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THE EFFECTIVENESS OF LOCAL WISDOM-BASED LKPD IN IMPROVING ALGEBRAIC NUMERACY LITERACY OF STUDENTS AT SMPN KAB. SIGI

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ABSTRACT

This study aims to examine the effectiveness of Student Worksheets (LKPD) based on local wisdom in improving students' numeracy literacy in the subject of Two-Variable Linear Equation Systems (SPLDV). This study uses an pre-experimental design with pre-tests and post-tests to measure students' numeracy literacy. A total of 90 students from 3 public junior high schools in Sigi Regency participated in this study, which were selected through purposive sampling. The instruments used to collect data were tests, questionnaires, and interviews, which were then analyzed using qualitative analysis for questionnaires and interviews and quantitative analysis for test instruments. The results showed a significant increase in post-test scores, with an average pre-test score of 42.86 and a post-test score of 84.17. Data analysis showed an effect size of 2.06, which is classified as very large, indicating a strong impact of the use of local wisdom-based LKPD in improving students' numeracy literacy. In addition, the results of the student response questionnaire showed that the majority of students (80%) felt that LKPD based on local wisdom helped them understand SPLDV material better and made learning more interesting and relevant to their lives. This study concludes that LKPD based on local wisdom is effective in improving students' numeracy literacy and can be an attractive and contextual learning alternative in areas with rich local cultures, with the hope that it can be used as a reference for teachers in designing more contextual mathematics learning tools.

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INTRODUCTION

Numeracy literacy is the ability to use simple or basic mathematics to help solve practical problems in everyday life (Hajerina et al., 2024; Nahdi et al., 2020; Rahmah et al., 2023). The 2022 PISA survey results for mathematical literacy scores were 366, ranking 70th out of 81 countries, which experienced a decline in scores but an increase in ranking compared to PISA 2018 (OECD, 2019). This shows that the level of numeracy literacy among junior high school students is still low. This also occurs among students in Sigi Regency who have Minimum Competency Assessment (AKM) scores below the average score (Sigi Regency Education Report).

The Sigi Regency Education Report shows that numeracy literacy in public junior high schools in Sigi Regency still shows moderate and poor achievement indicators, with of the 32 public junior high schools in Sigi Regency, 23 schools obtained red indicators with low domains, mostly in numbers and algebra (Archives of the Sigi Regency Education and Culture Office). This is shown by the average score of student abilities in the the domains of numbers, algebra, geometry, data, and uncertainty, which is 51.31, with the details of the competency scores in the domain of numbers being 50.54, the competency score in the domain of algebra being 50.2, the competency score in the domain of geometry being 52.8, and the competency score in the domain of data and uncertainty being 51.46. At the public junior high school level, the lowest achievement was in the numeracy competency indicator. The numeracy competency indicator was in the low achievement category with an achievement score of 31.87, defined as less than 40% of students achieving the minimum competency for numeracy, requiring efforts to encourage students to achieve minimum competency. One of the root causes of low numeracy skills is the teaching methods, the quality of PTK, and the adequacy of quality textbooks and non-textbooks (Sigi Regency Education Report Card, 2023). Therefore, the recommendation for improvement written in the Education Report Card is to strengthen the development of learning tools and teaching methods that are in line with the needs and characteristics of students. For this reason, it is important to develop an algebra learning tool such as LKPD in accordance with the local wisdom that exists in Sigi Regency and in accordance with the needs and characteristics of students to improve numeracy literacy.

LKPD is a teaching material that contains all the basic activities carried out by students with the aim of maximizing understanding and forming basic skills in accordance with the indicators of competency achievement (Febriansyah et al., 2021; Pradiptha & Wiarta, 2021). LKPD designed or created by teachers can be based on school and environmental conditions (Oktricia et al., 2019). The LKPD that is designed or developed not only assesses cognitive abilities but is also expected to be able to collaborate with the physical activities of students in understanding the material concepts (Kong, 2024; Ramadhayanti et al., 2020; Syafi'ah & Laili, 2020). Teachers are expected to be able to develop or design LKPD in accordance with the LKPD development procedure, where there are three requirements in LKPD development, namely didactic requirements, construction requirements, and technical requirements. In mathematics learning, teachers and students are encouraged to be creative, innovative, and sensitive to technological developments (Hajerina et al., 2023). The use of LKPD will provide opportunities for students to practice and discover concepts about a subject until they

find creative ideas whose learning steps can be carried out systematically (Puspita et al., 2021).

The importance of learning tools such as LKPD in the learning process is something that teachers must pay attention to in order to achieve effective learning. LKPD in mathematics lessons generally focuses more on mastering mathematical skills alone. Based on observations and interviews with several teachers at SMPN Kab. Sigi, another problem is that the availability of mathematics learning tools in the context of local wisdom is still limited, and students in Sigi Regency who use their local language both inside and outside of school have difficulty communicating effectively and mastering language skills that are important for formal education. Communication is an important aspect of mathematics learning, as it helps students solve mathematical problems (Suciati et al., 2022).

Several studies have developed LKPD related to local wisdom, such as LKPD containing local wisdom of students in Malang City (Rohmah et al., 2023), LKPD based on local wisdom of South Kalimantan (Sa'diah et al., 2021), LKPD based on local wisdom content literacy (Pane et al., 2022), but these studies have not been related to mathematics and local wisdom in Sigi Regency and do not see the impact of the LKPD. In fact, Sigi Regency has unique and diverse local wisdom related to numeracy in terms of its distinctive social, cultural, and geographical contexts, such as the diversity of local culture in Sigi that can be integrated into contextual mathematics learning, such as agricultural activities, trading in traditional markets, and natural resource management that involve calculations and measurements that can be incorporated into student worksheets (LKPD) both as mathematical problems and in mathematical problem-solving activities for students. Therefore, the researcher wants to conduct research by developing LKPD based on local wisdom in SPLDV material and assessing its impact on junior high school students in Sigi Regency. Therefore, this study aims to design LKPD based on the socio-economic local wisdom of Sigi Regency to improve the algebraic numeracy literacy of junior high school students in Sigi Regency, with the hope that it can be used as a reference for teachers in designing more contextual mathematics learning tools.

METHOD

The research method will be conducted through a quantitative research procedure with a one-group pretest-posttest pre-experimental design (Sugiyono, 2022). The research will be conducted in three public junior high schools in Sigi Regency, consisting of 90 students selected using purposive sampling. The instruments used in the research are observation sheets, test sheets, questionnaires and interview guidelines. The observation sheet is used to assess student involvement when using LKPD, the test sheet is used to determine students' numeracy literacy comprehension abilities before and after the implementation of LKPD based on local wisdom, the questionnaire is used to determine students' perceptions of LKPD, and the interview guidelines are used to obtain feedback on the effectiveness of LKPD in learning.

The stages of implementing this research began with the problem identification stage, which included a literature review, initial focus group discussions (FGDs), and field studies involving observation and interviews. After the initial research data was collected, the next step was to develop the LKPD based on local policies regarding SPLDV material and research instruments. After the LKPD development and design process, a validation process was carried out by experts, involving material experts, media experts, and cultural experts to test the feasibility of the LKPD and the instruments that had been designed. The validity of the instruments was analyzed using "Aiken's validity coefficient." Aiken (1985) formulated Aiken's V formula to calculate the content-validity coefficient based on the results of assessments by a panel of n experts on an item in terms of the extent to which the item represents the construct being measured. The formula proposed by Aiken is as follows (Tomoliyus & Sunardianta, 2020).

$$V = \sum s / [n(C-1)]$$

Description:
S = r – lo
lo = Lowest score (e.g., 1)
C = Highest score (e.g., 4)
r = Numbers provided by the validator

The results of calculations and analyses using Aiken's formula approach will then be summarized in the form of validity categorization/classification. The categorization of content validity adapted from Guilford's (Tomoliyus & Sunardianta, 2020) classification of validity is as follows:

Table 1. categorization of content validity

Validity Value	Category
0.80 < V < 1.00	very high validity (very good)
0.60 < V < 0.80	high validity (good)
0.40 < V < 0.60	moderate validity (fair)
0.20 < V < 0.40	low validity (poor)
0.00 < V < 0.20	very low validity (very poor)
V < 0.00	invalid

In addition to being valid, an instrument must also be reliable and dependable, so a reliability test is conducted. To calculate the reliability test, you can use SPSS or Cronbach's alpha formula as follows:

$$r_{11} = \left[\frac{n}{n-1}\right]\left[1 - \frac{\sum {S_i}^2}{{S_t}^2}\right]$$

Description:
r_{11} = Test Reliability Coefficient
n = The number of questions/statements
1 = Constant number
$\sum {S_i}^2$ = The amount of variance in scores for each item
${S_t}^2$ = Total variance

The testing criteria are that if the calculated r is greater than the table r with a significance level of a= 0.05, then the instrument is reliable; conversely, if the calculated r is smaller than the table r, then the instrument is not reliable.

After the LKPD and instruments were declared suitable for use in the field, the learning process was carried out using the LKPD. However, before the implementation process, a pretest was conducted to measure the students' initial abilities, and after the learning process, a posttest was also conducted to measure the students' numeracy literacy abilities. The data collected was then analyzed using Cohen's d formula to calculate the effect size (Goulet-Pelletier & Cousineau, 2018) in assessing the effectiveness of the LKPD and the improvement in students' numeracy literacy abilities.

$$d_D = \frac{\text{mean of Postest } (M_2) - \text{ mean of Pretest } (M_1)}{SD}$$

To calculate the standard deviation of the difference, you can use the formula:

$$SD = \sqrt{{S_1}^2 + {S_2}^2 - 2\,r\,S_1\,S_2}$$

Description:
S_1 = Pre-test Standard Deviation
S_2 = Post-test Standard Deviation
r = Corelation

The results of the effect size calculation are interpreted using the classification according to (Cohen et al., 2018), namely:

Table 2. Effect Size Classification

Effect Size Value	Category
0 – 0,20	Weak effect
0,21 – 0,50	Modest effect
0,51 – 1,00	Moderate effect
>1,00	Strong effect

RESULT AND DISCUSSION

Problem Identification

This study initially conducted a literature review to gain an in-depth understanding of the research topic and explore relevant previous studies. The literature reviewed was related to algebra material taught at the junior high school level, numeracy literacy, local wisdom in Sigi Regency, local wisdom-based LKPD, and relevant studies that had been conducted. The results of the literature review showed that the algebra material at the junior high school level applied in this study was SPLDV material. The local wisdom used in the preparation of LKPD and post-test instruments was related to the trading system, traditional measurements, local culture, and agriculture/plantations.

After the literature review process, a Focus Group Discussion (FGD) was conducted to explore the opinions, perceptions, and experiences of education stakeholders and teachers regarding the application of local wisdom-based LKPD in algebra learning. Some of the results of the FGD related to LKPD based on local wisdom are: 1) The challenges they face in teaching algebra at the junior high school level, especially in improving students' numeracy literacy, such as understanding difficult concepts and low student motivation to learn algebra. 2) The concept of using local wisdom in the developed LKPD and its relevance in the context of algebra learning. 3) Teachers' needs and expectations regarding teaching materials that are more contextual and interesting for students, especially those that integrate local values, such as materials that are more interactive and easy to understand, as well as the application of approaches that are interesting and relevant to the LKPD developed.

To reinforce the results of the literature review and FGD, a field study was conducted focusing on direct observation and interviews with teachers and students to obtain more specific data related to the issues in the field. Based on the results of the observation and interviews, it was found that teachers had never linked the subject matter to existing local wisdom, the students' numeracy skills were still very low, and the motivation to learn among most students was still low.

Design and Development of LKPD

Based on the identification of the above issues, LKPDs were developed for SPLDV material based on the local wisdom of Sigi Regency, which was divided into three LKPDs with interrelated learning objectives. In LKPD 1, the local wisdom of Sigi Regency that was highlighted was the Lestari Festival "*Potomu Ntodea*," which showcased and sold various natural resources of Sigi Regency, such as *lamale (Caridina linduensis and Caridina kaili)*, endemic mini shrimp from Lake Lindu. LKPD 2 is about the making and sale of handmade bags called "*Tonda*", and LKPD 3 is about the traditional buildings of Sigi Regency, namely "*Gampiri*", which are places for storing crops. In addition to LKPD, supporting research instruments were also developed in the form of numeracy pre-tests, numeracy post-tests, and student response questionnaires.

The instruments that have been developed were then validated by three experts, namely a material expert, a media expert, and a cultural expert. The results of the validation analysis are described in the following table:

Table 3. Results of the V Aiken Index Calculation for the LKPD Instrument

Aspect	Statement Points	Σs	V	Description
Material	1, 2, 3, 5, 6	9	1	Very high validity
	4	8	0,89	Very high validity
Activities	7, 11, 12	9	1	Very high validity
	8, 9, 10	8	0,89	Very high validity
Language	13, 14, 15, 16	9	1	Very high validity
Display	17, 18	9	1	Very high validity

Table 4. Results of the Aiken Index Calculation for the Numeracy Pre-Test

Question Item	Σs	V	Description
1, 2, 5	6	1	Very high validity
3, 4	5	0,83	Very high validity

Table 5. Results of the Post-Test Numeracy V Aiken Index Calculation

Question Item	Σs	V	Description
1	6	0,67	High validity
2, 3	9	1	Very high validity
4, 5	8	0,89	Very high validity

Table 6. Results of the V Aiken Index Calculation Using the Student Response Questionnaire Instrument

Aspect	Statement Points	Σs	V	Description
Instructions	1	9	1	Very high validity
Student Response Coverage	2, 3	9	1	Very high validity
Language	4 , 5, 6	9	1	Very high validity

Based on the analysis of expert validation results related to content and construct, and the reliability analysis results were processed using *SPSS.20*, which was 0.898 for the numeracy test and 0.881 for the student response questionnaire. So the research instrument can be used for the next stage.

Effectiveness of Local Wisdom-Based LKPD.

Before learning using LKPD based on local wisdom on SPLDV material, students first took a pre-test. The pre-test was conducted to measure students' initial abilities. After collecting data on students' initial abilities, the next meeting involved a learning process using the developed LKPD. During the learning process, most students appeared enthusiastic about the LKPD provided, although there were also students who found it difficult because their basic mathematical and literacy skills were still lacking or even low. This was revealed by the students during interviews related to the LKPD provided, namely:

S1: I like the LKPD because when we learned about SPLDV, we learned from stories about how people in my village made “Tonda” and calculated the price and profit. So, the material was easier to understand because it was relevant to everyday life. In addition, the LKPD was colorful and had clear instructions, so it was easier for us to solve the problems.

S2: Yes, that's right! Previously, mathematics felt like just numbers, but with these LKPDs, we are taught directly through the culture and activities around us, such as the size of Gampiri and the capacity of storage for harvests. So, we can see the direct benefits of learning mathematics.

Students' interest in LKPD based on local wisdom is reinforced by the results of the student questionnaire analysis (Table 7), which shows that the majority of students have a positive perception of LKPD based on local wisdom. As many as 80% of students felt that LKPDs adapted to local culture helped them better understand SPLDV material. Students also reported that learning with a local wisdom approach made them more interested and motivated in learning mathematics, because the concepts presented felt more relevant and meaningful.

Table 7. Results of Student Response Questionnaire Analysis

Assessment Aspects	Percentage (%)	Description
Understanding the Material	80	Most students believe that LKPD can help them understand SPLDV material
Interest in LKPD	85	Students find the worksheets interesting and relevant.
Motivation	80	Students feel more motivated to learn mathematics, especially SPLDV

After the learning process, a post-test was conducted to measure students' numeracy skills. The collected data was then analyzed to assess the effectiveness of the LKPD and the improvement in students' numeracy skills. The results of the pre-test and post-test analysis are as follows:

Tabel 8. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pre Test	90	4.3	76.2	42.86	18.58
Post Test	90	37.5	100	84.17	15.26
Valid N (listwise)	90				

Table 9. Paired Samples Test

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Sebelum - Sesudah	-42.09844	19.29541	2.03391	-46.13979	-38.05710	-20.698	89	.000

Based on Table 8, data analysis was conducted, and it was found that the average test score before using the LKPD teaching materials (pre-test) was 42.86 with a maximum score of 76.2 and a minimum score of 4.3, while after using the LKPD teaching materials, the average post-test score was 84.17 with a maximum score of 100 and a minimum score of 37.5. The correlation result (*r*) was 0.32. The average value of the pre-test and post-test data was calculated to determine the comparison before and after using LKPD based on local wisdom. The average pre-test and post-test scores were calculated using the *cohens'd* formula. The *effect size* score of the students was 2.06, which is in the very large category. The results of this effect size calculation can be concluded that the LKPD developed can improve students' numeracy literacy. Based on Table 9, the P-value (0.00) of 0.05 indicates that there is a significant difference between before and after the implementation of LKPD based on local wisdom.

Based on the results of research conducted to measure the effectiveness of Student Worksheets (LKPD) based on local wisdom in improving students' numeracy literacy, it can be concluded that the use of these LKPDs has a significant impact on students' understanding of the material, interest, and motivation in learning mathematics, particularly in the subject of Two-Variable Linear Equation Systems (SPLDV).

1. Improved Understanding of Materials and Numeracy Literacy

The results of the pre-test and post-test analysis show a significant increase in students' numeracy literacy after using LKPD based on local wisdom. The average pre-test score was 42.86 with a minimum score of 4.3 and a maximum score of 76.2, while the average post-test score increased sharply to 84.17 with a minimum score of 37.5 and a maximum score of 100. This shows that the majority of students experienced a substantial increase in their understanding of SPLDV material. These

results are in line with findings from previous studies showing that teaching that relates material to everyday life or local culture can help students understand abstract concepts, as found by researchers who emphasize the importance of direct experience and contextual relevance in the learning process (Anwar & Mailizar, 2021; Fouze & Amit, 2018, 2019; Ramadhani et al., 2025).

This improvement in numeracy literacy is also reflected in the analysis of the effect size score of 2.06, which falls into the very large category. This large effect size indicates that LKPD based on local wisdom has a strong impact on improving students' numeracy skills. This can be understood by referring to Piaget's (1972) constructivist learning theory, which states that learning based on concrete experiences and the socio-cultural relevance of students will strengthen their understanding of the subject matter (Brown, 1989; Harlow et al., 2006; Kamii & Ewing, 1996; Mcleod, 2024).

2. The Influence of Local Culture on Interest and Motivation in Learning

Students involved in this study revealed that they felt more interested and motivated in learning mathematics through the use of LKPD based on local wisdom. A total of 85% of students reported that these worksheets were interesting and relevant, while 80% of students felt more motivated in learning mathematics, especially in SPLDV material. This shows that a local wisdom-based approach can increase students' emotional involvement in learning, which can contribute to increasing their intrinsic motivation.

According to Deci and Ryan's theory of motivation, intrinsic motivation increases when students feel that the material being studied is relevant and meaningful to them (Deci, 2000). In this context, LKPD based on local wisdom provides a context that is familiar to students, so that they feel that mathematics is not just a matter of calculating numbers, but something that can be applied in their daily lives. The application of local culture in mathematics learning, as seen in the story about "*Tonda*" and the calculation of prices and profits, links mathematical concepts to students' social experiences, which helps them understand the practical benefits of mathematics.

3. Implications of Learning with LKPD Based on Local Wisdom

The use of LKPD based on local wisdom can be an effective strategy in improving numeracy literacy among students, especially in areas rich in local culture such as Sigi Regency. Learning that integrates local contexts can motivate students to become more interested in studying mathematics because they can directly see the relevance of mathematical concepts to their daily activities (Alaudin, 2024). This shows that mathematics teaching must involve more local social and cultural contexts, which can improve students' understanding of the material.

In addition, these findings show that LKPD based on local wisdom can also be used to overcome challenges often faced by students, such as a low level of basic mathematical understanding and limited literacy. This is in line with the results of Roviana's research, which states that the Application of Local Culture-Based LKPD Learning Media to Improve Students' Mathematics Learning Outcomes (Roviana et al., 2024; Saputra et al., 2024). By creating more interesting and relevant learning materials, students become more enthusiastic about participating in lessons, even if they initially have poor basic skills.

4. Recommendations for Learning Development

Based on the results of this study, it is recommended that LKPD based on local wisdom be used more widely in various schools, especially in areas with rich local culture. Further development of LKPD can include more diverse material, in accordance with the local context of each region. In addition, further research can examine the long-term impact of using LKPD based on local wisdom on improving students' mathematical competence and motivation to learn.

CONCLUSION

Overall, this study shows that LKPD based on local wisdom has a significant difference on students' understanding of the

material, interest, and motivation in learning mathematics, especially in SPLDV material, where there was an increase in the average numeracy test results of students before and after the implementation of LKPD based on local wisdom.

The application of local wisdom in mathematics learning makes the material more relevant and meaningful to students, which in turn improves their numeracy literacy. Therefore, the use of LKPD based on local wisdom can be an effective alternative to improve the quality of mathematics education in Indonesia, especially in areas with a rich local culture. In addition, this study provides a basis for designing teaching materials that are not only based on academic theory but also include cultural elements that are relevant to students. By incorporating local cultural values into education, students not only learn mathematics but also gain a deeper understanding of their own culture, which supports the development of their character and local identity.

This study has several limitations. First, the sample size (N=90) cannot be generalized to the population of junior high school students in Sigi Regency. Second, this study used interviews, which have limitations in terms of the depth of data obtained, because the responses received depend on the participants' ability and willingness to share information. Therefore, the interviews may not fully represent the views or experiences of students and teachers in all schools studied.

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AUTHOR CONTRIBUTIONS

Author One: Conceptualization, Methodology, Formal analysis, Investigation, Resources, writing - original draft, editing, and visualization;
Author Two: formal analysis, Investigation, and Writing - Review & Editing.

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