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Development of E-module Using Bengkulu Contexts to Improve Literacy Skills of Junior High School Students

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Abstract

This research aims to produce a valid and practical e-module using the Bengkulu context that potentially affects students' literacy skills to understand the materials of patterns and number sequences. This research employed a research and development method. The development stages refer to Plomp's five developments: (1) preliminary research, (2) the prototype-making stage, and (3) the assessment stage. The subjects of this research were 24 eighth-graders of SMP Negeri 6 Bengkulu City. The data collection techniques of this research were observation and test. Meanwhile, the research instruments were validation instruments, questionnaires, and literacy test questions. Validity analysis was conducted descriptively and consisted of an analysis of validity, practicality, and literacy test results. The average score of the expert validity is 0.64 and meets the valid criterion. The e-module has a practical category with a score of 3.55, and the requirements are very practical. The e-module has impacted students' literacy skills with an average score of 74.25 or good criteria. Moreover, e-module using Bengkulu context problems can encourage students to improve their mathematical literacy skills.

Keywords: Bengkulu Context, Development Research, E-Module, Literacy Skills

Abstrak

Tujuan dari penelitian ini untuk menghasilkan e-modul menggunakan konteks Bengkulu yang valid, praktis dan memiliki efek potensial terhadap kemampuan literasi siswa pada materi pola dan barisan bilangan. Metode penelitian menggunakan penelitian pengembangan. Tahapan pengembangan mengacu pada pengembangan Plomp, yaitu: (1) preliminary research (2) prototyping phase, dan (3) assessment phase. Subjek penelitian adalah siswa kelas VIII SMP Negeri 6 Kota Bengkulu sebanyak 24 siswa. Teknik pengumpulan data dilakukan dengan cara observasi, dan tes. Instrumen penelitian adalah instrumen lembar validasi, angket, dan soal tes literasi. Analisis validitas dilakukan secara deskriptif yang terdiri dari analisis kevalidan, kepraktisan dan hasil tes literasi. Hasil validitas ahli dengan rata-rata skor 0,64 dan memenuhi kriteria valid. E-modul memilki kategori praktis dengan skor sebesar 3.55 dan kriteria sangat praktis. E-modul juga ditemukan bahwa dapat berdampak terhadap kemampuan literasi siswa dengan rata-rata skor sebesar 74,25 atau kriteria baik. Penggunaan e-modul dengan masalah konteks Bengkulu dapat mendorong siswa dalam meningkatkan kemampuan literasi matematis.

Kata kunci: Konteks Bengkulu, Penelitian Pengembangan, E-Modul, Kemampuan Literasi

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INTRODUCTION

PISA results in the last three years show that Indonesian students still rank at the bottom. In particular, the math mastery of Indonesian students is below the international average score. Puspendik data (2019) show that from a maximum score of 600, the average score of Indonesian students in mathematics was only 375 in 2012 and increased by 386 in 2015 and by 379 in 2018. According to Jurnaidi and Zulkardi (2014), one of the contributing factors for this low score is students' less training

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in solving problems with characteristics, such as PISA questions. Contrary to these data, students must adapt to technological advances in the 21st century To live in this century, they require certain skills, such as communication, collaboration, complex thinking, and creativity (Soulé & Warrick, 2015). One of the abilities that meet these demands is mathematical literacy. This literacy refers to the ability to use concepts, principles, procedures, and mathematical functions to describe and predict an event (OECD, 2016). Literacy deals with strategies of using mathematical concepts and facts to solve daily problems (Fathani, 2016).

Mathematical literacy refers to selecting and applying knowledge, involving mathematics, gained from understanding real situations (Sumirattana et al., 2017). Mathematical literacy has eight competency indicators: mathematical thinking; mathematical argument; communication; modeling; problem-solving, representation, symbols, tools, and technology (Steen, 2001). To improve students' literacy skills, they must study factors causing low achievement. Jufri (2015), and Wijaya et al. (2014) deploy that the factor hampering students to solve PISA questions is difficulties in understanding mathematical problems in authentic contexts. Therefore, it is necessary to assist students to understand fundamental issues to support literacy skills. In this case, the student's environmental context is applicable. Kadir and Masi (2014) argue that using a context influences critical thinking, creativity, and problem-solving. Furthermore, Zulkardi (2013) states that using a context close to students' life will attract their attention and facilitate them to recognize and understand a problem before solving it. As a result, learning mathematics becomes more fun and meaningful.

Several studies show that learning using contexts, such as culture, ethnomathematics, and local contexts, could impact learning objectives. Zulkardi and Kohar (2018) have revealed that context in mathematics learning can be made by linking mathematics with students' daily lives and technological developments understood by students. Jannah et al. (2019), Putri and Zulkardi (2020) used the context of sports at the Asian Games to find out the impact on students' mathematical literacy. Zulkardi et al. (2020) use the context of covid-19 to stimulate students in learning mathematics. Saputri & Zulkardi (2020) used the context of a motorcycle taxi to stimulate students' mathematical modeling abilities. Fajriyah (2018) and Sarwoedi et al. (2018) have proved that ethnomathematical content in classroom learning could effectively improve students' abilities. Mathematics teaches cultural values by inviting students to connect their understanding and knowledge with daily life (Hartoyo, 2012). This strategy will support the achievement of learning outcomes in the classroom.

Improving students' literacy skills can be achieved by preparing and planning good learning resources. Meanwhile, a well-designed lesson plan is the main factor to achieve learning objectives (Posamentier, 2007). Learning activities emphasize process skills and active learning; thus, learning media becomes increasingly important (Nurseto, 2011). Furthermore, Mulyasa (2013) has modified and enriched teaching materials to implement the 2013 curriculum. One of the teaching materials that support teaching and learning is the teaching module. Laili et al. (2019) have discovered that modules improve the material mastery of teachers and students. E-modules are teaching materials in the form of

modules displayed in an electronic format that can increase students' interest and motivation to learn (Directorate of High School Development, 2017).

Priatna et al. (2017) and Putra et al. (2017) expect e-modules to serve as a new learning source for students, improve their understanding of concepts, and develop learning outcomes. Several studies have revealed that using e-modules could improve students' learning outcomes (Fadillah et al., 2021; Masruroh & Agustina, 2021; Amalia et al., 2021; Herawati & Muhtadi, 2018). Meanwhile several studies have discovered that e-modules can improve students' critical thinking skills, allow teachers to obtain positive responses from students, give a high percentage of improvement (Jayadiningrat & Ati, 2018), and escalate improve learning outcomes (Setiarini et al., 2016; Mutmainnah et al., 2021). Another study has discovered that the module's effectiveness can potentially affect HOTS with a very good average score (Tobing et al., 2022). Meanwhile, Aulia et al. (2021) investigate the impact of e-modules on literacy and have discovered that students' scientific literacy skills improve after applying e-module. Furthermore, Miller (2018) suggests that it is necessary to apply interactive technology in mathematics learning to improve the quality of learning.

Many similar studies have investigated e-modules in learning and revealed that that e-modules impact students' learning achievement, thinking skills, and literacy skills. E-modules can be developed using various contexts. Widiantari et al. (2022) report that the development of e-modules has successfully increased students' numeracy literacy using ethnomathematics that makes learning more contextual and meaningful. Moreover, many studies have investigated the development of e-modules to improve mathematical literacy. Therefore, this study compiled and developed an e-module based on literacy and using the Bengkulu context. This development aims to create a valid, practical, and effective e-module using the Bengkulu context to improve the mathematical literacy skills of junior high school students. The use of the Bengkulu context aims to assist students to solve real problems and introduce Bengkulu to the students.

METHODS

This research employed a research and development method and focused on developing e-modules with the Bengkulu context based on valid, practical, and effective literacy contexts. The product comprises two validity aspects (Nieveen, 1999). The first aspect investigates whether the developed device is based on solid rationale theories. The second aspect investigates whether there is an internal consistency in the device components. Meanwhile, the practicality criteria refer to two aspects (Nieveen, 1999). The first aspect examines whether the experts and practitioners stated that the developed tools are applicable. The second aspect examines whether the developed tools are applicable in real life. Kemp et al. (1994) propose several criteria of effective learning and state that the percentage is considered as an effective index if it meets two requirements: (1) the percentage of students achieving mastery levels and (2) the average percentage of all students achieving satisfactory goals.

The development stages of this research referred to the development model of Plomp (2015), which consists of three stages: (1) preliminary research, (2) development phase, and (3) assessment phase. The preliminary research stage is the initial stage which consists of student analysis, material analysis, context analysis, and assignments. This study conducted a student analysis to examine the characteristics of eight-graders at SMPN 6 Bengkulu City. These characteristics included the academic ability and students' social environment. Meanwhile, the material analysis was carried out on the essential competencies of the material of patterns. The context analysis examined the Bengkulu context in the material and analysis of student assignments. The prototyping stage included the initial product design, media selection, and product format. Meanwhile, the assessment stage aimed to assess the product development and consisted of expert tests and field trials.

The test subjects of this development research were 24 eighth-graders at SMPN 6 Bengkulu City. The data were collected using the test and non-test. The test was performed by giving the students literacy and non-test questions to assess the validity and readability of the module. The instrument was employed to measure the validity aspects, such as content feasibility, presentation feasibility, language feasibility, and context use. Meanwhile, the readability instrument measures aspects of presentation, symbol writing, and ease of use.

The data analysis consisted of product validity analysis, practicality analysis, and student literacy test. The validity analysis referred to the Aiken formulation (Retnawati, 2014) with the following equation. $V = \frac{\sum s}{n(c-1)}$ with $s = r - I_0$

Description:

$V =$ Item validity index

$r =$ Rater choice category score$I_0 =$ The lowest score in the scoring category

$c =$ Rater selectable category

$n =$ Number of raters

The product is considered valid and has met the test criteria if the Aiken index value (V) is more than 0.5. Meanwhile, the product's practicality was analyzed based on the student's assessment questionnaire scores after using the product. The practical criteria referred to the results of the score analysis and the rating scales ranged from 1 to 4.

Table 1. Practicality criteria of e-module

Interval	Criteria
1.00-1.80	Not Practical
1.81-2.60	Less Practical
2.61-3.40	Practical
3.41-4.00	Very Practical

The last stage of data analysis was the product effectiveness analysis. The study was carried out using descriptive statistics on student literacy test data. The criteria are considered effective if the average results of the student literacy test are above 65 on a score scale of 0-100. This score indicates that the e-module impacts students' literacy abilities.

RESULTS AND DISCUSSION

Results of the Preliminary Research Stage

At this stage, we conducted literature studies, observations, and interviews to obtain data on student characteristics, materials, assignments, and the Bengkulu context. The field observations show that the majority of the students have medium skills. The topics discussed in the module are patterns and number sequences with the following basic competencies.

3.1 Making generalizations from patterns in number sequences and object configuration sequences

4.1 Solving problems about patterns in number sequences and object configuration sequences

The result of the task analysis is the identification of the objectives achieved in learning. Assignments are based on basic competencies that are the focus of development. The formulations of the task analysis include observing real daily problems of patterns and number sequences, investigating problem-solving, and presenting solution results. In this stage, an analysis of the Bengkulu context was performed and used to prepare the e-module. This study was conducted by observing the existing contexts and the presented materials. We argue that the teaching materials or questions based on regional contexts should be studied before selecting the contexts to support the delivery of material. Kadir and Masi (2014) state that the use of context in learning mathematics has a positive effect on students' learning activity and can train them to think critically and creatively to solve mathematical problems. Context is pivotal to support students' learning interests. Kaiser et al. (2012) states that using context at the beginning of learning can increase students' motivation and interest in learning mathematics.

With the use of context in developing this e-module, we focus on the Bengkulu contexts to support the presentation of this e-module. These contexts include tourism contexts, such as Long Beach and Zakat Beach; Bengkulu contexts, such as Jamik Mosque, Bungkarno Exile House, Bengkulu traditional house; cultural contexts such as batik basurek Bengkulu and Tabot; and typical food contexts, such as tat cake. The contexts were selected by considering the results of the initial analysis and the familiar topics for Bengkulu people.

Prototyping Stage Results

This stage consisted of three implementation stages: initial product design, media selection, and product format. The initial design of the e-module was carried out by presenting pattern material and number sequences using the Bengkulu contexts. In the preparation of the e-module, the selected media consisted of media as supporting material, such as photo media as supporting material, video media using YouTube to strengthen exercises, and flip pdf media as supporting online media. At this stage, we also determined how the format of this e-module product was designed. To present the material, the e-module was designed based on six arrangements: (1) introductory material (Bengkulu context), (2) material presentation, (3) sample questions or applications, (4) reinforcement of exercise videos, (5) student tasks, and (6) and reinforcement of exercises. The example of displaying the design results at the prototyping stage is presented in Figure 1.

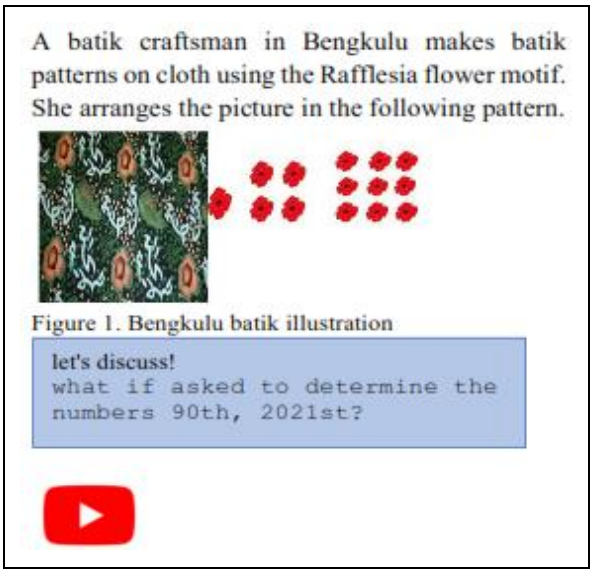


Figure 1. The initial design of the introduction to material and reinforcement videos

'To create the product's initial design, we should identify how the order of the material is presented. The format of teaching materials should be made consistently so that each sub-chapter or sub-material is shown in the same form. This requires planning to prepare teaching materials. A lesson plan is essential for learning activities (Moursund, 2012).

Assessment Stage

Data Validity Test Results

The developed initial e-module (draft) was tested by experts. The validity test was carried out using the Aiken index by three lecturers of the mathematics education study program: one from Universitas Bengkulu and two from Bengkulu State Islamic Institute (IAIN). The results of the validity test are summarized in Table 2.

Table 2. E-module validation results

Rated aspects	Validator Scores			Aiken Index	Criteria
	1	2	3		
Content eligibility	34	32	33	0.70	Valid
Presentation eligibility	23	20	22	0.66	Valid
Language eligibility	32	34	34	0.64	Valid
Context use	18	17	16	0.62	Valid
Online drafting	15	14	14	0.56	Valid

The validity results conclude that each aspect has met the valid criteria. The validators' suggestions were used as a reference to revise the product. Their suggestions are generally related to the presentation aspects and the context used to present the material. The expert's suggestions and comments on the draft are as follows.

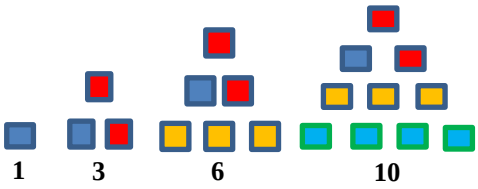
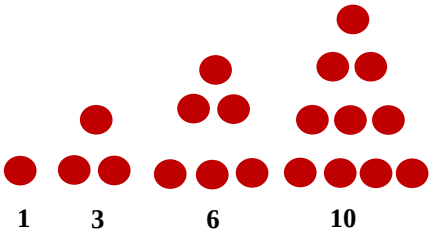
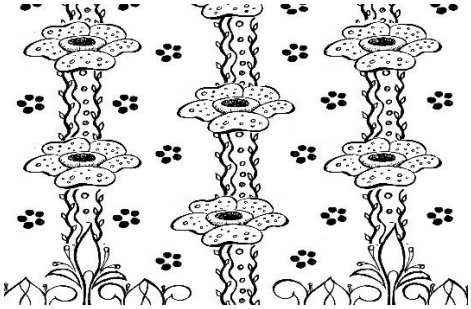
Table 3. Validators' suggestions at the assessment stage

No	Rated aspects	Comments
1	Content eligibility	"The material can be completed again, and the introduction of the material should use the Bengkulu contexts."
2	Presentation eligibility	"Questions or material should be presented in real context photos."
3	Context use	"We need to expand the use of Bengkulu contexts in all material, especially in number sequences. Comprehensive use of the Bengkulu contexts in the e-module will add the characteristics of Bengkulu."
4	Online Design	"The video display should provide a link and a YouTube video so that the video can be clicked directly."

Comments on the appropriateness of the content indicate the need for additional introductory material; for example, we use the history of Bengkulu *batik basurek* at the beginning of the material. Meanwhile, the Bengkulu contexts are directly presented using context photos. This concludes that using context in learning should be supported with images.

The results at the validation stage are in the form of revisions by considering the suggestions and comments of the validators. The revised results were summarized based on the assessment aspects on the validation sheet. The summary of the product before and after the revision is presented in Table 4.

Table 4. Summary of product before and after revision

Aspect	Before Revision	After Revision
Contents		
Use of Bengkulu Context	 	 

Practical Result Data

The practicality test of the e-module was carried out in the trial class, namely class VIII A of SMP Negeri 6 Bengkulu City, and involved 24 students. During the class using the e-module, when the students had difficulties working on a problem, they should have found the solution from the video in the e-module to enrich their understanding. After the class, the practicality test provided a practicality assessment questionnaire. The questionnaire contains statements about how students view, write, or use e-modules. The students' suggestions or comments on the developed e-module are summarized in Table 5.

Table 5. E-module practicality results

Rated aspects	Average Scores	Criteria
Layout, writing of symbols and letters, and display of e-modules	3.70	Very Practical
Ease of use in learning	3.38	Practical
Use of language easily understood	3.64	Very Practical
Appropriate use of contexts in the material	3.50	Very Practical

Table 5 shows that every aspect assessed has met the practical criteria and is very practical. Based on this result, the e-module was arranged according to students' suggestions; thus, it is practically used in classroom learning.

Effectiveness Test Result Data

The effectiveness test was conducted on eighth-graders of SMP Negeri 6 Bengkulu City. The stages of the effectiveness test were the preparation of the literacy test instrument, the learning process using the module, and the final test. The instrument to measure the impacts of the e-module was in the form of a descriptive test with four questions on mathematical literacy. The instrument has met the testing stages, consisting of expert trials and field tests. The four questions were declared valid with the Aiken index of 0.78, 0.67, 0.70, and 0.68, respectively. Furthermore, the instrument was tested empirically to measure reliability with Cronbach Alpha The instrument's effectiveness was revealed from the reliability test using Cronbach's alpha. The Cronbach alpha of the reliability estimation on the literacy test instrument is 0.66, indicating that the instrument has met the reliable criteria. The instrument also calculated the standard error measurement (SEM) using the following formula.

$$SEM = SD\sqrt{1 - r_{xx}}$$

(Reynolds et al., 2011)

The Cronbach's alpha of the reliability estimation on the instrument is 0.66 with a standard deviation of 0.324. Meanwhile, the SEM value is 1, and the standard error value of the instrument is 0.134.

The product's effectiveness was tested in a final test after the students had learned to use the e-module. The effectiveness is described based on the results of the student literacy test using a score scale of 0-100. From the student literacy test results, the minimum score was 46.77, the maximum value was 80.00, the average value was 74.25, and the standard deviation was 0.3. We conclude that the achievement of students' literacy skills is higher than the KKM, which is 65. Here are some student answers about solving problems in the module. The following is one of the students' answers to solving problems in e-modules.

Problem 1
Bengkulu traditional house

Bengkulu traditional house called *Bubungan Lima*. Like traditional houses in general, the name Bubungan Lima is taken from the shape of the roof, but this house also has other words. The *Bubungan Lima* House is now not used as a residence for the Bengkulu people but for certain traditional ceremonial activities.

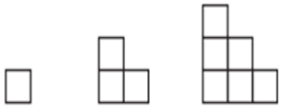


Figure a. Traditional house Figure b. Illustration staircase

To enter the upper floor, a staircase is built at the entrance. The stairs are designed with the sequence of stairs shown in the illustration as shown in Figure b (stairs 1, stairs 2, stairs 3).

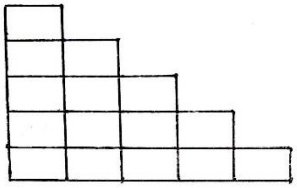
a. Draw the fourth stairs! (*knowing*)
b. Find the perimeter of the stairs to 1 to 4 and write the result in tabular form if each side of the square has a side length of 30 cm? (*applying*)

Stairs	Perimeter
1st stairs	
2nd stairs	
3rd stairs	
4th stairs	

c. The third staircase has three steps. Which staircase has 14 steps? (*Reasoning*)

Students Answer

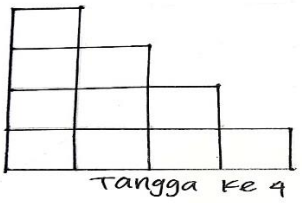
a.



b.

Tangga ke-	Keliling
Tangga ke 1	4 x 30 = 120
Tangga ke2	12 x 30 = 360
Tangga ke 3	24 x 30 = 720
Tangga ke 4	60 x 30 = 1800

Students Answer



Tangga ke	Keliling
Tangga ke 1	120 cm
Tangga ke 2	300 cm
Tangga ke 3	610 cm
Tangga ke 4	840 cm

yaitu, tangga ke 14

Figure 2. Students' answers determine the side perimeter of the Bengkulu traditional house stairs

The results of the analysis of student answers in terms of mathematical literacy indicators. Students have been able to think mathematically, which is indicated by the circular pattern. However, students were wrong in determining the perimeter by using the area concept at point b for the 2nd to 4th stairs and misconsept the second student in determining the perimeter of each square. The correct answer is that the side of the 1st stairs is 4 x 30 cm = 120 cm, the 2nd side of the stairs is 4 x 60 cm = 240 cm, the 3rd side of the 3rd stairs is 4 x 90 cm = 360 cm, the 4th side is 4 x 120 cm = 480 cm. Students have been able to represent using patterned pictures correctly. The results of this answer analysis show that in terms of mathematical argumentation l, literacy competence is good. This is shown by students being able to make patterns from existing phenomena, students being able to make connections from several statements so that a coherent pattern is formed. In terms of using tools, students have used tools to draw to find solutions to problems. In this case, *the modeling* to solve the

part c problem has not been written in sequence. Students can answer the 14th stairs through the pattern in question part a. Analysis of student answers gives us information that some students misinterpret the concept of the perimeter in question 1, which uses the context of a traditional house. This error assumes that students are given several interconnected pictures so that, in determining the perimeter, students are wrongly associated with the previous image. The context of this traditional house also influences students because some students do not know or visit Bengkulu traditional houses. This is to the research study of Prahmana & D'Ambrosio (2020), where Ethnomathematical Exploration in Indonesian culture can be one of the transformative efforts to bridge mathematics with the reality and perceptions of students in learning mathematics.

Studies several previous studies provide information that the use of context in learning can support students' thinking skills. Samo, Darhim, and Kartasasmita (2018) research show that culture-based contextual learning can improve students' mathematical problem-solving. The results of Putri and Zulkardi's research (2020) state that through PISA-type questions using an Asian context, students can learn collaboratively to make the learning process meaningful and easy. Learning mathematics can use several contexts, including Covid-19. According to Zulkardi et al. l (2020), Covid-19 as a phenomenon is one of the contexts that students can use in learning.

The results showed that the mathematical questions using the Bengkulu contexts help students more easily understand the questions. In other words, the use of e-module using the Bengkulu contexts effectively impacts students' literacy skills to learn mathematics. This finding is supported by Priyonggo, Wardono, and Asih (2019), who have found that the Agito module is an alternative media to improve mathematical literacy skills and assist students to understand contextual problems more closely. Meanwhile, Patri and Heswari (2021) have revealed that the ethnomathematics e-module is effectively used to learn mathematics.

CONCLUSION

The developed e-module using Bengkulu contexts has met the criteria of validity, practicality, and effectiveness to support the literacy skills of junior high school students shown with students' responses. This e-module was structured based on Plomp's model, and its development stages were revised. This Bengkulu context-based e-module is a solution for an independent learning resource, could guide students to learn, and is available online. The emphasis on Bengkulu context problems can support the students to improve their mathematical literacy skills.

Based on the research results, this study suggests two major points. First, teachers necessarily use online and offline learning resources that can facilitate students. Moreover, they should use problems close to the students' environment during the learning process. Second, further researchers should more comprehensively explore other Bengkulu contexts to enrich the prepared teaching

materials. Moreover, they could develop a measurable evaluation tool to compile online teaching materials.

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