Category	Score
1.	Very Good	81-100%
2.	Good	61-80%
3.	Good Enough	41-60%
4.	Bad	21-40%
5.	Very Bad	0-20%

(Source: Riduwan & Sunarto, 2010)

## 3. RESULT AND DISCUSSION

This research was conducted using a 4D model with stages namely *define*, *design*, *develop*, and *disseminate*. However, the stage of *disseminate* was not carried out in this

study. The three stages carried out can be explained through the following explanation.

#### a. *Define*

This stage aims to determine the instructional requirements obtained by conducting the analysis. The analysis are the preliminary analysis, student analysis, task analysis, concept analysis, and analysis of learning objectives.

The preliminary analysis is done to find out the basic problems in the field. The steps taken are to analyze the needs of teachers and students. Based on the results of interviews with physics teachers at SMAN 11 Kota Jambi and SMAN 8 Muaro Jambi, it was found that students used textbooks more often than non-text books such as enrichment books. In addition, it was also obtained data that many enrichment books are available in school libraries. This enrichment book had also been linked to daily life but has not yet been linked to objects of local wisdom, especially in the traditional coffee processing process.

Student analysis is carried out to determine the characteristics and abilities possessed by students, especially in learning physics. The steps taken are by distributing learning motivation questionnaires and diagnostic test questions. Based on the results of the learning motivation questionnaire, it was found that 69.7% of the 33 students had good enthusiasm for learning physics. Meanwhile, based on the results of the diagnostic test, it was found that 86.1% of the 33 students experienced difficulties in explaining the physics concepts contained in the Nur Kerinci coffee processing process.

Task analysis is carried out to determine the outline of the teaching material content. Based on the results of interviews with community leaders who mastered the traditional processing techniques of Nur Kerinci coffee, a number of data were obtained regarding the stages in the coffee processing process. After being analyzed, there were a correlation between the coffee processing process and several physics concepts. The physics concepts include heat transfer (radiation, conduction, and convection), circular motion changes regularly, partially resilient collisions, and frictional forces.

Concept analysis is done to determine the physics concepts that must be mastered by students. The steps taken are conducting

interviews with community leaders who mastered the traditional processing techniques of Nur Kerinci coffee. Based on the results of the interview, the community's indigenous knowledge of the object of local wisdom in the traditional processing of Nur Kerinci coffee was obtained which was reconstructed into scientific knowledge. The results of this reconstruction were then mapped into Basic Competencies and science content.

The last analysis is the analysis of learning objectives. This analysis was carried out to develop learning objectives obtained from task analysis and concept analysis.

#### b. *Design*

This stage aims to design the initial form of the enrichment book being developed. The steps taken are the preparation of benchmark reference tests, media selection, format selection, and initial design.

Preparation of benchmark reference tests is a step that connects between the "define" stage and "design" stage. This test is structured based on the results of student analysis and analysis of learning objectives.

Media selection is carried out to determine the learning media according to the needs of students. Based on the problems obtained from the results of the preliminary study, it was necessary to select the right media in the form of enrichment books that aim to broaden readers' insights, especially teachers and students. In addition, in learning physics, not all materials could be related to objects of local wisdom. So it was necessary to have an enrichment book that could specifically discuss the concept of physics on the object of local wisdom in the traditional processing of Nur Kerinci coffee.

After selecting the media, the next step is choosing the format. The making of ethnoscience-based physics service book on the traditional processing of Nur Kerinci coffee was designed using *Microsoft Office Word 2010* and *Adobe Photoshop CS6*. The paper size used was A5 paper (148 mm x 210 mm) which was presented in *portrait format* and uses 2.54 cm margins (right, left, top, and bottom).

The final step is the initial design. At this stage, the author had created an enrichment book product that includes a cover, title, material description, and supporting images. However, the enrichment book was

still in prototype form. However, this prototype had been validated by material and media expert validators.

**c. Develop**

This stage aims to produce ethnoscience-based physics enrichment book products in the traditional processing of Nur Kerinci coffee. This stage is also a form of implementation from the stages *define* and *design*. After the enrichment book prototype is produced, the book is validated by material and media expert validators. After that, the enrichment book is tested in the field.

The enrichment book that had been compiled and developed was validated by material and media expert validators. This validation was carried out to determine the feasibility of the enrichment book before being tested in the field. This validation process was carried out by 3 material expert validators and 3 media expert validators. The aspects assessed by the material expert validator were the aspects of the feasibility of the material / content and the presentation of the material / content. Meanwhile, the aspects assessed by the media expert validator were language and graphics aspects. Apart from some of the above aspects, the validator also provides suggestions regarding the enrichment book being developed. The suggestions from the validator and the results of their revisions can be seen in the following presentation.

a. Validator 1

**Table 2.** Validator 1 Suggestions

No.	Material	Media
1.	Writing formulas, please use centered text.	Reduce the color gradation on the cover of the chapter.
2.	Add references to existing coffee bussiness in kerinci	Add chapter 2 with the tittle "Kopi Kerinci".
3.	Deepen the concept of physics.	Add a formula symbol to the illustration image.

b. Validator 2

**Table 3.** Validator 2 Suggestions

No.	Material	Media
1.	Add an introduction to the material topic at the beginning of the book.	Correct how to cite.
2.	Complate the glossary.	Improve the quality of the book prints.

c. Validator 3

**Table 4.** Validator 3 Suggestions

No.	Material	Media
1.	Add people's indigenous knowledge before discussing the process of physics.	Fix the tittle position of the chapter cover.
2.	-	Fix the tittle of the section in chapter 4.

Some examples of the revised results of the enrichment book during the validation process can be seen in Figure 1 and Figure 2. Figure 1 is the result before and after the change in color gradations on the chapter cover. Meanwhile, Figure 2 is the result before and after changing the title in chapter 2.



**Figure 1.** The Changes of the Chapter Cover



**Figure 2.** The Title Changes in Chapter 2

The validation was carried out twice. While the results of the expert validation score assessment conducted by three material expert validators and three media expert validators using validation instruments can be seen in the following table.

1. First Validation

a. Material Validation

**Table 5.** Result of Material Validation

Component	Percentage	Category
Faesibility		
Material / Content	74,28%	Good
Presentation		
Material / Content	74,67%	Good
<b>Average Percentage</b>	<b>74,48%</b>	<b>Good</b>

b. Media Validation

**Table 6.** Result of Media Validation

Component	Percentage	Category
Language	73,33%	Good
Graphics	73,33%	Good
<b>Average Percentage</b>	<b>73,33%</b>	<b>Good</b>

2. Second Validation

a. Material Validation

**Table 7.** Result of Material Validation

Component	Percentage	Category
Faesibility		
Material / Content	93,33%	Very Good
Presentation		
Material / Content	93,33%	Very Good
<b>Average Percentage</b>	<b>93,33%</b>	<b>Very Good</b>

b. Media Validation

**Table 8.** Result of Media Validation

Component	Percentage	Category
Language	93,33%	Very Good
Graphics	93,33%	Very Good
<b>Average Percentage</b>	<b>93,33%</b>	<b>Very Good</b>

After having validation by material expert validators and media experts, the next step is to conduct development trials in the field. This trial can also be said to be a practicality test, where the practicality test aims to determine the practicality of the enrichment book that has been developed. The practicality test was carried out in class XII MIPA 1 SMAN 11 Kota Jambi by distributing student perception questionnaires online via *google form*.

The components or aspects that students assessed for the enrichment book developed were the components of the feasibility of the material / content, the presentation of the material / content, language, and graphics. The results of the questionnaire scores on students' perceptions regarding the enrichment book can be seen in Table 9 below.

**Table 9.** Result of Students Perceptions Questionare Analysis

Component	Percentage	Category
Faesibility		
Material / Content	90,83%	Very Good
Presentation		
Material / Content	89,77%	Very Good
Language	89,17%	Very Good
Graphics	88,34%	Very Good
<b>Average Percentage</b>	<b>89,53%</b>	<b>Very Good</b>

Based on Table 9, it can be seen that the material / content feasibility component obtained the highest score with an average percentage of 90.83%. The material / content presentation component obtained the second highest score with an average percentage of 89.77%. While the language component obtained the third highest score with an average percentage of 89.17%. Meanwhile, the graphic component obtained the lowest score

with an average percentage of 88.34%. Based on the percentage results of each component, the average student perception questionnaire result was 89.53% in the "very good" category. The final appearance of the ethnoscience-based physics enrichment book after revision and testing is as follows.

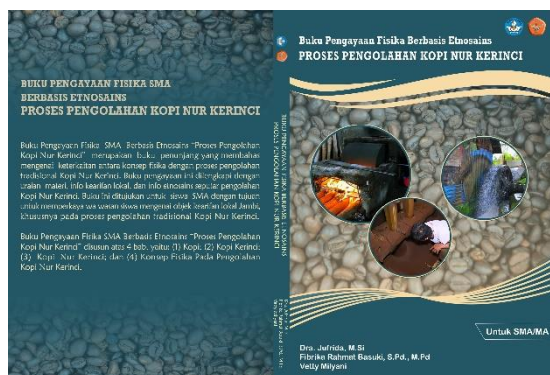


Figure 3. Cover of Enrichment Book



Figure 4. Cover of Chapter

The purpose of this development research is to develop an ethnoscience-based high school physics enrichment book on the traditional processing of Nur Kerinci coffee. In addition, this study was also conducted to determine students' perceptions of the enrichment book that had been developed. The development of this enrichment book is carried out using the 4D development model. According to Thiagarajan (1974) the 4D model consists of the stages of *define*, *design*, *develop*, and *disseminate*. However, the stage was *disseminate* not carried out in this study.

The first stage in this research is *define* which aims to analyze the problems in the field. At this stage, data was obtained that 86.1% of the 33 students experienced difficulties in explaining the physics concepts contained in the Nur Kerinci coffee processing process. One of the reasons is that schools have

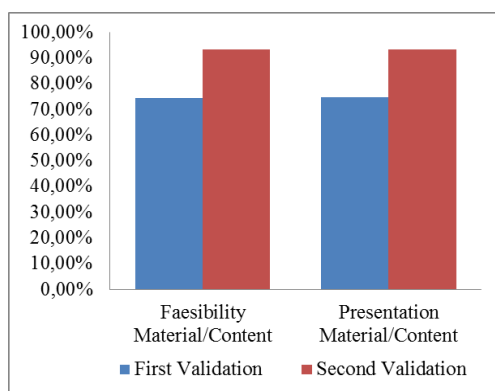
not implemented local wisdom-based learning processes. Local wisdom-based learning is very important to be implemented in schools. Darojah, et al (2018) stated that integrating local wisdom in learning can help solve problems related to global issues. So that students are expected to provide an understanding of local wisdom as filters and life guidelines. Bambang, et al (2015) also stated that local wisdom can be used as a tool to increase the value of local potential so that it can become a product that has advantages. This is in accordance with the creation of the 2013 curriculum which aims to provide opportunities for students to develop basic science competencies related to local wisdom.

In addition, the students' low ability to explain the concepts of physics in the traditional processing of Nur Kerinci coffee is also influenced by the type of book used. Students more often use compulsory text books and rarely use other supporting books such as enrichment books. Afandi & Zulaeha (2017) state that the existence of enrichment books can be used as a supporting facility that can provide additional knowledge, improve skills, and shape students' personalities. Not only do students' knowledge and skills need to be developed, but the formation of students' personalities is also very important to be noted. This personality can be integrated through the teaching materials used by the teacher.

The next stage is *design* which aims to design the initial form of the product being developed. At this stage, ethnoscience-based physics enrichment book design was carried out on the traditional processing of Nur Kerinci coffee. In this case, the results of the reconstruction of physics material related to the traditional processing of Nur Kerinci coffee were poured into the enrichment book that was developed. This was done so that students could more easily understand the physics concepts contained in the traditional processing of Nur Kerinci coffee. The activity of reconstructing people's indigenous knowledge about local wisdom into scientific knowledge is called ethnoscience. The application of ethnoscience in the world of learning has a positive impact on the learning process. Iriani & Kurniasih (2019) state that ethnoscience-based learning can make the learning process more memorable. Students can be more active, creative, critical, and

analytical. In addition, students who apply ethnoscience-based learning will have more understanding and experience compared to students who learn mediocre or conventionally. This is because students who apply ethnoscience-based learning have extensive experience and high enough understanding, not only in the field of science, but also in the field of environment and society.

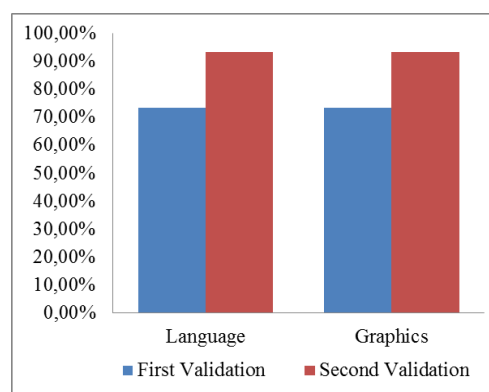
The next stage is the stage of *develop* that aims to develop ethnoscience-based physics enrichment book on the traditional process of Nur Kerinci coffee. The process of developing an enrichment book is carried out by considering the results from the stages *define* and *design*. After the enrichment book prototype is produced, the book is validated by material expert validators and media experts. After that, the enrichment book was tested in the field. Expert validation was carried out to determine the feasibility of the enrichment book before being tested in the field. This validation process was carried out by 3 material expert validators and 3 media expert validators. The aspects assessed by the material expert validator were the aspects of the feasibility of the material / content and the presentation of the material / content. Meanwhile, the aspects assessed by the media expert validator were language and graphics aspects. This validation was carried out twice. The results of the material expert validation score can be shown in the following diagram.



**Figure 5.** Result of Material Expert Validation

Based on the diagram in Figure 5, it can be shown that the acquisition of the first validation score by the material expert validator on the material / content feasibility component is 74.28% with the "good"

category and the material / content presentation component obtained a score of 74.67% with the category "good". The second validation score obtained by the material expert validator on the material / content feasibility component was 93.33% in the "very good" category and the material / content presentation component obtained a score of 93.33% in the "very good" category. So that the final score percentage of material expert validation is 93.33% with the "very good" category. While the results of the media expert validation score can be shown in the following diagram.



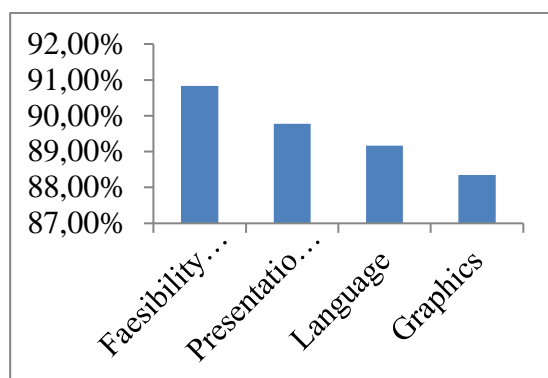
**Figure 6.** Result of Media Expert Validation

Based on the diagram in Figure 6, it can be shown that the acquisition of the first validation score by the media expert validator on the language component was 73.33% in the "good" category and the graphical component obtained a score of 73.33% in the "good" category. The second validation score obtained by the media expert validator for the language component was 93.33% in the "very good" category and the graphical component obtained a score of 93.33% in the "very good" category. So that the final score percentage of media expert validation is 93.33% in the "very good" category. Based on the results of the validation scores obtained by material experts and media experts, it can be concluded that the enrichment book developed is feasible to be tested in the field.

After the validation stage is carried out, the next step is to conduct development trials in the field. This trial is called the practicality test which aims to determine the practicality of the enrichment book that has been developed. The practicality test was carried out in class XII MIPA 1 SMAN 11 Kota Jambi by distributing student perception



questionnaires online via *google form*. This questionnaire was filled in by 24 students. The components assessed by the students were the components of the feasibility of the material / content, the presentation of the material / content, language, and graphics. The results of the students' perception questionnaire scores can be seen in the following diagram.



**Figure 7.** Students Perception Questionnaire Result

Based on the diagram in Figure 7, it can be shown that the material / content feasibility component obtained the highest percentage score of 90.83% in the "very good" category. The material / content presentation component obtained a score of 89.77% in the "very good" category. The language component obtained a score of 89.17% in the "very good" category and the graphic component obtained a score of 88.34% in the "very good" category. Based on this percentage, the average percentage of students' perceptions questionnaire was 89.53% with the "very good" category. Thus, it can be concluded that students responded very well to the enrichment book that was developed.

#### 4. CONCLUSION

Based on the reserach taht has been done, it can be concluded that:

1. The development of an ethnoscience-based high school physics enrichment book on the traditional processing of Nur Kerinci coffee was developed using the 4D model which consists of the stages of *define*, *design*, *develop*, and *disseminate*. However, the stage of *disseminate* was not carried out in this study. The advantage of the enrichment book that was developed was the integration of Jambi's local wisdom as outlined in physics learning, namely in the

form of the traditional processing of Nur Kerinci coffee. This book is equipped with material descriptions and ethnoscience information about the traditional processing of Nur Kerinci coffee.

2. The ethnoscience-based high school physics enrichment book on the traditional processing of Nur Kerinci coffee was validated by material experts and media experts. The results of the validation by material experts amounted to 93.33% with the "very good" category. The results of the validation by media experts also obtained a score of 93.33% in the "very good" category. So it can be concluded that the enrichment book is feasible to be tested in the field.
3. Based on the perception trial conducted by 24 students of class XII MIPA 1 SMAN 11 Kota Jambi, the results obtained a score of 89.53% in the "very good" category. So it can be concluded that the students responded very well to the enrichment book being developed.

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