

# Integrating Language Literacy into the Teaching of Systems of Linear Equations in Two Variables: A Conceptual Framework for Instructional Module Development

Zen Yasmine Al Judith<sup>1</sup>

Walisongo State Islamic University, Indonesia

Correspondence: [zenyasminea@gmail.com](mailto:zenyasminea@gmail.com)

---

## Article Information

### Article History:

Received Jun 3<sup>th</sup>, 2026

Revised Sept 15<sup>th</sup>, 2026

Accepted Sept 24<sup>th</sup>, 2026

---

### Keywords:

instructional materials; language literacy; mathematical literacy; instructional module; systems of linear equations in two variables.

---

## ABSTRACT

This study aims to formulate a conceptual framework for developing an instructional module on Systems of Linear Equations in Two Variables (SLETV) that integrates language literacy through a synthesis of previous research. A structured literature review was conducted on 38 initially identified documents, which were screened to 10 core articles published between 2019 and 2025. Data were extracted according to the development model, media format, instructional approach, and findings related to validity, practicality, effectiveness, problem-solving, and mathematical literacy. The synthesis indicates that SLETV research is dominated by the ADDIE, 4-D, and modified Borg and Gall models, together with the use of e-modules, websites, flipbooks, e-worksheets, and problem-based learning. Although these products have generally been reported as feasible and supportive of mathematics learning, linguistic support for understanding contextual problems has not yet been designed explicitly and systematically. This study therefore proposes three core module components: reinforcement of mathematical vocabulary, deconstruction of word-problem discourse, and mathematical language production, supported by teacher scaffolding guidelines and integrated assessment. The resulting framework provides a theoretical basis for the subsequent development and empirical testing of SLETV modules that integrate language and mathematical literacy.



© 2025 Para Penulis. Diterbitkan oleh Riset Anak Bangsa. Ini adalah artikel akses terbuka di bawah lisensi CC BY (<https://creativecommons.org/licenses/by/4.0/>)

---

## INTRODUCTION

Mathematical literacy occupies a central position in twenty-first-century learning because success in mathematics can no longer be adequately measured solely by the ability to execute algorithms or obtain numerical answers. Students need to be able to recognize quantitative information, formulate mathematical relationships, select solution strategies, interpret results, and communicate mathematical reasoning across diverse contexts. This orientation is consistent with efforts to strengthen literacy and numeracy in Indonesian education, which position the ability to understand, use, and reason with information as a cross-curricular competence (Tenny et al., 2022). Recent studies also suggest that mathematical literacy develops through the interaction of conceptual knowledge, experience in solving contextual problems, instructional strategies, and students' ability to interpret situations presented through language (Sumliyah et al., 2025). Thus, mathematical literacy is concerned not only with mastery of mathematical operations but also with understanding verbal representations that serve as the entry point to mathematical modeling.

The language dimension becomes particularly important when students encounter word problems. Before engaging in symbolic manipulation, students must first identify the objects under discussion, distinguish known from unknown information, understand relationships among quantities, define variables, and translate verbal statements into mathematical expressions or equations. These stages demonstrate that language functions not merely as a medium for delivering instructions but also as a tool for constructing mathematical meaning. Principles for designing mathematics instruction that integrates language and content development emphasize the need to support students' understanding of terminology, sentence structures, explanations, argumentation, and academic language production

throughout the learning process (Zwiers et al., 2021). Without such support, errors may arise even before calculation begins, particularly when students interpret information or construct a mathematical model. Consequently, the development of mathematics instructional materials should provide sufficient support for the transition from everyday language to formal mathematical language.

Systems of Linear Equations in Two Variables (SLETV) constitute a topic in which procedural competence, mathematical modeling, and language comprehension intersect directly. In learning SLETV, students are expected not only to master elimination, substitution, graphical, or combined methods, but also to identify two relevant quantities as variables and formulate two equations from relationships implied in a given situation. Consequently, success in solving SLETV problems is strongly influenced by students' ability to read the context and organize information before performing algebraic operations. A range of Indonesian studies have developed instructional materials to strengthen SLETV learning through e-modules, problem-based modules, website-based materials, flipbooks, electronic student worksheets, and Realistic Mathematics Education. These products have generally been reported to satisfy validity and practicality criteria, while several studies have also indicated potential effectiveness in improving conceptual understanding and problem-solving ability (Aisy et al., 2020; Jakiah et al., 2022; Silvi & Auliya, 2022; Widyasari et al., 2021). These findings indicate that innovation in SLETV instructional materials has developed substantially in terms of both development models and media formats.

These developments also reveal a strong tendency toward problem-based learning. Modules and worksheets designed around Problem-Based Learning or Problem-Based Instruction provide students with opportunities to learn through situations that require problem identification, strategy formulation, discussion, and explanation of solutions. Suprihatiningsih and Annurwanda (2019) showed that a problem-based mathematics module for SLETV could be developed to meet validity, practicality, and effectiveness criteria. Similar findings were reported by Hunalo et al. (2025) in the development of a problem-based module, while Mariska et al. (2024) found that an electronic worksheet based on Problem-Based Instruction demonstrated strong validity, practicality, and potential effectiveness. Naibaho et al. (2025) subsequently examined Problem-Based Learning in relation to mathematical literacy. Meanwhile, Agussya et al. (2025) and Wulandari and Yahfizham (2025) showed that the development of SLETV instructional materials continues to move toward more contextual and participatory learning activities. Collectively, these findings are important because they confirm the extensive use of contextual problems as learning vehicles; however, using contextual situations does not automatically mean that the linguistic processes required to understand those situations have been explicitly designed into the instructional materials.

This is where a more critical issue emerges. The mapping of SLETV development studies that underpins this review shows that previous research has largely focused on development models, media types, product validity, practicality of use, learning outcomes, conceptual understanding, or problem-solving ability. Aisy et al. (2020) emphasized the development of a software-assisted e-module; Jakiah et al. (2022) developed website-based instructional materials; Widyasari et al. (2021) focused on flipbook media; Silvi and Auliya (2022) developed an electronic worksheet based on Realistic Mathematics Education; and Mariska et al. (2024) developed an electronic worksheet based on problem-oriented instruction. These studies make important contributions to instructional innovation, yet strategies that specifically guide students to recognize mathematical vocabulary, unpack the information structure of word problems, explain relationships among quantities in their own words, and construct mathematical arguments have not emerged as a primary design focus. In other words, language has generally been embedded implicitly within problem-solving activities rather than designed, sequenced, and assessed systematically as an instructional component.

This research gap is important because the quality of a module is determined not only by the completeness of its content and media presentation, but also by its capacity to provide cognitive support when students encounter difficulty at the transition between text and symbols. In SLETV, this transition involves at least three linguistic processes: understanding the mathematical register, namely terms that carry specialized meanings in mathematics; deconstructing problem discourse to identify relevant

information, relationships, and conditions; and producing mathematical language through written or oral explanations of how a model is constructed and why a particular solution strategy is selected. These three processes are interrelated. Knowledge of terminology without the ability to identify relationships within a text is insufficient for constructing equations, while obtaining an answer without being able to explain the reasoning does not demonstrate comprehensive mathematical literacy. Accordingly, language literacy in this study is not positioned as language content added to mathematics lessons, but as scaffolding that helps students construct, examine, and communicate mathematical meaning. This view is consistent with principles for integrating language and content in mathematics learning, which treat reading, speaking, writing, and argumentation as integral components of disciplinary learning (Zwiers et al., 2021).

On the basis of this gap, the novelty of the present study lies in formulating a framework for developing SLETV instructional modules in which language literacy is integrated as a structural component of instructional design rather than treated merely as supporting content. The proposed framework connects three core components: reinforcement of mathematical vocabulary, guided deconstruction of contextual problem texts, and opportunities for mathematical language production. These components are further integrated with teacher scaffolding guidelines, problem-solving activities, and assessment instruments that evaluate not only procedural accuracy but also the quality of problem translation and the clarity of students' mathematical arguments. This novelty distinguishes the present review from earlier development studies in which innovation has primarily centered on media formats or instructional models. Digital formats such as websites, flipbooks, and electronic worksheets remain relevant as implementation platforms (Jakiah et al., 2022; Mariska et al., 2024; Widyasari et al., 2021); however, within the proposed framework, technology is positioned as a means of facilitating literacy processes rather than as the central source of innovation.

This study aims to analyze recent trends in the development of SLETV instructional materials and to formulate a theoretically grounded conceptual framework for a language-literacy-based SLETV instructional module that can subsequently be operationalized through development research. The literature review is not used to claim the effectiveness of a product that has not yet been tested, but rather to construct a conceptual synthesis based on patterns, strengths, and gaps in previous studies; such an approach requires critical engagement with the literature so that the review extends beyond descriptive summary (Abdurrahman, 2024). Theoretically, this study is expected to broaden the discussion of mathematical literacy by positioning language as part of the modeling and reasoning processes involved in SLETV. Practically, the resulting framework is intended to provide a foundation for developing modules that gradually support students in understanding contexts, constructing models, solving systems of equations, and communicating the meaning of their solutions. Accordingly, the contribution of this study does not lie in claiming that the module has already been proven effective, but in providing a clear and operationalizable conceptual design whose validity, practicality, and effectiveness can be tested in future research.

## RESEARCH METHODS

This study employed a qualitative approach using a structured literature review design. This design was selected because the study was not intended to test an instructional intervention directly in the classroom, but rather to synthesize prior empirical findings and formulate a conceptual framework for developing a language-literacy-based instructional module on Systems of Linear Equations in Two Variables (SLETV). Literature reviews can be used to integrate dispersed research findings, map patterns, identify knowledge gaps, and construct scientifically grounded propositions or conceptual frameworks (Snyder, 2019; Xiao & Watson, 2019). In educational research, a literature-based approach is also relevant when the study focuses on a critical examination of theories, research findings, and scholarly documents related to a particular educational problem (Abdurrahman, 2024).

The data sources comprised national and international peer-reviewed journal articles, full-text academic works, and theoretical sources relevant to the development of mathematics instructional materials, mathematical literacy, problem-based learning, and SLETV. Literature searches were

conducted through Google Scholar, SINTA, Scopus, and university repositories. Using more than one search system was intended to broaden the coverage of the search and reduce the risk of overlooking relevant publications, because each database has different indexing characteristics and coverage. In addition to direct database searching, a snowballing technique was applied by examining the reference lists of articles that met the eligibility criteria to identify additional relevant publications.

Inclusion criteria were established to ensure that the documents analyzed were directly relevant to the focus of the study. Literature was included if it: (1) was published between 2019 and 2025; (2) specifically addressed SLETV; (3) reported empirical research, particularly development or experimental studies; (4) focused on modules, instructional materials, learning media, problem-based approaches, problem-solving ability, or mathematical literacy; and (5) provided outcome information suitable for synthesis, such as validity, practicality, effectiveness, conceptual understanding, problem-solving ability, or mathematical literacy. Conversely, documents were excluded if they were published outside the specified period, did not address SLETV directly, consisted only of conceptual discussion without relevant empirical data, or did not provide sufficient information to address the objectives of the review. Establishing criteria in advance is an important element of transparency in literature reviews because it helps maintain consistency in the selection process and reduces subjective source selection (Xiao & Watson, 2019).

The selection process was conducted in stages based on the search data available for the study. The identification stage yielded 38 documents considered relevant to the initial keywords and focus of the review. During screening, 18 documents were excluded because they had been published outside the 2019-2025 period or did not specifically address SLETV. Accordingly, 20 articles proceeded to full-text assessment. Of these, a further 10 articles were excluded because they did not focus on the feasibility of instructional-material development or did not constitute experimental studies relevant to the study objectives. The final stage yielded 10 research articles that served as the core sources for data extraction and synthesis. This selection flow is reported explicitly to clarify the relationship among the number of documents identified, the reasons for exclusion, and the number of studies ultimately analyzed.

Data were collected through document analysis using an extraction matrix. Information recorded from each article included the authors and year of publication, study title, development model, type of module or learning medium, instructional approach, and research findings related to validity, practicality, effectiveness, conceptual understanding, problem solving, and mathematical literacy. The matrix served to standardize the information extracted from each source, thereby enabling more consistent comparison across studies. At this stage, findings were not immediately generalized; instead, they were first grouped according to similarities in focus, product characteristics, and outcome indicators.

Data analysis was conducted through narrative synthesis and thematic mapping. First, each finding was summarized according to the characteristics of the development design, the type of media or instructional material, and the reported evaluation outcomes. Second, findings displaying similar patterns were grouped to identify dominant tendencies in research on SLETV instructional-material development. Third, the synthesized findings were compared to determine which aspects had received substantial research attention and which remained underexplored. The thematic mapping focused on four analytical themes: the use of instructional development models, the use of media and instructional approaches, validity-practicality-effectiveness outcomes, and the presence of language-literacy elements in instructional-material design. A thematic approach was used because it enables patterns of meaning across sources to be identified systematically while preserving the contextual characteristics of individual findings (Snyder, 2019; Xiao & Watson, 2019).

The trustworthiness of the synthesis was maintained through consistent application of the inclusion and exclusion criteria, cross-checking the information recorded in the extraction matrix against the analyzed articles, and comparing findings across studies before establishing any pattern as a basis for the conceptual framework. This study does not claim to constitute a full systematic review or meta-analysis because it did not pool quantitative effect sizes and no information was available

regarding study-quality assessment by more than one reviewer. Accordingly, the findings are positioned as a literature-based conceptual synthesis intended to construct a framework for developing a language-literacy-based SLETV instructional module, while the empirical validity of the framework remains to be examined through subsequent development research and field testing.

## RESULTS AND DISCUSSION

The literature search yielded 10 core articles that met the review criteria. These studies indicate that research on SLETV learning over the six-year period examined has developed primarily along two pathways. The first concerns the development of instructional materials and media, including modules, e-modules, websites, flipbooks, electronic student worksheets, and electronic worksheets. The second concerns instructional approaches emphasizing contextual problems, particularly Problem-Based Learning (PBL), Problem-Based Instruction (PBI), and Realistic Mathematics Education (RME). This pattern is important because it demonstrates that challenges in SLETV learning have been addressed extensively through instructional design and media innovation. However, the synthesis also indicates that support for reading, interpreting, and constructing meaning in mathematical language has not yet emerged as an explicit, stand-alone design component. Thus, the review not only identifies what has already been developed successfully, but also reveals a conceptual area that remains comparatively underexplored.

**Table 1. Synthesis of Ten Core Studies on SLETV Development and Learning**

| No. | Author(s) and Year                   | Focus/Product                                                 | Model/Design         | Relevant Finding or Contribution                                                                                                                                                                |
|-----|--------------------------------------|---------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | Aisy et al. (2020)                   | Sigil-assisted e-module using a scientific approach           | Modified Borg & Gall | The e-module was rated highly feasible and received a highly positive student response; effectiveness was reported in the moderate N-Gain category.                                             |
| 2.  | Suprihatiningsih & Annurwanda (2019) | Problem-based mathematics module                              | ADDIE                | The module was developed for Grade 8 students and was reported to meet validity, practicality, and effectiveness criteria.                                                                      |
| 3.  | Jakiah et al. (2022)                 | Website-based SLETV instructional materials                   | ADDIE                | The product was reported as highly valid (92.61%), highly practical (85.52%), and effective (76.62%) for problem-solving instruction.                                                           |
| 4.  | Agusya et al. (2025)                 | Problem-Based Learning module                                 | ADDIE                | The module was categorized as valid and highly practical and was designed to improve student participation and independent learning.                                                            |
| 5.  | Widyasari et al. (2021)              | Flipbook-based learning media                                 | ADDIE                | The medium obtained a feasibility score of 85.70% and was categorized as highly valid for use in SLETV learning.                                                                                |
| 6.  | Wulandari & Yahfizham (2025)         | Marble-game-based student worksheet                           | 4-D                  | The worksheet was reported as highly valid (87.5%) and highly practical (87%), indicating the potential of game contexts as an entry point for learning.                                        |
| 7.  | Mariska et al. (2024)                | Electronic worksheet based on Problem-Based Instruction       | ADDIE                | The electronic worksheet was reported as highly valid (86.58%), highly practical (96.82%), and potentially effective/effective (79.58%).                                                        |
| 8.  | Hunalo et al. (2025)                 | Problem-based learning module                                 | ADDIE                | The module was reported to meet validity, practicality, and effectiveness criteria and was oriented toward conceptual understanding and learning motivation.                                    |
| 9.  | Naibaho et al. (2025)                | PBL and mathematical literacy in SLETV                        | Exsperimental        | The study examined the relationship between PBL implementation and students' mathematical literacy in SLETV; the findings indicate a shift of attention from products toward literacy outcomes. |
| 10. | Silvi & Auliya (2022)                | Electronic worksheet based on Realistic Mathematics Education | Modified 4-D         | The study developed an RME-based electronic worksheet for SLETV and provides evidence that realistic contexts can serve as a basis for organizing instructional materials.                      |

The findings presented in Table 1 demonstrate the dominance of established instructional development models. ADDIE was used in most studies, while the 4-D model and modified Borg and Gall model appeared as alternatives. This dominance is understandable because all three models provide relatively clear stages for needs analysis, product design, material development, validation, and

outcome evaluation. In the context of SLETV, such structure is important because instructional materials must connect algebraic concepts, symbolic representations, solution procedures, and contextual applications. Suprihatiningsih and Annurwanda (2019), Jakiah et al. (2022), Widyasari et al. (2021), and Agusya et al. (2025) all showed that structured development procedures can produce instructional materials that satisfy feasibility criteria. From a synthesis perspective, however, the success of a development model does not automatically explain which pedagogical components students need most when they fail to understand word problems. Thus, ADDIE, 4-D, and Borg and Gall are more appropriately positioned as frameworks for the development process than as direct responses to the cognitive-linguistic barriers encountered in learning SLETV.

The second finding concerns the increasing digitalization of instructional materials. Sigil-assisted e-modules, website-based materials, flipbooks, and electronic worksheets indicate that SLETV research has moved from printed resources toward more interactive media (Aisy et al., 2020; Jakiah et al., 2022; Widyasari et al., 2021; Mariska et al., 2024). This shift is relevant to the need for flexible learning because digital media can provide nonlinear navigation, rapid feedback, visualization, and opportunities for independent access. Nevertheless, the synthesis of these studies also shows that digitalization has been discussed primarily as a mode of presentation and interaction. Digital media acquire stronger pedagogical value only when technological features are directed toward specific cognitive processes. In the context of this study, technology should not merely convert printed pages into screens; it should be used to provide contextual glossaries, highlight key terms, visualize verbal-to-symbolic modeling sequences, present examples of mathematical argumentation, and offer feedback that helps students recognize interpretation errors. Accordingly, the aspect that requires improvement is not simply the sophistication of the medium, but the alignment between media features and students' mathematical-literacy needs.

The third finding concerns the strong orientation toward problem-based learning and realistic contexts. Problem-based modules, PBL, PBI, and RME recur throughout the literature analyzed (Suprihatiningsih & Annurwanda, 2019; Mariska et al., 2024; Hunalo et al., 2025; Naibaho et al., 2025; Silvi & Auliya, 2022). This pattern reflects growing recognition that SLETV should not be taught merely as a set of elimination, substitution, or graphical procedures, but should be connected to situations that require mathematical modeling. Contextual problems allow students to understand why mathematics is being used, identify variables, and evaluate whether the solutions obtained are reasonable within a given context. Kandira and Aini (2025) also positioned module development as one avenue for strengthening mathematical literacy. Nevertheless, the more contextual a problem becomes, the greater the linguistic demands students must process. This creates an important paradox: problem-based strategies may strengthen reasoning, yet their benefits can be diminished when students lack sufficient support for reading the linguistic structure of the problems presented.

This paradox constitutes a critical point that distinguishes the present study from most previous research. In SLETV word problems, students do not immediately encounter two formal equations; instead, they are often presented with narratives containing objects, quantitative relationships, comparative expressions, conditions, and questions. To solve such problems, students must perform a sequence of transformations: identify relevant information, define variables, connect words or phrases with mathematical operations, construct two equations, select a solution method, and then reinterpret the values of the variables in relation to the original context. In other words, success in SLETV word problems results from the interaction between mathematical competence and language comprehension. The principles of mathematics curriculum design proposed by Zwiers et al. (2021) emphasize that language development and mathematical content development should be promoted simultaneously rather than treated as separate processes. This is also consistent with Tenny et al. (2022), who emphasized that literacy and numeracy should be strengthened across subject areas, including when students interpret information and use it to make mathematical decisions.

When compared directly, most of the studies in Table 1 address how products were developed and whether they were feasible for use, but few treat language as an explicit object of design. Aisy et al. (2020), Jakiah et al. (2022), Widyasari et al. (2021), Wulandari and Yahfizham (2025), and Mariska

et al. (2024) demonstrate a wide range of media; Suprihatiningsih and Annurwanda (2019), Agusssya et al. (2025), Hunalo et al. (2025), and Naibaho et al. (2025) emphasize the importance of problem-based approaches; while Silvi and Auliya (2022) incorporate realistic contexts through electronic worksheets. However, based on the information available in the core literature, there is no clearly articulated module framework that systematically sequences linguistic support from understanding terminology, reading discourse structure, and transforming verbal information into symbols, through to producing mathematical explanations. This gap forms the basis of the present study's novelty. The contribution is not merely to combine a 'module' with 'language literacy', but to position language as part of the architecture of SLETV problem solving.

Based on this synthesis, the proposed framework comprises three core components and two supporting components. The first core component is reinforcement of mathematical vocabulary, or the mathematical register. At this stage, the module should help students distinguish between everyday and mathematical meanings of terms such as variable, coefficient, constant, equation, system, difference, sum, twice, more than, less than, and expressions that indicate equality. Such vocabulary should not be presented merely as a list of definitions. The module should demonstrate how terms function within sentences and how particular phrases map onto mathematical operations or relationships. The purpose is to reduce the cognitive leap from everyday language to formal symbols. From the perspective of mathematical literacy, mastery of the mathematical register provides students with tools to interpret information and articulate quantitative relationships more precisely.

The second core component is the deconstruction of word-problem discourse. At this stage, contextual problems should not be followed immediately by space for calculation; instead, they should be unpacked through structured questions. Students are guided to identify who or what is being discussed, what information is known, what is being asked, which quantities vary, and what relationships are expressed in each sentence. This information is then transferred to a graphic organizer that divides the process into three columns: problem language, quantitative meaning, and mathematical form. For example, the statement 'two books and three pencils cost IDR 12,000' can first be interpreted as a relationship involving quantities of two types of objects and then expressed as  $2x + 3y = 12,000$  after  $x$  and  $y$  have been defined. The strength of this strategy does not lie in the example itself, but in making visible the transformation process that is often left implicit. When the intermediate steps are made explicit, teachers can determine whether a student's error originates in language comprehension, variable definition, equation construction, or algebraic procedure.

The third core component is mathematical language production. After constructing a model and solving the system of equations, students are asked to explain why they selected a particular strategy, interpret the meaning of the result, and formulate a conclusion in complete sentences. This stage is necessary because a correct numerical answer does not necessarily demonstrate understanding of the process. Students may obtain values for  $x$  and  $y$  through mechanical procedures yet still be unable to explain what those values represent in context. By prompting explanations such as 'I chose elimination because...' or 'the value of  $x$  represents the price of one book because...', the module positions language as a means of making reasoning visible. Zwiers et al. (2021) emphasize the importance of providing students with opportunities to use academic language to develop mathematical understanding. Thus, language-production activities are not treated as supplementary tasks but as integral components of constructing and evaluating understanding.

Two supporting components are required to ensure that the three core components can be implemented consistently. The first is teacher scaffolding guidance. Teachers need examples of prompting questions that do not directly provide answers but instead focus students' attention on the structure of the problem. Questions such as 'Which word indicates an equality relationship?', 'What can you define as a variable?', 'Which sentence forms the first equation?', or 'What does the value of  $x$  mean in the context of the story?' can be used to gradually transfer responsibility from teacher support to student independence. The second supporting component is integrated assessment. Assessment should address not only the accuracy of the final answer but also the appropriateness of variable definitions, the quality of discourse-to-model translation, procedural correctness, clarity of reasoning, and the

ability to interpret a solution within its context. In this way, assessment is aligned with the goals of mathematical literacy because it measures the processes of formulating, employing, and interpreting mathematics rather than computation alone.

The conceptual framework is summarized in Table 2. This table does not present the results of a new empirical test; rather, it represents a synthesis derived from patterns and gaps identified in the core literature. This distinction is important so that the framework is not interpreted as a product that has already been proven effective. Its primary function is to provide design specifications that can be tested in subsequent development research.

**Table 2. Conceptual Framework for a Language-Literacy-Based SLETV Instructional Module**

| Component                        | Pedagogical Purpose                                                   | Implementation in the Module                                                    | Indicator/Assessment                                   |
|----------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------|
| Mathematical vocabulary          | Understand the mathematical register and word-operation relationships | Contextual glossary, term highlighting, examples of verbal phrases              | Accuracy in interpreting terms and relationships       |
| Discourse deconstruction         | Identify relevant information and construct a model                   | Graphic organizer: problem language - quantitative meaning - mathematical model | Accuracy of variable definitions and the two equations |
| Mathematical language production | Articulate reasoning and the meaning of solutions                     | Explanation prompts, written reflection, discussion                             | Clarity of reasoning and interpretation of results     |
| Teacher scaffolding              | Provide gradual support without taking over students' thinking        | Prompting questions, response examples, graduated assistance                    | Student independence and quality of responses          |
| Integrated assessment            | Assess mathematics and literacy as a unified process                  | Rubric for formulation, procedure, argumentation, and interpretation            | Profile of process and outcome achievement             |

Operationally, the framework can be implemented through a sequence of learning activities that moves from language to model, from model to procedure, and from procedure back to language. The first stage is contextual orientation, in which students read a problem without being immediately asked to calculate. The second stage is identification of terminology and quantitative relationships. The third stage is deconstruction of sentences into information and relationships. The fourth stage is formulation of two linear equations. The fifth stage is selection and implementation of a solution strategy. The sixth stage is interpretation and communication of the result. This sequence provides a more explicit structure than instructional materials that move directly from a word problem to a calculation space. Conceptually, each stage also generates observable evidence of learning. Teachers can identify whether students have misunderstood a phrase, defined a variable incorrectly, constructed an inappropriate model, applied an algorithm incorrectly, or simply failed to communicate the result.

The framework also clarifies the roles of PBL and RME. Problem-based approaches remain relevant because they provide authentic contexts and create a need for reasoning, while RME uses realistic experience as a starting point for mathematization. In the proposed design, however, neither PBL nor RME replaces language-literacy support. Instead, these approaches provide contexts within which language scaffolding can operate. Consequently, the module need not choose between 'mathematics learning' and 'language learning'. Language functions as a tool for accessing and communicating mathematical concepts. This synthesis explains why studies such as Suprihatiningsih and Annurwanda (2019), Silvi and Auliya (2022), Mariska et al. (2024), Hunalo et al. (2025), and Naibaho et al. (2025) are important to the new framework: these studies provide foundations in contextual and problem-solving approaches, while the present study adds specifications regarding how students can be supported in processing language within those contexts.

From a technological perspective, the findings of Jakiah et al. (2022), Widyasari et al. (2021), Aisy et al. (2020), and Mariska et al. (2024) indicate that digital instructional materials are viable formats for further development. A language-literacy framework can make more purposeful use of the affordances of digital formats. Glossaries can appear as pop-ups when terms are selected; keywords in a problem can be highlighted progressively; graphic organizers can be completed interactively; hints can be provided according to the type of error; and reflection spaces can preserve students' explanations before they view model answers. Such features are pedagogically more meaningful than animations or decorative elements unrelated to the learning objectives. The central principle is that every digital feature should have an identifiable cognitive and linguistic function. In this way, technology does not

become the center of innovation but rather an instrument for clarifying relationships among text, representations, symbols, and argumentation.

The discussion also indicates that validity, practicality, and effectiveness, which are frequently reported in development studies, are insufficient as the sole indicators of module quality. These indicators remain important, but the proposed framework requires measures that are more specific to language literacy. Expert validation, for example, should involve not only subject-matter and media experts but also language or instructional experts capable of assessing readability, clarity of the mathematical register, appropriateness of prompts, and consistency in verbal-to-symbolic transformations. Practicality testing should evaluate whether scaffolding genuinely supports students or instead increases reading load. Effectiveness testing should distinguish procedural improvement from improvement in students' ability to model and explain. Thus, evaluation designs in future Research and Development studies should address not only whether a module is 'feasible', but also which components contribute to changes in students' capabilities.

At the curriculum level, the framework is relevant to efforts to strengthen literacy and numeracy because it connects text comprehension with the use of mathematics in context. Tenny et al. (2022) emphasize that literacy and numeracy should be developed across subject areas, while Sumliyah et al. (2025) highlight the importance of examining mathematical literacy in relation to curriculum and instructional practice. The implication is that SLETV learning should assess not only whether students can solve two equations, but also whether they can formulate a problem from information, select representations, use procedures meaningfully, and explain the results. This orientation broadens the meaning of learning success from algorithmic proficiency to the ability to use mathematics as a tool for understanding situations.

Nevertheless, the synthesis should be interpreted within several clear limitations. First, the review included only 10 core articles and therefore does not represent the entirety of published research on SLETV. Second, the analyzed studies varied in design, participants, media, and outcome indicators, preventing the findings from being combined into a single effect-size estimate. Third, most studies emphasized product validity, practicality, or effectiveness rather than providing specific data on students' language processes. Accordingly, the identified language-literacy gap reflects a synthesis of the reported focuses and components; it does not constitute evidence that no other study has developed comparable forms of support. Fourth, the proposed framework has not yet undergone expert validation or field testing. These limitations are essential for ensuring that the claims remain proportionate to the structured literature review methodology employed.

In light of these limitations, the next stage of research should adopt a Research and Development design that explicitly tests the components generated by the synthesis. An initial stage could involve content validation by experts in mathematics, instructional design, and language, followed by readability testing and small-group trials to determine whether the instructions, glossary, and graphic organizer are comprehensible to students. Field testing could subsequently compare student performance before and after using the module on indicators such as problem formulation, accuracy of the SLETV model, solution procedures, and interpretation of results. Where possible, quantitative data should be complemented with process data, such as written responses, recorded discussions, or task-based interviews, to identify changes in how students read and explain problems. Such an approach would allow future research not only to determine whether the product is effective, but also to examine the mechanisms through which language scaffolding operates within mathematical problem solving.

Overall, this synthesis establishes a more explicit theoretical position for the development of SLETV modules. Previous literature has provided a strong foundation concerning development models, digital media, problem-based learning, and realistic contexts. The contribution of the present study is to organize these findings around a need that has not been addressed explicitly: linguistic support at critical points in mathematical modeling. The proposed framework retains the strengths of previous approaches while shifting the central question from 'What product is used?' to 'What thinking processes need to be facilitated?' This shift is important because module quality is determined not only by the

form of the medium but also by how effectively the module helps students move from everyday language to mathematical representation and back again to meaningful language.

Another conceptual contribution of the framework lies in differentiating the sources of students' errors. In classroom practice, incorrect answers are often immediately interpreted as evidence of weak mathematical ability, even though errors may arise at different stages. A student may understand the elimination procedure but misinterpret the phrase 'more than'; another may be able to define variables but fail to construct the second equation; still another may obtain the correct numerical result but be unable to explain its meaning. The language-literacy framework enables teachers to diagnose such errors more precisely. A rubric can distinguish indicators of term comprehension, modeling, procedure, argumentation, and interpretation. This differentiation has pedagogical consequences because the type of support provided should correspond to the source of the error. Vocabulary errors require clarification of meaning, modeling errors require reconstruction of relationships among quantities, and procedural errors require reinforcement of algebraic concepts. Thus, the proposed module functions not only as instructional material but also as a tool that helps teachers determine more appropriate forms of intervention.

The synthesis further demonstrates the need for continuity between learning activities and assessment. In many instructional materials, contextual activities are used at the beginning of learning, whereas final assessments return to predominantly procedural questions. Such discontinuity can render students' ability to read and communicate mathematics invisible in their learning outcomes. Within the proposed framework, assessment should follow the same progression as the learning activities: students read the context, identify terms, construct a model, solve the model, and interpret the result. Consequently, a single problem can be assessed through multiple forms of evidence, including the appropriateness of variable definitions, the reasoning behind equation construction, the correctness of elimination or substitution procedures, and the alignment of the conclusion with the original context. This approach is consistent with mathematical-literacy orientations that treat the formulation, employment, and interpretation of mathematics as interconnected competencies. In practical terms, such assessment also provides richer information than a simple right-or-wrong score because teachers can identify which stages have been mastered and which still require scaffolding.

From the perspective of scientific novelty, the proposed framework should be clearly distinguished from media innovation. Previous studies have shown that e-modules, websites, flipbooks, electronic worksheets, PBL, and RME can be used to teach SLETV (Aisy et al., 2020; Jakiah et al., 2022; Widyasari et al., 2021; Silvi & Auliya, 2022; Mariska et al., 2024). The present study is not intended to replace these findings; rather, it adds a design layer that has not been explicitly articulated, namely how language is managed at each stage of modeling. Future prototypes may therefore be print-based or digital and may be combined with PBL or RME, provided that the five core elements remain present: the mathematical register, discourse deconstruction, language production, teacher scaffolding, and integrated assessment. This position makes the contribution more resilient to technological change because the proposed innovation is a set of design principles rather than a specific platform. If subsequent validation and field testing yield positive results, these principles may be extended to other mathematics topics that are also rich in verbal problems; however, such generalization must be tested independently and cannot be assumed solely on the basis of this SLETV review.

## CONCLUSION

Based on the synthesis of 10 core articles, research on the development and teaching of SLETV during 2019-2025 has made extensive use of the ADDIE, 4-D, and modified Borg and Gall models, together with modules, e-modules, websites, flipbooks, electronic worksheets, and electronic student worksheets. Problem-based approaches and realistic contexts have also emerged as important trends because they promote modeling and problem solving. However, the literature analyzed does not yet demonstrate linguistic support as an explicitly sequenced design component extending from terminology comprehension to communication of results. To address this gap, the present study formulates a language-literacy-based SLETV module framework comprising three core components—

reinforcement of mathematical vocabulary, deconstruction of word-problem discourse, and mathematical language production—and two supporting components, namely teacher scaffolding and integrated assessment. The novelty of the framework lies in positioning language as part of the architecture of mathematical problem solving rather than as an additional element external to SLETV learning. The framework remains conceptual; therefore, its effectiveness cannot yet be claimed empirically.

As a next step, future studies should develop a module prototype based on this framework through Research and Development. Validation should involve experts in mathematics content, instructional design, and language, followed by readability testing, small-group trials, and field testing. Measures of effectiveness should extend beyond learning-outcome scores to assess students' ability to understand terminology, construct SLETV models from text, explain their choice of strategy, and interpret solutions within context. Teachers are also encouraged to use prompting questions and process-oriented rubrics so that linguistic errors can be distinguished from mathematical procedural errors. In this way, future research can determine whether, and at which stages, language-literacy scaffolding makes a substantive contribution to students' SLETV problem-solving ability.

## REFERENCES

- Abdurrahman, A. (2024). Metode penelitian kepustakaan dalam pendidikan Islam [Literature research methods in Islamic education]. *Adabuna: Jurnal Pendidikan dan Pemikiran*, 3(2), 102–113.
- Agussya, F., Fitri, D. Y., & Hamdunah, H. (2025). Pengembangan modul problem-based learning pada materi sistem persamaan linier dua variabel [Development of a problem-based learning module on systems of linear equations in two variables]. *Pedagogy: Jurnal Pendidikan Matematika*, 10(4), 2134–2147.
- Aisy, D. R., Farida, F., & Andriani, S. (2020). Pengembangan e-modul berbantuan Sigil software dengan pendekatan saintifik pada materi sistem persamaan linier dua variabel (SPLDV) [Development of a Sigil-assisted e-module using a scientific approach for systems of linear equations in two variables]. *EduSains: Jurnal Pendidikan Sains & Matematika*, 8(1), 61–71.
- Hunalo, N. A., Badu, S. Q., Achmad, N., & Ismail, S. (2025). Pengembangan modul pembelajaran berbasis masalah untuk meningkatkan pemahaman konsep matematika siswa kelas X pada materi sistem persamaan linear dua variabel [Development of a problem-based learning module to improve Grade 10 students' mathematical conceptual understanding of systems of linear equations in two variables]. *Leibniz: Jurnal Matematika*, 5(2), 21–34.
- Jakiah, N., Ahmad, M., & Ardiana, N. (2022). Pengembangan bahan ajar sistem persamaan linear dua variabel berbasis website untuk membelajarkan kemampuan pemecahan masalah matematika siswa [Development of website-based instructional materials on systems of linear equations in two variables to support students' mathematical problem-solving ability]. *Jurnal MathEdu (Mathematic Education Journal)*, 5(3), 101–113.
- Kandira, R. V., & Aini, A. N. (2025). Developing math modules to improve students' mathematical literacy. *Educational Insights*, 3(1), 54–62.
- Mariska, S., Ningsih, Y. L., & Mulbasari, A. S. (2024). E-LKPD berbasis problem-based instruction pada materi sistem persamaan linier dua variabel [Electronic student worksheets based on problem-based instruction for systems of linear equations in two variables]. *Differential: Journal on Mathematics Education*, 2(2), 200–212.
- Naibaho, E., Marbun, Y. M., & Purba, Y. O. (2025). Pengaruh model problem-based learning (PBL) terhadap kemampuan literasi matematika kelas VIII di SMP Negeri 2 Siantar pada materi sistem persamaan linear dua variabel (SPLDV) [Effect of the problem-based learning model on Grade 8 students' mathematical literacy at SMP Negeri 2 Siantar in systems of linear equations in two variables]. *PIJAR: Jurnal Pendidikan dan Pengajaran*, 4(1), 511–524.
- Silvi, K. L., & Auliya, N. N. F. (2022). Bahan ajar E-LKS berbasis Realistic Mathematics Education materi sistem persamaan linear dua variabel [Electronic worksheet instructional materials based

- on Realistic Mathematics Education for systems of linear equations in two variables]. *Plusminus: Jurnal Pendidikan Matematika*, 2(3), 381–390.
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- Sumliyah, S., Junaedi, I., & Mulyono, M. (2025). Mathematical literacy: A comparative analysis of school mathematics curricula in Indonesia, Singapore, and China. *Inovasi Matematika (Inomatika)*, 7(1), 105–129.
- Suprihatiningsih, S., & Annurwanda, P. (2019). Pengembangan modul matematika berbasis masalah pada materi sistem persamaan linear dua variabel [Development of a problem-based mathematics module on systems of linear equations in two variables]. *Jurnal Karya Pendidikan Matematika*, 6(1), 57–63.
- Tenny, T., Nisa, A. K., & Murtaolah, M. (2022). *Pengembangan literasi dan numerasi dalam proses belajar dan mengajar berbagai mata pelajaran* [Developing literacy and numeracy in teaching and learning across subjects]. Direktorat Sekolah Menengah Atas, Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi.
- Widyasari, I., Zetriuslita, Z., Istikomah, E., & Herlina, S. (2021). Pengembangan media pembelajaran berbasis flipbook pada materi sistem persamaan linear dua variabel di kelas VIII SMP [Development of flipbook-based learning media for systems of linear equations in two variables in Grade 8 junior secondary school]. *Jurnal Derivat*, 8(1), 25–36.
- Wulandari, T., & Yahfizham, Y. (2025). Pengembangan lembar kerja peserta didik berbasis permainan kelereng pada materi sistem persamaan linear dua variabel [Development of marble-game-based student worksheets for systems of linear equations in two variables]. *Jurnal Pendidikan Matematika dan Sains*, 13(1), 69–80.
- Xiao, Y., & Watson, M. (2019). Guidance on conducting a systematic literature review. *Journal of Planning Education and Research*, 39(1), 93–112. <https://doi.org/10.1177/0739456X17723971>
- Zwiers, J., Dieckmann, J., Rutherford-Quach, S., Daro, V., Skarin, R., Weiss, S., & Malamut, J. (2021). *Principles for the design of mathematics curricula: Promoting language and content development*. Stanford University Graduate School of Education.