

The Advantages of Pemalang Area-Based SPLDV Questions Development

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ABSTRACT

One of the obstacles faced by students in Two Variable Linear Equations System (SPLDV) is solving problems in the narrative form. The integration of local culture is used to stimulate students to solve mathematical problems in narrative questions that are quite familiar in daily life. This study aims to develop the advantages of Pemalang area-based SPLDV questions to achieve competence so that students are able to solve mathematical problems. The type of this research is research and development (R&D) to the product development stage. The instrument used is questions of the advantages of Pemalang area-based test and a questionnaire validation sheet. The data analysis performed by describing the responses, statements and suggestions of the four validators, reliability, level of difficulty, and item discrepancy. The results showed that the test instrument is valid with the percentage of material validity is 83%, the construction aspect validity is 83%, and the language validity is 92%, it has a reliability with a Cronbach Alpha value of 0.799, the questions have a moderate difficulty, and good at the discrimination index. The conclusion of this study is students could solve problems by using the advantages of Pemalang area-based SPLDV questions in mathematics learning.

Keywords: *Local wisdom, Two variable linear equations system (SPLDV), Problem solving.*

1. INTRODUCTION

Culture is an important part of human life development. It contains many aspects of language, social, political, economic, ideology, belief, science, mathematics, food, clothing, and human behavior [1,2]. Mathematics can be found in daily life related with culture closely, for instance in activities community culture namely art, patterns, and artifacts [3]. However, every culture has different mathematical elements. Indonesia is one of the countries that has a wide variety of cultures from buildings, clothing, food, and social life. Apart from being used for learning mathematics because it is familiar with students' daily lives, culture can also be an alternative in implementing education character in order to foster a sense of nationalism of students [4]. Culture is also often associated with certain activities that are developed among the local community in connection with efforts to fulfill their daily needs. Thus, each region with other regions can have

different cultures with their own characteristics [5]. The mathematical concepts learned by students can be combined with the local culture around their environment so that they can learn from two sides, namely local culture and mathematical concepts.

Several forms of implementation of local wisdom have been developed in various content on mathematics learning. For instance, on the Rejang Lebong house traditional in Bengkulu is used in learning mathematics on geometry content includes flat shapes two-dimensional to three-dimensional [6], Besurek batik Bengkulu can be used in congruence and similarity materials [7], emping food which is a superior product in the Banten area is used as a context in the subject matter of social arithmetic for grade 7 SMP and got a percentage of 80.76% with a feasible category [8]. The form of fish buying and selling activities for coastal fishing communities in the Cirebon Regency fish market has a mathematical nuance that has been practiced and developed in the

community, namely how to add, subtract, and count. The existence of fishing community activities in the Cirebon district fish market as local knowledge contributes to the understanding of mathematical concepts in schools, particularly at the junior high school level [9].

Pemalang is a small regency in the coast of Central Java which is directly facing towards the North Sea. One of culture forms in the Pemalang Regency is a handicraft, namely goyor weaving gloves. The weaving gloves maintains manufacture by manual weaving or known as term non-machine loom (ATBM). Goyor weaving gloves are grouped into two types based on manufacture, namely bottled and planthopper. The bottled goyor weaving gloves Sarong has a unique motif design feature that is not too complicated while the goyor weaving gloves planthopper sarong have complex motif designs. There are many patterns of sarongs that are produced and sold in market. Some of them are goyor weaving gloves bottles Sarong with waru motifs, bottled with rhombus motifs, bottled with floral, bottled with cross combination, planthopper motif with rhombus, planthopper motif with cacah gori and others. In the making, buying and selling process of goyor sarongs, there are several mathematical activities, including the calculating process in buying and selling [10].

Based on previous research that conducted an ethnomathematical exploration of the Gotor woven sarong, the researcher was interested in developing a regional advantage-based question in Pemalang regency, namely the Goyor tenung sarong on the Two Variable Linear Equation System material (SPLDV).

SPLDV is an algebraic material that contains mathematical modeling of story questions. However, most of the students still have difficulty in implementing mathematical concepts in questions in the form of stories or narratives [11]. One alternative to overcome these difficulties is to use story questions that come from culture because it is close to daily life of students [12, 13]. Therefore, it is hoped that students will be more familiar with math problems around so as to increase the understanding in mathematics learning [14]. However, in Pemalang there are still many teachers who have not used local culture as one of alternatives to help students more to be more familiar with math problems particularly on the SPLDV material.

Based on the description above, local culture and product advantages of a region can be optimized as a learning approach mathematics by developing questions on SPLDV content. In this development, the culture used is based on the superiority of the

Pemalang area to enable students to solve familiar math problems in the environment in which he lives. Therefore, students have an awareness that Mathematics has an important role in solving problems in daily life. This study needs to be carried out as findings related to students' problem-solving abilities in solving problems based on advantage in the Pemalang regency. Moreover, students admitted that it was easier to understand problems in the context of their understanding. Through this study, teachers in Pemalang regency can also develop similar questions. Thus, students can have a variety of experiences in solving math problems that are not routine questions. If this study is not carried out, it is very likely that students are only fixated on routine questions and students' experiences in learning mathematics are not meaningful, even though students can learn mathematics from their immediate environment in familiar contexts in their daily lives.

2. METHODS

2.1. Design

This study uses research and development (R&D). The model development used in this study is Budiyo development model through four stages, namely preliminary study, product development, product efficacy testing, and dissemination and product implementation [15]. However, in this study, it will only discuss the product development. The preliminary stage is an identification of problems related to the advantages of Pemalang area and SPLDV both in the reality or through studies literature. The product development stage was carried out by designing an instrument for preparing test questions the advantages of Pemalang area-based SPLDV content that later validated by the validator, and then tested limited trial to know the reliability, the difficulty rate and the discrimination index of each question.

2.2. Instruments

Products developed in this study namely the advantages of Pemalang area-based SPLDV questions development and it was used as a measure of students' ability in mathematical problem solving. To know the validity of the test instrument developed, a questionnaire sheet in the form of a Likert scale is used with possible answer choices, namely "strongly agree", "agree", "disagree", and "strongly disagree". Validation sheet to assess the suitability of the test items that had been developed had three aspects: namely material/ content, construction, and language [16].

The aspects of material/content were used to analyze the suitability of the test instrument items that was in accordance with learning carried out, the construction aspects was used to examine the subject matter that had been developed along with the answers, and the aspects of language was used to determine whether the use of the language was in accordance with the rules of the Indonesian language and had used communicative language [17].

The test instrument developed was validated by three mathematics education lecturers who have made study related to local culture and understand the advantages of the Pemalang area. The three lecturers namely two lecturers from IAIN Pekalongan and one lecturer from Universitas Pekalongan. The instruments were also validated by a mathematics teacher in junior high school grade VIII as a material expert from SMPN 5 Pemalang.

Some suggestions from the four validators namely to provide varied types of questions according to a cognitive level by Bloom's taxonomy, sarong The goyor sarong used was still limited so the introduction of culture in Pemalang regency was still not carried out to the maximum, and the advantaged of Pemalang area that presented in the question were made even more contextual, as well as the use of language that was easier to understand.

2.3. Data Collection Methods

Data collections are done with questionnaire and tests about the advantage of Pemalang area-based SPLDV questions. Questionary was given to find out the validity of the instruments, the validator gave an assessment by giving a mark tick on the assessment aspect with very agree criteria (4), agree (3), disagree (2), and strongly disagree (1).

Tests about the advantage of Pemalang area-based SPLDV questions has four questions and was given to 15 students of SMPN 5 Pemalang. Tests was given to find out the realibity, difficulty level and discrimination index.

2.4. Data Analysis

The development of questions for the advantages of the Pemalang area-based SPLDV material were said to be valid if included in the "valid" and "very valid" criteria after going through a validation process and revision based on comments and suggestions for improvement from the validator. The score of each validator was summed for find the total score and looked for the percentage through the formula:

$$\text{validation} = \frac{\text{score obtained}}{\text{max score}} \times 100\% \tag{1}$$

Based on the percentage of validity obtained, the validity criteria was set which presented in the Table 1 [18].

Table 1. Instrument validity criteria

Validity (%)	Validity Criteria
81-100	Very valid
61-80	Valid
41-60	Quite valid
21-40	Less valid
0-20	Not valid

After that, a limited trial to 15 students of SMPN 5 Pemalang was conducted to find out its reliability with Cronbach's Alpha. To find out the reliability of the questions, the calculation was done by using the help of the IBM application SPSS Statistics 20 to find the coefficient of Cronbach's Alpha. The instruments can be said to be reliable if Cronbach's Alpha coefficient ≥ 0.70 [19].

Furthermore, the instruments that had been said to be valid and reliably calculated the level of difficulty and different power. The calculation of the difficulty level aims to find out the difficulty of a question. The essay question can be said to have a high level of difficulty if $0.3 \leq P \leq 0.7$ [20]. The formula used to calculate the item difficulty index as follows.

$$P = \frac{\bar{s}}{s_{\max}} \tag{2}$$

The discrimination index of essay question was calculated by finding correlation coefficient between item scores and total scores. The discrimination index can be said to have a good criteria if $D \geq 0.30$. The formula used is presented as follows [21].

$$D = r_{pbis} = \frac{n \sum XY - (\sum X)(\sum Y)}{\sqrt{(n \sum X^2 - (\sum X)^2)(n \sum Y^2 - (\sum Y)^2)}} \tag{3}$$

3. RESULT AND DISCUSSION

3.1. Preliminary Study

At this stage, the preliminary study was carried out to know the basic problems that occur in mathematics learning. At this stage, the curriculum analysis was done first to find out core competencies and basic competencies that were implemented in grade VIII of junior high school. One of the materials obtained by students were SPLDV material with basic competencies namely: 1) Explaining of two variable linear equations system and the solutions connected

with contextual problems, and 2) Solving problems related to two variable linear equations system.

Furthermore, after knowing what competencies were obtained in grade VIII of junior high school, the interview with mathematics teachers at SMPN 5 Malang was carried out. The result was obtained that states the questions given by the teacher had not varied and it was only routine questions, students also had difficulty in solving problems.

Local wisdom on the advantages of Pematang area was chosen as an approach to student activities that would be developed in order to improve problem solving skills mathematically with more varied forms of questions. The existence of the advantages of Pematang area also answered the purpose of basic competence at the same time which was related with contextual problem. Thus, students became more aware that in their surrounding also had various problems that can be solved by math, one of them is the use of SPLDV material [22].

Based on the results of field observations and studies literature, it was obtained the data that Pematang Regency have some pretty close cultures with daily life can be implemented in mathematics learning. One that stands out, namely the production and marketing activities of gonor weaving gloves. The production gonor weaving gloves was one of the livelihoods of the community in Pematang Regency. The gonor sarong has two types namely bottled weaving gloves and weaving gloves planthopper, the production of weaving gloves planthopper was more complicated than bottled weaving gloves.

3.2. Product Development

After the preliminary study was completed, the next stage was the planning stage of product development that was started with compiling the development of test instruments as many as 5 essay test questions that would be implemented in the students activities when practicing questions during learning. Then, the instrument and validation sheet were submitted to the validator to find out its validity by paying attention to aspects of material, construction, and language.

Validator 1 was a lecturer from IAIN Pekalongan who provided input so that the development of questions could be more varied and payed attention to the cognitive level of each question, so that the questions developed could help students in solving complex problems. The questions used one type of gonor weaving gloves, namely bottled gonor weaving gloves while there were two types of gonor sarongs,

namely: bottled gonor weaving gloves and planthopper type, it would be better if it used both types of gonor weaving gloves sarongs so that students knew more about the culture in Pematang, particularly the gonor weaving gloves sarong. Validator 2 was a lecturer at IAIN Pekalongan and provided input so that the language used more concise and examples of questions made more contextual. Validator 3 was a lecturer from the Universitas Pekalongan who provided input so that the questions number 3 and 4 were just combined because had the same context, then the score guidelines were made in more detail, those suggestions was also given by validator 4 who was a teacher of SMPN 5 Pematang. Thus, the number of the questions that would be used were four questions.

After the validation was conducted, the percentage of each aspects of material, construction, and language were searched by using the formula listed in the data collection method section. The first step was to calculate the score of four validators on each aspect, the score was then totaled and averaged with the final result in the form of percentage. The final result of the material validity score test instrument was obtained namely 83% with "very valid" validity criteria, construction aspect validity score test instrument was obtained namely 83% with "very valid" validity criteria, and language validity score test instrument was obtained namely 92% with "very valid" validity criteria. The results of validity recapitulation the Advantages of Pematang area-based test instrument on content of SPLDV is attached in Table 2.

Table 2. Percentage of validity from experts

Validator	Aspect		
	Material	Construction	Language
1	88%	92%	100%
2	75%	67%	75%
3	81%	92%	94%
4	88%	83%	100%
Average	83%	83%	92%
Criteria	Very Valid	Very Valid	Very Valid

Then, a small-scale trial was conducted to students who had received SPLDV material. 15 students of grade VIII H SMPN 5 Pematang did exercise about the advantage of Pematang area-based test questions as many as 4 questions. According to 4 questions that had been done, the scores were analyzed to calculate the reliability test. Based on the calculation by using SPSS, it was found that the value of Cronbach's Alpha

was 0.799. Therefore, the results can be said to be reliable because the reliability coefficient was > 0.70 .

After the test instrument is valid and reliable, the test items test was carried out including the level of difficulty and the discrimination index test by using test results data given on 15 students. The level of difficulty was carried out to determine whether the question was difficult or not. After it was calculated, the results of calculations and interpretations were obtained that are listed in Table 3.

Table 3. The Difficulty Level of Question Items

Question Number	Level of Difficulty	Interpretation
1	0.65	Moderate
2	0.73	Easy
3	0.63	Moderate
4	0.69	Moderate

The calculation was conducted by finding the average score of question items obtained from students' answers, then it was divided by the maximum score of the test items scores. Based on the calculation of the level of difficulty, it is found that there are three questions, namely number 1, 3, 4 which are categorized as moderate and question number 2 is categorized in the easy category.

Then, the discrimination index of test items were calculated. The discrimination index calculations were carried out to distinguish students who had high abilities and students who had low ability. In the essay question, the discrimination index was determined by the point biserial correlation coefficient, namely by using the correlation coefficient between item score and total score. The score item can be said has a good discrimination index if $D \geq 0.30$. Based on these calculations, the discrimination index was obtained in Table 4.

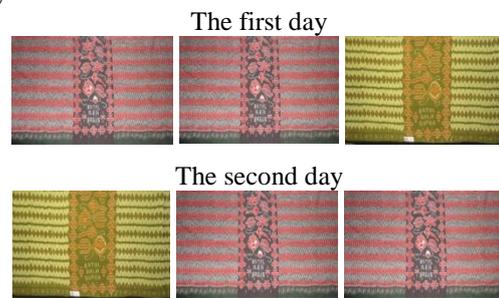
Based on the table, it can be concluded that each question has a discrimination index namely $D \geq 0.30$ so that all of them are in good criteria.

Table 4. The Discrimination Index of Test Items

Question Number	Discrimination Index	Interpretation
1	0.80	Good
2	0.85	Good
3	0.73	Good
4	0.65	Good

For some the advantage of Pemalang area-based examples of questions and student answers are shown as follows.

Meta wants to help her mother sell goyor weaving sarongs with two different motifs. On the first day, Meta selling three sarongs, namely 2 goyor weaving sarongs with rhombus planthopper motif and 1 bottled goyor weaving gloves with rhombus motif. She earns as much as IDR 420000. On the second day, Meta also sells three sarongs, namely 1 planthopper goyor weaving sarong with rhombus motif and 2 bottled goyor sarongs with rhombus motif. She earns IDR 390000. The following is an illustration the sarongs that successfully sold by Meta on the first and second day.



If Meta wants to change its sales results in mathematical form to implement the two variable linear equations system material she got at school, what is the mathematical model that supposed to be made by Meta?

Figure 1 The advantage of Pemalang area-based question number 1

Question number 1 presented above discusses about a child who helps her parents to sell goyor weaving sarongs as the advantages of Pemalang-area. The production and the sale of goyor weaving sarongs is one of the livelihoods of the Pemalang community, so this is familiar to students. Through this question, students were asked to make a mathematics model on a two variable linear equations system. One of the student's answer is shown in Figure 2.

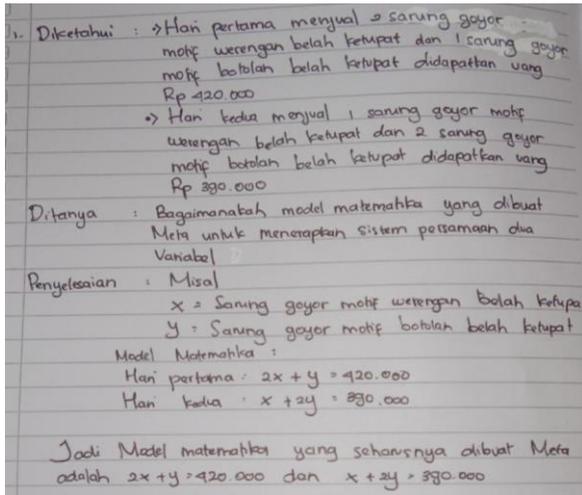


Figure 2 Student's answer for number 1

The next is question number 2 which discusses about implementation of elimination and substitution on the SPLDV which presented in Figure 3.

Riko and Aina want to give gifts to their grandpa by buying goyor weaving sarongs in the city with different motifs. They buy the sarong at the same shop however with different amounts.

Sarong Motif	Riko	Aina
Goyor weaving gloves Sarong with bottled waru motif		
Goyor weaving gloves Sarong with bottled floral motif		
Total Price	Rp320.000	Rp440.000

Based on the data above, how much is the goyor weaving gloves sarong with bottled waru motif and the goyor weaving gloves with bottled floral motif cost purchased by Riko and Aina?

Figure 3 The advantage of Pernalang area-based question number 2

Question number 2 is about two children named Riko and Aina who buy goyor sarong to their grandfather as a gift. It is different from the question number 1, question number 2 uses goyor weaving

gloves sarong with bottled waru motif and the goyor weaving gloves with bottled floral motif. In addition, the issues raised is that students are asked to calculate the price of each sarong. This question type are done through making two mathematical models, as well as using elimination and substitution. Student's answer is attached in Figure 4.

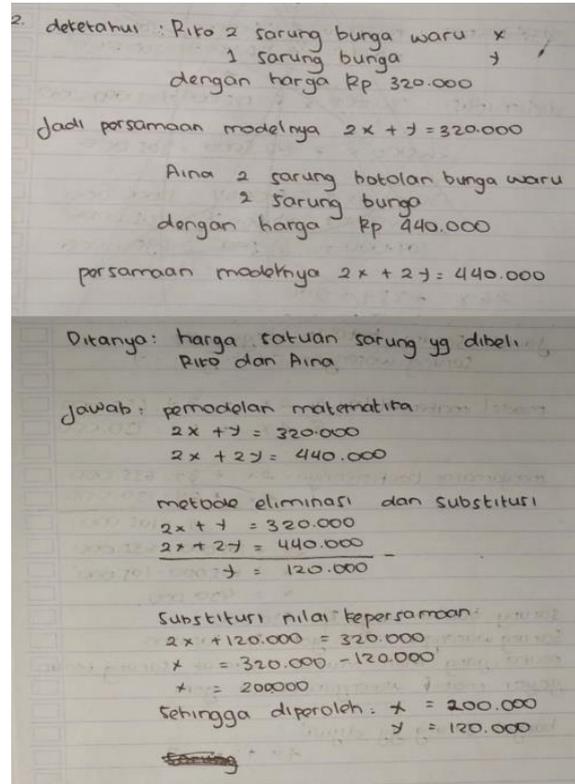


Figure 4 Student's answer for question number 2

Overall, based on validity, reliability, level of difficulty, and discriminatory power, then the advantages of Pernalang area-based questions can be used in SPLDV learning. However, this study is still limited on one type of area advantage only, researchers can then develop questions by using the advantages of other areas so that the problem can be more diverse.

4. CONCLUSION

Based on the results of the validity of the advantages of Pernalang area-based SPLDV questions development that had been validated by four experts, the final result of the material validity score test instrument is valid with the percentage of validity is 83% and it is stated as "very valid", the construction aspect validity score test instrument is valid with the percentage of validity is 83% and it is stated as "very valid", and the language validity score test instrument is valid with the percentage of validity is 92% and it is

stated as "very valid". Based on the calculation by using SPSS, it is found that the value of Cronbach's Alpha is 0.799 so that reliable results are obtained. The level of difficulty from four questions are numbers 1, 3, 4 in the moderate category and question number 2 is in the easy category. Every question has a discrimination index $D \geq 0.30$ so that all are included in good criteria. Based on validity, reliability, level of difficulty, and discrimination index obtained from students' answers when conducting limited trial, it can be concluded that students were able to solve mathematics problems on SPLDV material that was familiar in the daily life of their surroundings where they live. This study can be a reference for teachers in Pemalang regency to continue in developing similar problem solving problems so that the learning process becomes more meaningful. The existing questions can also be used to test students' other abilities namely understanding concepts, student creativity, and so on. In addition, the next researcher can conduct study in a different context and explore more about the advantages of the Pemalang district so that it can be integrated in learning mathematics.

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