Kognitif
Jurnal Riset HOTS Pendidikan Matematika
Volume - 6 No - 3 2026 Page 1329 – 1343
ISSN 2776-9704 P-ISSN 2776-9984
https://doi.org/10.51574/kognitif.v6i3.5724

Development of a Mathematics Learning Module Based on Bugis-Makassar Culture for Systems of Linear Equation in Two Variables

Nurfadillah Umar, Andi Dian Angriani, Fitriani Nur

How to cite: Umar, N., Angriani, A. D., & Nur, F. (2026). Development of a Mathematics Learning Module Based on Bugis-Makassar Culture for Systems of Linear Equation in Two Variables. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, *6*(3), 1329–1343. https://doi.org/10.51574/kognitif.v6i3.5724

To link to this artcle: https://doi.org/10.51574/kognitif.v6i3.5724

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i3.5724 Volume 6, No 3, July - September 2026, pp. 1329 –1343

Development of a Mathematics Learning Module Based on Bugis-Makassar Culture for Systems of Linear Equation in Two Variables

Nurfadillah Umar[1], Andi Dian Angriani[1], Fitriani Nur[1*]

[1]Department of Mathematics Education, Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Alauddin Makassar

Article Info

Article history:

Received Aug 20, 2026
Accepted Aug 27, 2026
Published Online Aug 31, 2026

Keywords:

Bugis–Makassar Culture
Learning Module
Linear Equation
Research and Development

ABSTRACT

The limited availability of mathematics instructional materials that incorporate local cultural elements, particularly Bugis–Makassar culture, represents a notable gap in contextual mathematics education. Prior studies suggest that integrating local culture into mathematics learning can enhance students' conceptual understanding and contextual relevance. This study aims to describe the development procedure and evaluate the quality of a mathematics module grounded in Bugis–Makassar culture for the topic of systems of linear equations in two variables (SLETV), assessed against criteria of validity, practicality, and effectiveness. Using a Research and Development (R&D) design based on the ADDIE model, the study involved 30 Grade VIII students at MTs Madani Alauddin. Data were collected through teacher and student response questionnaires, student activity observation sheets, module implementation sheets, and learning outcomes tests and were analyzed descriptively across the three quality dimensions. The developed module met all three criteria: it achieved an average validity score of 3.7 (on a 1–4 scale), an 88% teacher response rate, and an implementation score of 1.9 (on a 1–2 scale), indicating strong practicality. Effectiveness was evidenced by an 88% positive student response rate, an 85% learning activity rate, and a 90% mastery rate on learning outcomes. These findings suggest that the module is feasible for classroom use. The novelty of this study lies in its explicit integration of Bugis–Makassar cultural context into a mathematics module on the SLETV topic, offering a contextual and culturally responsive learning resource for students.

Corresponding Author:

Fitriani Nur,
Department of Mathematics Education,
Faculty of Tarbiyah and Teacher Training,
Universitas Islam Negeri Alauddin Makassar,
Jl. H. M. Yasin Limpo No. 36, Romangpolong, Somba Opu, Gowa Regency, South Sulawesi 92113, Indonesia
✉ fitrianinur@uin-alauddin.ac.id

Introduction

Systems of Linear Equations in Two Variables (SLETV) is a mathematics topic that remains empirically difficult for students to comprehend, particularly in translating contextual

problems into mathematical models. This condition is closely related to the lack of learning materials that connect SLETV concepts with the daily life and cultural contexts familiar to students. For instance, visual bridges such as the GeoGebra media have been used to contextualize trigonometry materials (Bhoke & Bara, 2021). Several factors contribute to suboptimal mathematics learning outcomes, including a learning process that tends to emphasize rote learning and mastery of formulas. In these settings, teachers have not aligned mathematics instruction with contextual learning, which would help students understand the connection between mathematical concepts and everyday life problems. Furthermore, mathematics instruction often pays insufficient attention to reasoning and problem-solving skills (Harahap, 2025; Mahpudin & Yuliati, 2019). Consequently, improvements are necessary in both the learning process and the availability of learning resources to maximize student outcomes.

A teacher's ability to develop instructional materials is crucial to the success of mathematics learning (Bakhrodin & Istiqomah, 2019; Rohayati et al., 2017). As instruments for conceptual understanding, instructional materials must be designed to foster students' active engagement in constructing their knowledge (Saluky, 2016; Sangi et al., 2024; Ainiah et al., 2024). The effectiveness of these materials increases significantly when the content presented is relevant to students' actual characteristics and needs (Mahpudin & Yuliati, 2019). Therefore, integrating culture or local wisdom as a contextual learning resource is a strategic step toward creating more meaningful, concrete, and impactful mathematics instruction, thereby enhancing learning outcomes.

Ethnomathematics is a field of study that explains the relationship between mathematics and culture. The term ethnomathematics is defined as the art of understanding, explaining, learning, coping with, and managing the natural, social, and political environment through processes such as counting, measuring, classifying, modeling, and inferring, which are produced by well-identified cultural groups (D'Ambrosio Ubiratan, 1985). In other words, ethnomathematics refers to mathematics practiced within identified cultural groups (D'Ambrosio, 1989). The culturally rich lives of the Indonesian people shape students' characteristics in accordance with the culture developing in their respective environments, making culture inseparable from their daily lives. Therefore, instructional materials with local cultural contexts address students' daily life contexts. Thus, developing mathematics materials based on cultural values has great potential to create an effective learning environment that achieves the expected learning goals.

Dahlan & Permatasari (2018) found that ethnomathematics-based materials on sets enabled students to construct mathematical knowledge inductively, although they still faced difficulties in formulating formal mathematics. However, students were quite creative in responding to the problems presented, communicated ideas, showed curiosity, collaborated with clear roles, and, crucially, acquired knowledge of social and cultural values. Observations conducted by researchers in Grade VIII at MTs Madani Alauddin revealed that the textbook used lacked cultural elements, which contradicts existing theories and previous research. Based on this issue, there is a clear need for learning materials that integrate mathematics with cultural elements. One such learning material is a module. A module is a written workbook designed to enable students to learn independently, with or without teacher assistance, containing learning instructions, target competencies, material descriptions, supporting information, exercises, work guidelines, and evaluations.

The Bugis-Makassar cultural contexts used in this study include the motifs and structures of traditional houses (*Balla Lompoa*), the traditional Phinisi boat, and the measurement patterns in traditional market transactions, which are used as illustrations and as contextual word

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i3.5724 Volume 6, No 3, July - September 2026, pp. 1329 –1343

problems for SLETV. The module was developed in print form (rather than an e-module) due to students' limited access to digital devices and internet connectivity at the research site, making printed modules more applicable for individual or group use in the classroom. Based on the literature, previous research on local culture-based mathematics materials has generally focused on Javanese, Batak, or Kediri cultures, whereas the integration of Bugis-Makassar culture specifically for SLETV has been examined only to a limited extent. This gap constitutes the novelty of this study: the development of a Bugis-Makassar culture-based mathematics learning module specifically designed for Grade VIII SLETV. This study aims to answer the following research questions: (1) what is the development procedure of the Bugis-Makassar culture-based mathematics module for the SLETV topic? and (2) what is the quality of the resulting module in terms of validity, practicality, and effectiveness?

Method

Design and Participants

The research design employed in this study is Research and Development (R&D). This design was selected because the study aims to develop and test the feasibility of a learning product (the learning module), which requires a systematic procedure from needs analysis to product evaluation that cannot be accomplished through standard descriptive approaches. The development model used is ADDIE. As the name suggests, the ADDIE model consists of five main phases: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009). This study is descriptive-quantitative and aims to develop a mathematics instructional module based on Bugis–Makassar culture. The research was conducted at MTs Madani Alauddin, involving 30 Grade VIII D students, consisting of 16 males and 14 females.

Instruments

The research instruments used in this study consisted of five types: (1) validation sheets, used by expert validators to assess the feasibility of the module, Lesson Plans (RPP), and other research instruments before field testing; (2) teacher response instruments, in the form of a questionnaire to determine the teacher's perspective on the module's practicality; (3) student response instruments, in the form of a questionnaire to assess students' opinions after using the module; (4) student activity instruments, in the form of observation sheets to monitor student engagement during learning; dan (5) learning outcomes tests, used to measure students' competency achievement in the SLETV material after module-based instruction. Expert validators assessed all instruments before use to ensure the validity of the collected data in Table 1.

Table 1. Test Blueprint and Item Specifications

Basic Competence	Indicator	Sample Question
Explain systems of linear equations in two variables (SLETV) connected to the Bugis-Makassar cultural context	Write examples and non-examples of systems of linear equations in two variables	The price of a *baju bodo* (traditional blouse), a *jas tutu'* (traditional jacket), and a *songkok racca'* (traditional cap) at a cultural clothing store is Rp550,000.00. Meanwhile, the price of 2 *baju bodo* and 1 *jas tutu'* is Rp450,000.00.
Solve real-world problems related to SLETV	Create mathematical models from daily life problems related to SLETV	To commemorate the Prophet Muhammad's Maulid on 12 Rabiul Awal, Mrs. Ondeng wants to make white and black *Sokko/Songkolo* (sticky rice). Mrs. Ondeng goes to the market to buy white and black

Basic Competence	Indicator	Sample Question
		glutinous rice. She buys 4 liters of white glutinous rice and 2 liters of black glutinous rice for Rp100,000.00. Meanwhile, the price for 2 liters of white glutinous rice and 1 liter of black glutinous rice is Rp50,000.00. Write two equations that represent this information. Use the letters x and y as variables!
Solve real-world problems related to SLETV using the graphical method	Solve real-world problems related to SLETV using the graphical method	At a *Pallu Basa* (Makassar traditional beef soup) food stall, there are 2 packages listed on the menu: Package A (1 portion of *pallu basa* + 1 portion of rice) for Rp16,000.00, and Package B (2 portions of *pallu basa* + 1 portion of rice) for Rp28,000.00. Rini wants to know the individual prices of a portion of *pallu basa* and a portion of rice. Help Rini find the price of each using the graphical method!
Solve real-world problems related to SLETV using the elimination method	Solve real-world problems related to SLETV using the elimination method	Dg. Bolong owns a traditional clothing boutique. For a certain type of *songkok racca'*, if Dg. Bolong sells 2 more caps, she obtains the same total amount of money. The selling price of 1 *songkok racca'* is Rp20,000.00 cheaper than its normal price. If Dg. Bolong sells 2 fewer pairs, she also obtains the same total amount of money. The selling price of 1 *songkok racca'* is Rp40,000.00 more expensive than its normal selling price. (Solve using the elimination method). How many *songkok racca'* did Dg. Ngawing sell for this type? What is the normal price of 1 *songkok racca'*?
Solve real-world problems related to SLETV using the substitution method	Solve real-world problems related to SLETV using the substitution method	Mr. Andi owns a Bugis traditional house whose foundation/body (*ale bola*) is rectangular with a perimeter of 32 meters. The length is 2 meters longer than its width. Determine the length and width of the house body (*ale bola*) using the substitution method!

Procedures

The development of this module followed the five systematic phases of the ADDIE model. The Analysis phase comprised performance analysis, which identified the study's core problem (limited use of Bugis-Makassar culture-based mathematics materials) and confirmed the need for a programmatic solution rather than mere management improvement (Pribadi, 2017), and needs analysis, which determined the competencies students must master by identifying problems, defining basic competencies and learning objectives, assessing students' knowledge, attitudes, and skills, selecting relevant topics, and compiling supporting references. In the Design phase, findings from the needs analysis were translated into a structured draft aligning classroom needs with development capabilities (Farhatin et al., 2020); this involved determining the module title, compiling reference sources, mapping basic competencies to the curriculum, designing learning activities and competency indicators, planning assessment formats, and drafting the overall layout.

The Development phase produced a print-format module that is attractive, varied, and communicative, featuring supporting text and visuals, standard writing conventions, and

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i3.5724 Volume 6, No 3, July - September 2026, pp. 1329 –1343

content integrating Bugis-Makassar culture. The Implementation phase tested the module's practicality—its ease of use, benefits, and time efficiency for students and teachers—through participant briefing, module distribution, guided reading, and questionnaire completion on the culture-based learning experience. Finally, the Evaluation phase assessed the module's feasibility based on implementation results and guided a second revision, using qualitative and quantitative descriptive analysis to interpret validation and practicality outcomes.

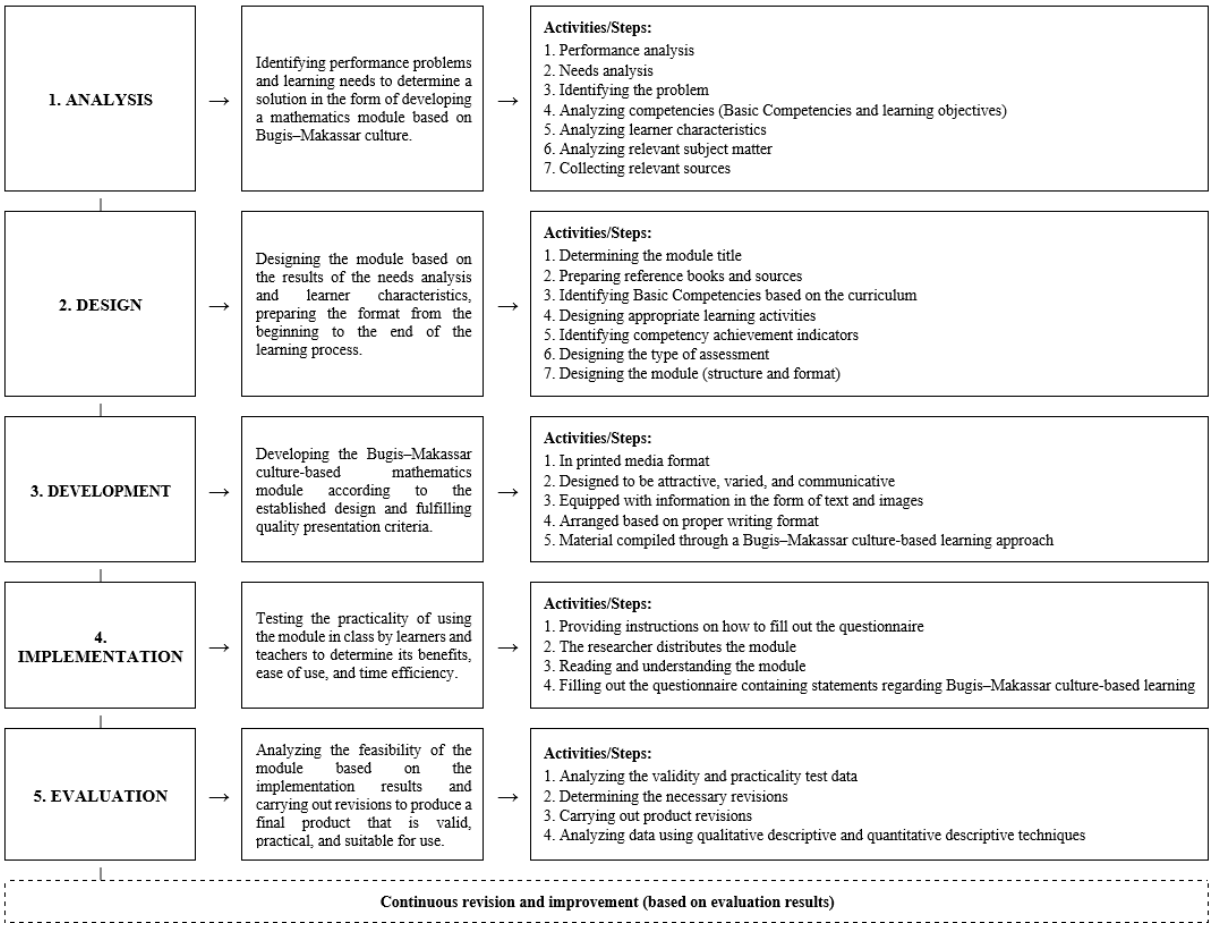

Figure 1. Research Procedure Flowchart

Data Collection

Data were collected using validation sheets, module implementation observation sheets, student and teacher response questionnaires, learning observation sheets, and learning outcomes tests, then analyzed to evaluate the module's validity, practicality, and effectiveness. Non-test techniques (validation sheets, response questionnaires, and implementation observation sheets) captured validity and practicality data, while test techniques captured student learning outcomes. Validity data came from expert validators via validation sheets assessing content adequacy, language appropriateness, presentation quality, design feasibility, and alignment with the learning model; feedback from these instruments guided revisions until the module achieved valid status. Practicality data, drawn from module implementation observation sheets and student and teacher response questionnaires, determined whether the module could be effectively implemented in classroom learning. Effectiveness data, gathered through student activity and classroom management observation sheets alongside learning outcomes tests, determined whether the module produced the expected educational outcomes.

Data Analysis

Data analysis in this study comprised three main analyses: validity, practicality, and effectiveness.

Validity

The data analysis technique used to evaluate validity involved averaging the scores provided by experts/practitioners on the validation sheets. The validity category was then determined based on the actual average score using the intervals shown in Table 2. The module is considered valid if it meets at least the "Valid" category and at most the "Very Valid" category.

Table 2. Validation Categories

Interval	Category
$3{,}5 \leq M \leq 4$	Very Valid
$2{,}5 \leq M < 3{,}5$	Valid
$1{,}5 \leq M < 2{,}5$	Fair
$M < 1{,}5$	Invalid

Practicality

The technique used to determine module practicality involved module implementation sheets and teacher response questionnaires. In analyzing the module implementation data, the criterion for determining whether the Bugis-Makassar culture-based module was sufficiently implemented was an average score (M) at least in the "Partially Implemented" category, indicating that the module did not require revision. The evaluation criteria for module implementation are as Table 3

Table 3. Module Implementation Categories

Interval	Category
$1{,}5 \leq M \leq 2$	Fully Implemented
$0{,}5 \leq M < 1{,}5$	Partially Implemented
$0 \leq M < 0{,}5$	Not Implemented

The criterion for declaring that the Bugis-Makassar culture-based module implementation reached an adequate level was that the aspect and overall average scores were at least in the "Partially Implemented" category, meaning no revisions were required. Teacher response data were obtained from the teacher response questionnaire by calculating the average response to each question or statement within each aspect, with "negative" representing scores of 1 and 2 and "positive" representing scores of 3 and 4. The teacher response categories are defined in Table 4

Table 4. Teacher Response Categories

Average Score	Category
1,0 – 1,4	Negative
1,5 – 2,4	Tending to Negative
2,5 – 3,4	Tending to Positive
3,5 – 4,0	Positive

The response percentage was calculated using the following formula:

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i3.5724 Volume 6, No 3, July - September 2026, pp. 1329 –1343

$$Response\ Percentage = \frac{Number\ of\ Positive\ Teacher\ Responses\ for\ Each\ Aspect}{Number\ of\ Teachers} \times 100\%$$

The category for positive responses was determined by matching the percentage with the established criteria. If the analysis indicated that the teacher's response was not positive, revisions were made to the learning process regarding the low-scoring aspects. If the overall analysis showed a non-positive teacher response, revisions were made to the developed materials. The established criterion for a positive teacher response is at least 50% (Arsyad, 2016).

Effectiveness

The effectiveness of the developed module was evaluated through three measurement criteria: student response questionnaires, student activity observation sheets during mathematics instruction, and learning outcomes tests (THB). Student response data were obtained via questionnaires and analyzed by counting the number of students who responded to each question or statement, with "negative" representing scores of 1 and 2 and "positive" representing scores of 3 and 4. The student response categories are specified in Table 5

Table 5. Student Response Categories

Average Score	Category
1,0 – 1,4	Negative
1,5 – 2,4	Tending to Negative
2,5 – 3,4	Tending to Positive
3,5 – 4,0	Positive

The response percentage was calculated using the following formula:

$$Response\ Percentage = \frac{Number\ of\ Positive\ Student\ Responses\ for\ Each\ Aspect}{Number\ of\ Student} \times 100\%$$

The positive response category was verified by matching the percentage results with the criteria. If student responses were not positive, revisions were applied to the instructional process regarding lower-rated aspects. If the overall response was not positive, the developed materials were revised. A positive student response requires a minimum threshold of 50% (Arsyad, 2016). Student activity data analysis. Observational data from student activity sheets were used to monitor learning processes and progress. The percentage of student activity was calculated using the formula:

$$Percentage\ (P) = \frac{Score\ Obtained}{Maximum\ Score} \times 100\%$$

The student activity percentage categories are detailed in Table 6

Table 6. Student Activity Categories

Average Score	Category
P ≥ 81%	Excellent
61% ≤ P < 80%	Good
41% ≤ P < 60%	Fairly Good
21% ≤ P < 40%	Poor
P < 20%	Very Poor

The criterion for determining that student activity in the learning process is adequate is that the student percentage (P) must fall at least in the "Good" category, indicating that student activity can be maintained. If the percentage falls below this threshold, students must adjust their activities to focus on the lower-scoring aspects. Subsequent observations are conducted and analyzed until the student activity percentage reaches at least the "Good" category (Yakub, 2019). Learning outcomes analysis : Data on students' mathematics learning outcomes were analyzed quantitatively using descriptive statistics to describe students' conceptual understanding of linear equations and inequalities after instruction with the Bugis-Makassar culture-based module, using the categorization standards of the Ministry of National Education (Nurhusain, 2012): 91%-100% (or score 91–100): Very High; 75%-90% (or score 75–90): High; 60%-74% (or score 60–74): Moderate; 40%-59% (or score 40–59): Low; 0%-39% (or score 0–39): Very Low. To determine individual student mastery (learning mastery), the following equation was used:

$$KB = \frac{T}{T_1} \times 100\%$$

Note:
KB = Learning mastery
T = Score obtained by the student
T_1 = Total maximum score

Student learning outcome analysis focused on individual or classical mastery. An individual student is declared to have passed (mastered) if they achieve at least the minimum passing criterion (KKM) of 78. The instruction is declared classically successful if at least 70% of students achieve the minimum score.

Results

Development Process of The Bugis-Makassar Culture-Based Learning Module

The development of the module followed the five phases of the ADDIE model systematically. In the *Analysis* phase, researchers identified that students required SLETV learning materials contextualized with local culture. In the *Design* phase, the module framework was drafted, containing concept maps, competence indicators, and Bugis-Makassar cultural illustration concepts. In the *Development* phase, the draft module was written and validated by three expert validators to achieve a trial-ready product. In the *Implementation* phase, the module was field-tested in Grade VIII D through several steps: distributing the modules, providing brief explanations on how to use them, directing students to learn the SLETV content individually and in groups under teacher guidance for six sessions, and then administering questionnaires and a learning outcomes test. In the *Evaluation* phase, all collected data were analyzed to determine feasibility and final revisions. The final product was an A5-sized printed book featuring a cover with Bugis weaving patterns, a concept map, SLETV topics integrated with Bugis-Makassar cultural contexts (such as word problems involving Phinisi boats and *Balla Lompoa* traditional houses), sample problems, independent exercises, summaries, and evaluations at the end of each learning activity. The developed Bugis-Makassar Culture-Based Learning Module layout is structured as follows in Figure 2, Figure 3, and Figure 4.

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i3.5724 Volume 6, No 3, July - September 2026, pp. 1329 –1343

Figure 2. Module Content Layout

Figure 3. Guidelines for Module Use

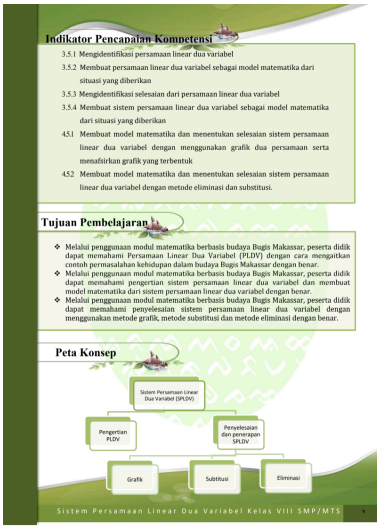

Figure 4. Concept Map

Validity

Validation was conducted to assess the quality of the developed module and instruments using expert ratings. Validation occurred in two stages. The first stage involved submitting the initial draft, which generated feedback and revision suggestions from the validation team. The second stage involved submitting the revised module in accordance with the validators' suggestions. After revision, the product was re-evaluated. In this stage, validators provided final scores for the learning materials and assessment instruments (In Table 7).

Table 7. Validation Result

Research Material/Instrument	Score	Category
Module	3.6	Very Valid
Teacher response instrument	3.7	Very Valid
Student response instrument	3.7	Very Valid
Learning implementation observation sheet	3.9	Very Valid
Student activity observation sheet	3.8	Very Valid
Lesson Plan (RPP)	3.5	Very Valid
Learning outcomes test	4.0	Very Valid
Average	**3.7**	**Very Valid**

Table 7 shows that all research materials and instruments achieved an average validity score of 3.7, falling within the interval of $3.5 \leq M \leq 4.0$ (Very Valid category). This indicates that the learning module and research instruments were highly feasible and ready for field trials. The validated module was subsequently tested to observe its practicality and effectiveness

Practicality

The teacher response questionnaire was completed by a Grade VIII mathematics teacher at MTs Madani Alauddin after reviewing the Bugis-Makassar culture-based mathematics module for SLETV. The learning implementation instrument was completed by the researcher, who served as an observer during the research (In Table 8).

Table 8. Practicality Analysis Results

Instrument	Data Source	Number of Aspects	Result	Criterion	Category
Teacher Response Instrument	Grade VIII Mathematics Teacher at MTs Madani Alauddin	9	**88,89 %**	≥ 50%	**Positive**
Learning Implementation Instrument	Researcher (Observer)	-	**1,95**	1,5 ≤ M ≤ 2,0	**Fully Implemented**

The teacher's response yielded an 88.89% positive response across 9 evaluation aspects. Since 88,89% ≥ 50%, it is categorized as positive. Meanwhile, the average score for the module implementation observation sheet was 1.95, falling into the "Fully Implemented" category because it lies within the interval $1{,}5 \leq M \leq 2$. The analysis of both teacher response and module implementation instruments indicated that all evaluated components were fully implemented, concluding that the Bugis-Makassar culture-based mathematics learning module for SLETV meets the criteria for practicality.

Effectiveness

Classroom implementation spanned six sessions, where students studied SLETV individually and in groups using the Bugis-Makassar culture-based module under teacher guidance. In each session, students solved contextual word problems integrated with local culture, discussed in groups, and presented their solutions. In the final session, students completed response questionnaires and the learning outcomes test (Table 9).

Table 9. Effectiveness Analysis Results

Evaluated Aspect	Result	Criterion	Category
Student Response	88% (10 aspects)	≥ 50%	**Positive**
Student Activity	Average 4.26 (85%)	P ≥ 81%	**Excellent**
Learning Outcomes	Average 90	81 – 100	**Very High**
	Conclusion		**Effective**

Thus, the students' learning outcomes test scores met the mastery standard, concluding that the developed learning module successfully meets the effectiveness criteria.

Discussion

Overall, the findings of this study demonstrate that the Bugis-Makassar culture-based mathematics learning module for SLETV was successfully developed and met the criteria of validity, practicality, and effectiveness, making it feasible for contextual classroom instruction. The validation results categorized the module as very valid. This finding aligns with several previous studies indicating that local wisdom or culture-based mathematics learning materials are consistently rated as valid or very valid by experts across media, content, cultural, linguistic, and design aspects (Utami et al. 2018; Ferdianto dan Setiyani, 2018; Suprana dan Farida, 2019; Laia et al., 2026). The consistency of these findings reinforces the conclusion that culture-based instructional material development generally yields high-quality validation, confirming that the Bugis-Makassar module in this study has comparable, and in some respects higher, quality than similar products in other cultural contexts. This alignment is due to both this study and previous

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i3.5724 Volume 6, No 3, July - September 2026, pp. 1329 –1343

research implementing rigorous, multi-stage validation by subject-matter, media, and language experts before field trials, ensuring that content adequacy, presentation, and student compatibility are meticulously evaluated during the development phase. Additionally, using familiar contexts that are close to students' lives has consistently been shown to improve the quality of module content.

In terms of practicality, the positive teacher response and full learning implementation indicate that the module is easy to implement in classroom instruction. This finding aligns with Bella et al. (2023), who stated that the practicality of learning media is reflected in positive teacher responses and the feasibility of field implementation. This is also consistent with Aini et al. (2018), who obtained an average learning material validity score of 3.97 (valid) and found student responses to be practical and engaging during wide trials. Similarly, Harahap et al. (2026) support this finding, reporting that a Batak Angkola culture-based mathematics module for SLETV achieved an average practicality score of 66% and positive student acceptance. This study also indicated that integrating local culture into learning materials helps present mathematical concepts in a contextual and meaningful way. This consistency shows that local culture integration not only increases content validity but also facilitates practical implementation by teachers in the field.

Regarding effectiveness, the student response questionnaire showed 88% positive responses, student activity averaged 4.26 (85%, Excellent category), and learning outcomes mastery showed that 70% of students scored between 91–100 (classical mastery), demonstrating that the Bugis-Makassar culture-based module significantly enhances students' understanding of SLETV. This aligns with Farhatin et al. (2020), who showed that local wisdom-based instructional materials were rated highly by content experts (80%) and media experts (85%) and achieved an 81% positive student response rate. Furthermore, this finding is supported by Ali et al. (2026), who developed a Tabuik Pariaman culture-based ethnomathematics module using a Contextual Teaching and Learning (CTL) approach, showing valid, practical, and effective results, with a 69% efficacy rate in improving students' mathematical problem-solving skills. Similarly, Wirajaya et al. (2026) developed ethnomathematics student worksheets (LKPD) based on traditional Kediri foods for the volume topic, showing a significant increase in student learning outcomes post-intervention ($p = 0.00029$, One-Way ANOVA). The consistency of these results across different educational levels and cultural contexts strengthens the argument that integrating local culture into mathematics materials not only boosts student interest and engagement but also significantly impacts academic achievement. Thus, integrating Bugis-Makassar culture into the developed module is key to establishing a contextual, meaningful, and effective SLETV learning environment.

Theoretical implications, the findings of this study enrich ethnomathematics research by demonstrating that integrating local culture into mathematics learning materials consistently improves content quality, implementation, and learning outcomes across cultures, including the Bugis-Makassar culture, which was previously underrepresented in SLETV module development. These findings also support contextual teaching and learning (CTL) theory and culturally responsive pedagogy (CRP), which assert that abstract mathematical concepts are more easily understood and meaningful when linked to the social-cultural realities and experiences of students' daily lives. Practical implication, the developed module can be directly used by mathematics teachers and other schools with Bugis-Makassar cultural backgrounds as a contextual learning resource for SLETV, and can serve as a reference for teachers and researchers developing local culture-based mathematics materials on other topics. This module can also be utilized in teacher professional development programs, such as Subject Teacher

Forums or instructional material development training, as a concrete example of how local wisdom can be integrated into mathematics without compromising scientific rigor.

Another implication is the importance of school and local education department policies in encouraging the formulation of mathematics materials that integrate local wisdom as part of curriculum contextualization and Bugis-Makassar cultural preservation through formal education. This aligns with the "Kurikulum Merdeka" framework, which emphasizes local content integration and project-based learning, and supports the global diversity dimension of the Profil Pelajar Pancasila, stressing the importance of recognizing, respecting, and preserving local culture as part of national identity. Thus, local culture-based modules serve not only to achieve mathematical competence but also to strengthen cultural identity and students' pride in their Bugis-Makassar heritage. Methodological implication, this study demonstrates that the ADDIE development model can be applied to produce valid, practical, and effective culture-based mathematics learning materials, providing a procedural reference for other researchers. For scientific development, these findings open opportunities for further research to test the effectiveness of local culture-based modules in other mathematical topics and educational levels, including the potential development of digital or interactive formats to expand accessibility and engagement, thereby strengthening the generalizability of ethnomathematics approaches.

Conclusion

The developed Bugis-Makassar culture-based mathematics learning module on Systems of Linear Equations in Two Variables (SLETV) has met the criteria for validity, practicality, and effectiveness. The module and validated research instruments were categorized as "Very Valid" with an average score of 3.7. Practicality was demonstrated by an 88% teacher response rate and a module implementation score of 1.9 (Fully Implemented). Effectiveness was indicated by an 88% positive student response rate, an 85% student learning activity rate (Excellent category), and student learning outcomes mastery reaching 70% in the very high category. This study has several limitations, including the scope of participants restricted to one class (Grade VIII D) in a single school, meaning the results may not be generalizable to other schools or regional contexts. Additionally, the study focused solely on the SLETV topic and did not cover other mathematics topics suitable for integration with Bugis-Makassar. Based on these limitations, future research is recommended to expand the scope of participants across multiple schools with diverse characteristics and to develop Bugis-Makassar culture-based modules for other mathematics topics to enrich ethnomathematics learning resources.

Conflict of Interest

The authors declare that there are no conflicts of interest.

Auhor Contributions

N.U. conceptualized the research idea and collected the data. The other two authors (A.D.A. and F.N.) actively contributed to the theoretical development, methodology, data organization and analysis, interpretation and discussion of the results, and approval of the final version of the manuscript. All authors read and approved the final version of the manuscript. The overall percentage contributions to the conceptualization, preparation, and revision of the manuscript were as follows: N.U.: 40%, A.D.A.: 30%, and F.N.: 30%..

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i3.5724 Volume 6, No 3, July - September 2026, pp. 1329 –1343

Data Availability Statement

The authors state that the data supporting the findings of this study will be made available by the corresponding author, F.N., upon reasonable request.

References

Aini, E. P., Masykur, R., & Komarudin, K. (2018). Handout Matematika berbantuan Etnomatematika Berbasis Budaya Lokal. *Desimal: Jurnal Matematika*, *1*(1), 73. https://doi.org/10.24042/djm.v1i1.1950

Ainiah, F., Kriswandani, & Nikmah, A. R. (2024). Peningkatan Hasil Belajar pada Materi Lingkaran Kelas XI 1 SMA Negeri 3 Salatiga Melalui Model Problem Based Learning Berbantuan Quizizz. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *8*(3), 2189–2201. https://doi.org/10.31004/cendekia.v8i3.3534

Ali, F. H., Jamaan, E. Z., Yerizon, Y., & Harisman, Y. (2026). Pengembangan Modul Ajar Etnomatematika Berbudaya Tabuik Pariaman Dengan Pendekatan Contextual Teaching And Learning Pada Keterampilan Pemecahan Masalah. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *15*(1). https://doi.org/10.24127/ajpm.v15i1.13993

Arsyad, N. (2016). *Model Pembelajaran Menumbuhkembangkan Kemampuan Metakognitif*. Pustaka Refleksi.

Bakhrodin, B., & Istiqomah, U. (2019). Identifikasi Etnomatematika Pada Masjid Mataram Kotagede Yogyakarta. *Jurnal Ilmiah Soulmath Jurnal Edukasi Pendidikan Matematika*, *7*(2), 113–124. https://doi.org/10.25139/smj.v7i2.1921

Bella, M. C. S., Sumilat, J. M., & Tarusu, D. T. (2023). Pengembangan Media Pembelajaran Berbasis Teknologi Untuk Meningkatkan Hasil Belajar Siswa SD Negeri 14 Manado. *Jurnal Ilmiah Wahana PendidikaN*, *9*(13), 723–729. https://doi.org/10.5281/zenodo.10149524

Bhoke, W., & Bara, F. E. (2021). Pengembangan Lembar Kerja Siswa (LKS) Berbasis Pendekatan Penemuan Terbimbing Berbantuan Geogebra Untuk Membelajarkan Materi Trigonometri Pada Siswa Kelas X SMA. *Jurnal Pendidikan Tambusai*, *5*(3), 10429–10443. https://doi.org/10.31004/jptam.v5i3.2648

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Springer. https://doi.org/10.1007/978-0-387-09506-6

D'Ambrosio, U. (1989). A research program and a course in the history of mathematics: Ethnomathematics. *Historia Mathematica*, *16*(3), 285–287. https://doi.org/10.1016/0315-0860(89)90026-8

D'Ambrosio Ubiratan. (1985). *Ethnomathematics and Its Place in the History and Pedagogy of Mathematics. "For the Learning of Mathematics."*

Dahlan, J. A., & Permatasari, R. (2018). Pengembangan Bahan Ajar Berbasis Etnomatematika dalam Pembelajaran Matematika Sekolah Menengah Pertama. *JNPM (Jurnal Nasional Pendidikan Matematika)*, *2*(1), 133–150. https://doi.org/10.33603/jnpm.v2i1.987

Farhatin, N., Pujiastuti, H., & Mutaqin, A. (2020). Pengembangan Bahan Ajar Matematika Berbasis Kearifan Lokal Untuk Siswa Smp Kelas Viii. *Prima: Jurnal Pendidikan Matematika*, *4*(1), 33. https://doi.org/10.31000/prima.v4i1.2082

Ferdianto, F., & Setiyani, S. (2018). Pengembangan Bahan Ajar Media Pembelajaran Berbasis Kearifan Lokal Mahasiswa Pendidikan Matematika. *JNPM (Jurnal Nasional Pendidikan Matematika)*, *2*(1), 37. https://doi.org/10.33603/jnpm.v2i1.781

Harahap, H. M. (2025). Analisis Kesulitan Belajar Matematika Siswa Kelas VIII MTs S Islamiyah Batu Ajo dan Strategi Guru dalam Mengatasinya. *Jejak Digital: Jurnal Ilmiah*

Multidisiplin, *1*(4), 2092–2099. https://doi.org/10.63822/fcbnbw98

Harahap, M. S., Harahap, A., Nasution, F. H., Nasution, N. F., Siregar, D. A., & Fadli, V. P. (2026). Pengembangan Modul Ajar Matematika Berbasis Budaya Lokal Batak Angkola: Studi Kepraktisan Pada Materi SPLDV. *URNAL MathEdu (Mathematic Education Journal)*, *9*(2), 120–125. https://doi.org/10.37081/mathedu.v9i2.8241

Herman Hudoyo. (2003). *Pengembangan Kurikulum Dan Pembelajaran Matematika* (1st ed.). Universitas Negeri Malang.

Indonesia, R. (2003). *Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional*. https://pusdiklat.perpusnas.go.id/regulasi/download/6

Laia, M. P., Mendrofa, N. K., & Telaumbanua, Y. N. (2026). Pengembangan Modul Pembelajaran Matematika Berbasis Kearifan Lokal Untuk Siswa SMP. *Emasains Jurnal Edukasi Matematika Dan Sains*, *15*(1), 27–43. https://doi.org/10.59672/emasains.v15i1.5727

Mahpudin, & Yuliati, Y. (2019). Pengembangan Bahan Ajar Matematika Berbasis Budaya Lokal Masyarakat Cirebon. *Jurnal Sekolah Dasar*, *4*(2), 50–56. https://doi.org/10.36805/jurnalsekolahdasar.v4i2.883

Nurhusain. (2012). Pengembangan Desain Pembelajaran Kooperatif Berbasis Kasus pada Siswa Kelas VII.3 SMP Negeri 1 Bontoramba. *UNM Makasssar*.

OECD. (2015). PISA 2015 Result in Focus. https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf

Pribadi, R. B. A. (2017). *Desain Sistem Pembelajaran*. Dian Rakyat.

Rohayati, S., Karno, W., & Chomariyah, I. (2017). Identifikasi Etnomatematika Pada Masjid Agung Di Yogyakarta. *Prosiding. Seminar Nasional Pendidikan Matematika*, 1–8.

Saluky, S. (2016). Pengembangan Bahan Ajar Matematika Berbasis Web Dengan Menggunakan Wordpress. *Eduma : Mathematics Education Learning and Teaching*, *5*(1). https://doi.org/10.24235/eduma.v5i1.685

Sangi, K. G., Rahmawati, T. D., & Jufriansah, A. (2024). Pengembangan Bahan Ajar Media Pembelajaran Berbasis Kearifan Lokal. *Edukasi Elita Jurnal Inovasi Pendidikan*, *1*(3), 1–13. https://doi.org/10.62383/edukasi.v1i3.167

Suprana, E., & Farida, N. (2019). Pengembangan Bahan Ajar Matematika Berbasis Etnomatematika pada Materi Geometri Transformasi. *Limacon: Journal of Mathematics Education*, *1*(1), 1–7. https://doi.org/10.24127/ajpm.v15i2.14261

Syahril, R. F., Saragih, S., & Suanto, E. (2023). Pengembangan Modul Ajar Berbasis Problem Based Learning Untuk Memfasilitasi Kecakapan Pemecahan Masalah Matematis. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(2). https://doi.org/10.24127/ajpm.v12i2.6923

Utami, R. E., Nugroho, A. A., Dwijayanti, I., & Sukarno, A. (2018). Pengembangan E-Modul Berbasis Etnomatematika Untuk Meningkatkan Kemampuan Pemecahan Masalah. *JNPM (Jurnal Nasional Pendidikan Matematika)*, *2*(2), 268. https://doi.org/10.33603/jnpm.v2i2.1458

Wirajaya, L., Marhamah, M., & Waluyo, E. (2026). Pengembangan LKPD Model Flip Berbasis Teori Vanhiele dengan Pendekatan Etnomatematika untuk Meningkatkan Berpikir Kreatif. *Educatio*, *21*(2), 377–389. https://doi.org/10.29408/edc.v21i2.36192

Yakub, R. D. (2019). *Pengembangan Perangkat Pembelajaran Matematika Berbasis Kontekstual Pada Materi Sistem Persamaan Linear Dua Variabel*. Alauddin Journal of Mathematics Education (AJME), *1*(2). https://doi.org/10.24252/ajme.v1i2.10968

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i3.5724 Volume 6, No 3, July - September 2026, pp. 1329 –1343

Authors Biography

	**Nurfadillah Umar** is an undergraduate student of the Mathematics Education Study Program, Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Alauddin Makassar, South Sulawesi, Indonesia. ✉ nurfadillahumar8@gmail.com
	**Andi Dian Angriani** is a lecturer and researcher in the Mathematics Education Study Program, Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Alauddin Makassar, South Sulawesi, Indonesia. ✉ dian.angriani@uin-alauddin.ac.id
	**Fitriani Nur** is a lecturer and researcher in the Mathematics Education Study Program, Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Alauddin Makassar, South Sulawesi, Indonesia. ✉ fitrianinur@uin-alauddin.ac.id