



Development of Sumbawa Local Wisdom-Based Mathematics Module

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Abstract

This study aims to produce an applicable Sumbawa local wisdom-based mathematics module for elementary school students by using the Four-D (4D) development research design from Thiagarajan. However, the development design of this module only includes three steps, namely define, design, and develop. The product feasibility test is only on the aspect of validity. Observation, interviews, and questionnaires were used to collect the data. The defined stage resulted in the formulation of the material, including the KPK, FPB, Fractions, Two-dimensional Shapes, and three-dimensional Geometry. A draft was created by emerging the elements of Sumbawa local wisdom in the materials, which is then validated at the design stage. The average validation results of material experts were 91.678%, linguists 90%, and media experts were 91.15%. The average validation result of the three specs is 90.94%, categorized as very valid, which confirms that the module is valid and suitable for elementary school students.

Abstrak

Penelitian ini bertujuan untuk menghasilkan modul matematika berbasis kearifan lokal Sumbawa yang valid untuk siswa sekolah dasar dengan menggunakan desain penelitian pengembangan Four-D (4D) dari Thiagarajan. Namun, desain pengembangan modul ini hanya meliputi tiga langkah yaitu define, design, dan develop. Pada tahap develop, uji kelayakan produk hanya pada aspek kevalidan. Teknik pengambilan data meliputi observasi, wawancara dan angket. Hasil penelitian pada tahap define yaitu perumusan materi yang meliputi KPK, FPB, pecahan, bangun datar dan bangun ruang. Hasil penelitian pada tahap design yaitu memunculkan unsur kearifan lokal Sumbawa pada materi sehingga menghasilkan draf modul matematika berbasis kearifan lokal Sumbawa untuk divalidasi. Hasil validasi diperoleh bahwa rata-rata hasil validasi ahli materi 91.67%, ahli bahasa 90% dan ahli media 91.15%. Rata-rata hasil validasi ketiga spek yaitu 90.94% dan dikategorikan sangat valid, sehingga dapat disimpulkan bahwa modul matematika berbasis kearifan lokal Sumbawa dikatakan sangat valid dan layak digunakan oleh siswa sekolah dasar.

Keywords: module; mathematics; Local wisdom; Sumbawa.

INTRODUCTION

Learning mathematics should begin with introducing problems of the environment around students, especially students at the concrete operational stage of cognitive development. According to the theory of cognitive development, children aged 6-7 to 11-12 are in the concrete operational stage. This stage is a condition where the child's thinking ability in real situations is limited (Piaget, 1954). This shows that students at the elementary school level should be introduced to problems under situations or experiences that students have experienced in everyday life.

In general, the ideal media and teaching materials in learning activities can build students' knowledge according to their stage of cognitive development (Apriliani et al., 2020). Teaching materials that are under students' environmental conditions can facilitate the process of understanding knowledge students (Anwar et al., 2017; Ariasih et al., 2018; Ferdianto, 2018; Nurafni et al., 2020) and make learning more meaningful (Dahlan & Permatasari, 2018; Wanabuliandari & Purwaningrum, 2018; Zulfah, 2018).

However, the facts in the field found by previous researchers are that teachers were more likely to use ready-to-use teaching materials without being developed by adjusting the characteristics and social environment of students (Anwar et al., 2017; Kamid & Ramalisa, 2019; Nurrahmi, 2018; Wijiningsih et al., 2017). The results of interviews with several elementary school mathematics teachers in Sumbawa showed that teachers tend to use teaching materials provided by The Ministry of Education and Culture or other sources that are not under the environmental conditions of students in Sumbawa.

The student handbook contains examples of contextual problems found in other regions and large cities in Indonesia, which have language and cultural differences from those experienced by students in Sumbawa. The images displayed and the terms used are sometimes unfamiliar to students' lives, especially students who live in villages and use local languages every day.

For example, in the fractions subject matter, in the fourth-grade student handbook published by The Ministry of Education and Culture in 2018, there is an image of Pizza as a medium to explain the concept of fractions, as shown in Figure 1 below.



Figure 1. Illustration of Fractions Using Pizza in Fourth-Grade Student Book

Pizza is a type of food that is hard to find in Sumbawa, and there are even students who have just heard the name and have just seen the image. This causes students sometimes to have difficulty visualizing the problems given, resulting in students' misunderstanding. The students' misunderstanding causes the learning outcomes achieved to be not optimal.

This problem shows that using modules in the environment around students is very important in understanding mathematics subject matter to achieve learning objectives. Seeing the importance of this, the researchers initiated to development of a mathematics module based on Sumbawa local wisdom. Local wisdom is

described as wisdom in the culture of each ethnic group (Sedyawati, 2007). In a broader sense, local wisdom is described as cultural norms and values, including all elements of ideas, including those that have implications for technology, health care, and aesthetics.

There have been several previous studies about the development of mathematical matter related to local wisdom (Anggara, 2019; Farhatin et al., 2020; Nurafni et al., 2020; C. K. Sari et al., 2019; Syutaridho, 2019; Yustinaningrum, 2017). However, the modules developed focused on certain mathematics subject matters or specific classes. Such as Anggara (2019), which focused on developing modules on probability subject matter based on Indramayu local wisdom.

As for this research, the module developed consists of several subject matters, namely Two-dimensional (2D) Shapes, Three-dimensional (3D) Shapes, Fractions, Least Common Multiple (LCM), and Greatest Common Factor (GCF), which are intended for students in fourth grade, fifth grade, and sixth grade of elementary school. Each subject matter contained in this module is related to Sumbawa local wisdom. The presentation of the subject matters starts from concept introduction to high-level problem solving, which includes subject matters taught in fourth grade, fifth grade, and sixth grade of elementary school. The connection of the subject matter with Sumbawa local wisdom is believed to make it easier for students to learn independently or when accompanied by a teacher.

The difference in the presentation of the subject matters in this module is the element of novelty in this research. In addition, printed modules that connect mathematics subject matter with Sumbawa local wisdom have not been found in elementary school teachers in Sumbawa.

Therefore, the development of this local wisdom-based mathematics module needs to do. The problem formulation of this research is how to develop a valid Sumbawa local wisdom-based mathematics module?

METHODS

The research type used is Research and Development (R&D), adopting the 4D development model developed by Thiagarajan et al. (1974). The 4D development model includes definition, design, development, and dissemination. As for this research, the development phase is carried out only until the development phase, namely up to the aspect of the module validity level.

The define phase aimed to identify products that match the students' goals. Activities at the define phase include initial-final analysis, student analysis, concept analysis and task analysis. The initial-final analysis aimed to identify students' problems at SDN Jorok, find out the possibility of integrating Sumbawa local wisdom into subject matter through literature studies, and interview teachers and community leaders regarding forms of Sumbawa local wisdom.

Student analysis aimed to determine students' mathematical abilities and learning experiences. Furthermore, in the concept analysis activity, the competencies to develop were determined based on the data from the student analysis. The last activity is task analysis which aims to determine the tasks required to achieve each competency.

The next development phase is the design phase, which aims to design and produce a draft of the Sumbawa local wisdom-based mathematics module based on data from observations and interviews obtained at the define phase. In contrast, the development phase aimed to test the

feasibility of the module draft on the validity aspect through a questionnaire method conducted by six validators, including four subject matter expert validators, one linguist validator, and one media expert validator.

The research location is SDN Jorok, Unter Iwes District, Sumbawa Regency. The data analysis technique used is descriptive qualitative and quantitative analysis. Qualitative data analysis techniques were carried out to analyze data through observations, interviews, comments, and suggestions given by the validator regarding the validated module draft. Quantitative data analysis was conducted to analyze the results of the validation questionnaire in the form of a score consisting of six validators who validated the aspects of the feasibility of content, presentation, language, and graphics.

This research has limitations in the scope of the adopted development phases that only reach the development phase. Further research will be carried out up to the dissemination phase in the future.

RESULTS AND DISCUSSIONS

Research Results

The research and development results using 3D development design will be described in 3 phases as follows.

Define

Initial-final analysis, student analysis, concept analysis, and task analysis were carried out in the define phase. In the initial-final analysis phase, interviews were first conducted to find out the students' problems at school. The interview results showed that most students at SDN Jorok still had difficulties understanding the mathematical subject matter. One of them is to connect the examples in the

book that is not to the students' environmental conditions in Sumbawa.

The next step was to conduct literature studies and interviews with teachers and community leaders to find out the forms of Sumbawa local wisdom applicable to learning mathematics. Based on the results of a literature study (Dinas Pendidikan dan Kebudayaan Provinsi NTB, 2018; Haris, 2018; Purna, 2012; Rahman, 2014) and the results of interviews with teachers and community leaders, it was found that there are many forms of Sumbawa local wisdom that can be integrated into mathematics subject matters, both relate directly or indirectly.

Some of these local wisdoms are as follows.

Table 1. Integration of Local Wisdom in Mathematics Subject Matter

Category	Name	Subject Matter
Traditions and Celebrations	Moyo Festival; Pasaji Pohan Festival; Barodak; Nyorong	LCM and Fractions
Buildings	Istana Dalam Loka; Bala Kuning; Bala Sawo Alang	Geometry
Folk Games	Karaci; Barapan Kebo; Maen jaran; Barempuk	LCM, Fractions, and Geometry
Arts	Dance (dadara Boto, Tanak, Nguri, Rapancar, dll); Sakeco; Nesek Art (Weaving); Gentao	LCM and Fractions
Tools	Genang; Palompang/Cungklik; Rebana; Serune; Santong Serek	Geometry
Traditional Culinary	Manjareal; Bulu Berai; Dange	LCM, Fractions, and Geometry

The next phase is student analysis. The results of interviews with fourth grade, fifth grade, and sixth grade teachers, it was concluded that most students had difficulties with LCM and GCF, Fractions, 2D Shapes and 3D Shapes subject

matters. The results at the student analysis phase were used as a reference in determining Basic Competencies at the concept analysis phase.

At the concept analysis phase, the researchers determined the Basic Competencies that students must be mastered in LCM and GCF, Fractions, 2D Shapes and 3D Shapes subject matters. Each Basic Competencies has its own learning objectives that must be mastered by students. The next step in the define phase is task analysis. At this phase, the researchers analyzed the tasks required for the achievement of each learning objective from each subject matter of LCM and GCF, Fractions, 2D Shapes and 3D Shapes.

Design

The first activity in this phase is to select and define the format for the module. Sumbawa local wisdom-based mathematics module uses B5 paper. The module format consists of several components: cover, table of contents, introduction, learning activities, competency test, closing, bibliography, and appendix.

The cover contains illustrations that describe the subject matter to discuss in the module. There is an image of Sumbawa Sultanate Palace, namely *Istana Dalam Loka* accompanied by illustrations of the geometry of 2D shapes and 3D shapes of several parts of the palace. In addition, there are images of traditional games that illustrate the concepts of fractions and 2D shapes.

Table of Contents contains the entire list of Sumbawa local wisdom-based mathematics module content components. The introduction section contains a description of the module's contents and instructions for using the module.

Furthermore, four learning activities discuss different subject matters in the

Learning Activities component. Activity 1 discusses the LCM and GCF subject matters; activity 2 discusses the Fractions subject matter; activities 3 and 4 discuss the 2D shapes and 3D shapes subject matters, respectively. Each subject matter is associated with Sumbawa local wisdom to make it easier for elementary school students in Sumbawa to understand mathematics subject matter.

For example, in the basic competency of 2D shapes subject matter, namely "recognize triangles, quadrilaterals and circles", 2D shapes are illustrated with objects or patterns used in Sumbawa traditional games which children usually play. For example, a kite game is an object that resembles a kite shape, as shown in Figure 2.



Figure 2. Example of the Integration (continue...)

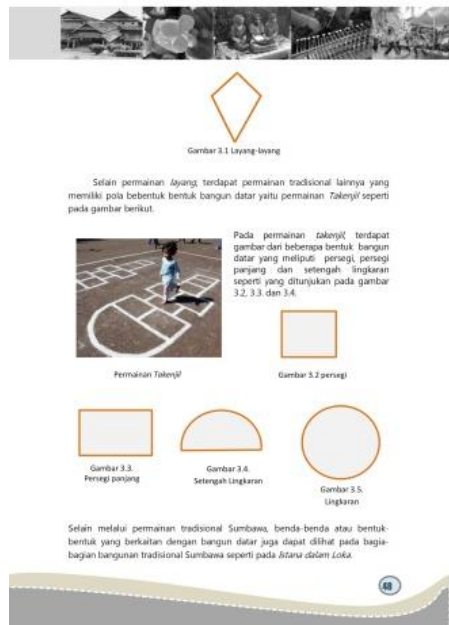


Figure 2. Example of the Integration of Local Wisdom in 2D Shapes Subject Matter

In addition, the subject matter is also related to the cultural heritage of Sumbawa by linking it to the roof of *Istana Dalam Loka*, which is formed by several 2D shapes forms are illustrated in a geometric form that includes triangle, parallelogram, and isosceles trapezoid, as shown in Figure 3 below.

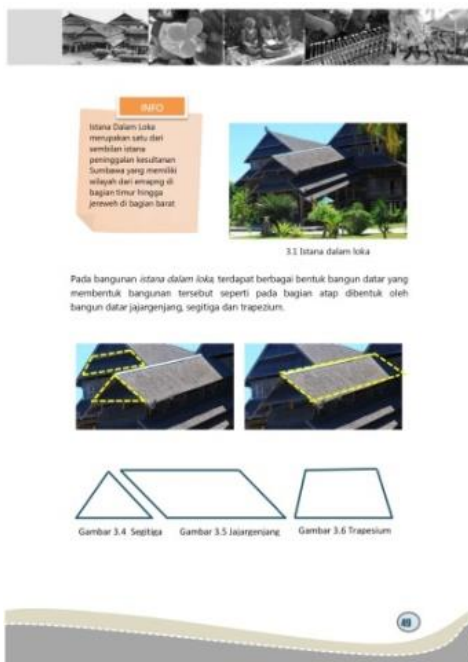


Figure 3. Example of the Integration of Local Wisdom in 2D Shapes Subject Matter

Another example of the integration of local wisdom in the module is the indicator "determine the factor of a number" in the LCM subject matter, which is associated with Sumbawa traditional foods. There is an illustration of the Sumbawa traditional food menu package with the name "*Menu 12*", which consists of several pairs of numbers representing "*Singang*" food and "*Sirup Madu Semongkat*" drink, as shown in Figure 4. Furthermore, students were directed to understand the concept of a number factor, with an example determining the factor of 12.

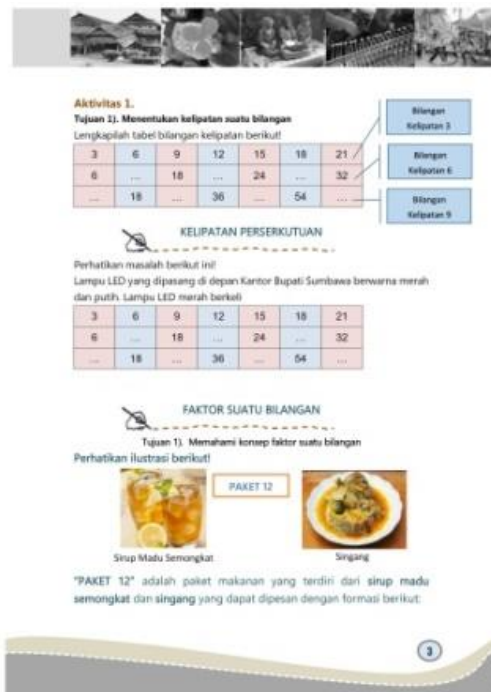


Figure 4. Example of the Integration of Local Wisdom in LCM Subject Matter

In addition to the description of subject matter that is integrated with Sumbawa local wisdom, the components of learning activities also include assignments, summaries, and formative tests. Assignments and formative tests were given at the end of each learning activity to strengthen students' understanding of the subject studied. Each activity's amount of formative test questions is the same, namely ten numbers with multiple-choice questions. As for assignments, the

amount varies in each learning activity. Tests are used to determine students' ability in all activities contained in the component of the competency test.

The competency Test component contains 15 multiple-choice questions and five essay questions that aim to measure students' learning achievement on all subject matters, namely LCM, GCF, Fractions, 2D Shapes and 3D Shapes. The last component in this module is in the appendix section, which contains a glossary of Sumbawa terms used in the module. In addition, there is an answer key appendix and an explanation of the answer to each exercise and test given.

After producing a draft of the Sumbawa local wisdom-based mathematics module, the next activity is compiling an instrument in a questionnaire to measure the module validity level on content and presentation feasibility, linguistic feasibility, and visual feasibility aspects.

Develop

Only a feasibility test was carried out on the validity aspect at this phase. The module draft was validated by six validators: four subject matter expert validators, one linguist validator, and one media expert validator. The subject matter expert validators include three practitioners who teach students in fourth grade, fifth grade, and sixth grade at SDN Jorok and one lecturer in Mathematics Education scientific field. The linguist validator is a lecturer in the Indonesian language scientific field, while the media expert validator is a lecturer in the Information and Communication Technology scientific field. The validation results of the six validators are shown in Table 2.

Table 2. Module Draft Validation Results

Validator	Aspects	Total Score	Percentage
Content feasibility			
Subject matter expert	1 st Validator	32	88.89
	2 nd Validator	34	94.44
	3 rd Validator	34	94.44
	4 th Validator	32	88.89
	Average		91.67
Presentation feasibility			
Subject matter expert	1 st Validator	32	88.89
	2 nd Validator	34	94.44
	3 rd Validator	33	91.67
	4 th Validator	33	91.67
	Average		91.67
Total			91.67
Linguist	Language	18	90
Graphics			
Media expert	Module size	8	100
	Cover design	35	87.5
	Content design	55	85.94
Average			91.15
Overall Aspect Average			90.94

Table 2 shows that the average percentage of validation results carried out by four subject matter expert validators on content feasibility and presentation feasibility aspects reached the same average, 91.67%, and was categorized as valid. Four validators submit several comments and suggestions regarding the feasibility and presentation aspects, as shown in Table 3 below.

Table 3. Subject Matter Expert Validators' Suggestions and Comments

Validators	No	Comments/suggestions
1 st Validator	1	Great selection of images and colour combinations
	2	ordered subject matter presentation
	3	there should be more questions related to local wisdom in the formative test
	4	there was a writing error in the formula for the area of a circle in the conclusion section
2 nd Validator	1	The presentation of examples of questions has varied and starts from the easy to the most difficult.

Validators	No	Comments/suggestions
	2	the explanation of the local wisdom image in the INFO section should be shorter
3 rd Validator	1	the display is attractive
	2	learning activities are suitable because it involves a lot of students' activeness
4 th Validator	1	the subject matter discussed is complete and sequential
	2	Many activities can strengthen students' understanding
	3	fix writing errors

Furthermore, the percentage achieved reached 90% in the linguistic aspect and was categorized as very valid. There are several suggestions submitted by the linguist validator, as shown in Table 4.

Table 4. Linguist Validator's Suggestions and Comments

No	Comments/suggestions
1	there were repeated words that were not hyphenated,
2	some languages should be simplified even more.

Furthermore, the validation results on the graphics aspects, including module size, module cover design, and module content design, respectively, reached 100%, 87.5%, and 85.94% are valid. Table 2 shows that the module size aspect gets a maximum total score of 8, the module cover design aspect scores 35 out of 40, and the module content design scores 55 out of 64. Like subject matter experts and linguist validators, media expert validators also provided comments and suggestions regarding Sumbawa local wisdom module draft, as shown in Table 5.

Table 5. Media Expert Validator's Suggestions and Comments

No	Comments/suggestions
1	The display of module cover and module content is attractive.
2	module cover already describes the subject matter discussed in the module
3	the author's name on the cover should be written at the bottom part

4	it is better to use an image of a child in traditional clothes on the module cover
5	there were some pages in which fonts and spacing were not the same
6	there were some writing errors/typos
7	there was an image that was positioned too close to the page.

Based on Tables 3, 4 and 5, there were several suggestions for module improvement in each aspect. The subject matter aspect was suggested to correct writing errors and shorten the info from some images of local wisdom used. In the presentation aspect, the advice given is to increase the provision of questions based on local wisdom informative tests. In the linguistic aspect, there were suggestions, namely correction of some repetitive word writing and some use of language to make it easier for elementary school students to understand.

In the media aspect, there were comments on the cover; namely, it was recommended to use cartoon images of children wearing traditional clothes, and the writing of the author's name was recommended to be at the bottom. In addition, there were suggestions: the location of the image that is too close to the page, the font size is not the same, and writing errors or typos.

The suggestions given were used as a reference in improving the module draft designed to be suitable for elementary school students. Here are some examples of how the module design changes before and after validation.

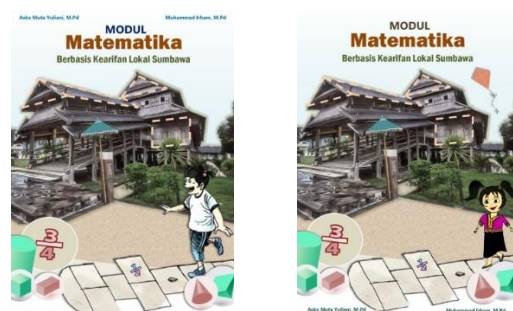


Figure 5. Cover Revision
(Left: Before Revision; Right: After Revision)

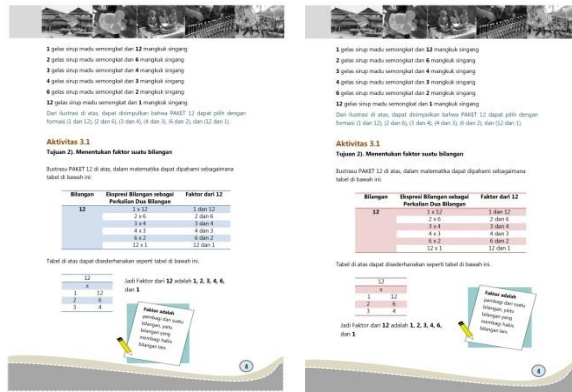


Figure 6. Image Layout Revision (Left: Before Revision; Right: After Revision)

Discussions

The feasibility of Sumbawa local wisdom-based mathematics module on the validity aspect was seen from the validation of content feasibility, presentation feasibility, media feasibility and visual feasibility aspects. Based on the validation results, the average validation results of subject matter experts, linguists, and media experts was 90.94% and was categorized as very valid. The highest percentage was in the subject matter aspect, which reached 91.67%. The validation results on the subject matter aspect became the highest percentage in several previous studies regarding the development of modules related to local wisdom (Novisatul Chusna et al., 2019; Nurrahmi, 2018; S. G. Sari & Jusar, 2018; Wijiningsih et al., 2017).

In the subject matter aspect, Sumbawa local wisdom-based mathematics module presents an ordered description of the subject matters, both concepts and examples of questions, under the comments made by several validators. The orderliness of the subject matters makes it easier for students to understand what they studied to support the achievement of learning objectives (Farhatin et al., 2020). Learning that starts from easy to difficult and from close to far will make students understand knowledge gradually (Anwar et al., 2017). The principle of

subject matter orderliness in the development of this module fulfilled the learning principle, describing it from easy to complex and concrete to abstract as formulated by Depdiknas (2008).

In this module, the formulas used are proven through concrete objects. For example, in the area of a kite, students are asked to bring a kite made of paper. Next, the students and teacher follow the instructions in the module, as shown in Figure 7 to find the concept of a kite's area.

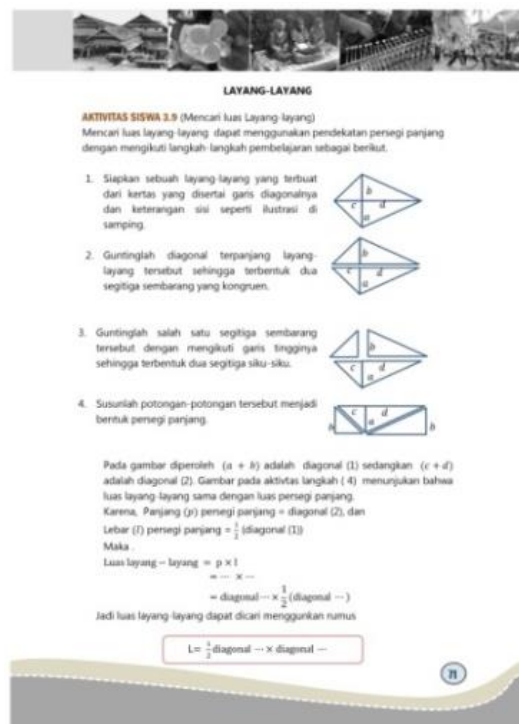


Figure 7. Students' activity in constructing the concept of the area of a kite

At the end of the activity, there is a conclusion of the formula for finding the kite area. This activity shows that the presentation of subject matter is carried out starting from the concrete to the abstract. So, it is hoped that it can minimize what was stated by Munaka et al. (2013) that one of the factors causing the low learning achievement of mathematics experienced by students is due to the abstract nature of mathematics which makes most students consider mathematics difficult so that mathematics is far

from students' lives.

Sumbawa local wisdom-based mathematics module provides many learning activities that students can do as stated by the subject matter validator. Each learning activity contains activity instructions or steps, and there are instructions for using the module in the Introduction section so that students can study independently at home. This is based on module characteristics according to Depdiknas (2008) under the definition of the module according to Majid (2008), who argued that the module is a book written by providing opportunities for students to be able to use it for self-study without or with teacher guidance equipped with instructions for use.

The phases of students' self-study through this module start by reading the instructions for using the module and then understanding what competencies they want to achieve in the subject matter to be studied. Next, students will see and understand the relationship between Sumbawa local wisdom and mathematics subject matter presented in several learning activities that activity instructions have accompanied. To ensure the level of students' understanding of the subject matter, students will be asked to solve exercise questions in the form of assignments and formative tests that have been accompanied by an answer key in the module appendix.

The teacher's role is to facilitate students so that no phases of learning activities in the module are missing. The teacher can also be a resource to provide a deeper explanation of the subject matter studied if students do not understand the subject matter contained in the module. Teachers are also allowed to add explanations related to local wisdom contained in the module.

In the readability aspect, several things need to be improved, one of which

is the use of language adapted to the students' development stage. The use of language that is easy to understand can affect the ease of students in understanding the subject matter studied. Because reading books with a good level of readability will affect the reader by increasing learning interest and memory, increasing reading speed and efficiency, and maintaining reading habits. (Rachmani Dewi & Yuni Arini, 2018)

The developed module display was attractive in the media aspect, as commented by the media expert validator. A good selection of images, fonts and colour combinations made the module look attractive. With an attractive module display, students are expected to be motivated to learn. Students' motivation can develop activeness and initiative and direct and maintain perseverance in learning activities (Rumhadi, 2017).

The use of Sumbawa local wisdom images as a medium to make it easier for students to understand the subject matter makes the module display more attractive. With this exciting module, it is hoped that students are motivated to learn independently and make it easier for students to understand each competency that must be achieved (Prastowo, 2013).

CONCLUSIONS

Based on the results of data analysis regarding the Sumbawa local wisdom-based mathematics module, the validation results of each validator were subject matter experts, linguists, and media experts, respectively 91.67%, 90%, and 91.15%, with an average of 90.94% and was categorized as very valid. It can be concluded that the Sumbawa local wisdom-based mathematics module is suitable for elementary school students.

This research was limited to product feasibility tests on the validity aspect only.

Teachers are expected to use Sumbawa local wisdom-based mathematics module in learning mathematics to observe the feasibility of the product in terms of the practicality and effectiveness of the module so that improvements can be made for further learning and can be disseminated to schools in Sumbawa.

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