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Pengembangan Lembar Kerja Mahasiswa Berbasis *Problem Based Learning Bilingual* untuk Mendukung Kemampuan Berpikir Kritis Calon Guru

Development of a Bilingual Problem Based Learning Worksheet to Support Pre-Service Teachers' Critical Thinking Skills

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ABSTRAK

Penelitian ini bertujuan mengembangkan serta mengevaluasi validitas dan kepraktisan Lembar Kerja Mahasiswa (LKM) bilingual berbasis Problem-Based Learning (PBL) yang dirancang berdasarkan indikator berpikir kritis pada materi perkembangan emosional bagi mahasiswa calon guru. Penelitian menggunakan metode Research and Development (R&D) dengan model evaluasi formatif Tessmer yang meliputi expert review, one-to-one evaluation, dan small group evaluation. Subjek penelitian terdiri atas sembilan validator ahli, tiga mahasiswa pada tahap one-to-one, dan sepuluh mahasiswa pada tahap small group. LKM dirancang dengan mengintegrasikan sintaks PBL, aktivitas pemecahan masalah kontekstual, penggunaan bahasa Indonesia dan Inggris, serta indikator berpikir kritis yang meliputi analisis, evaluasi, inferensi, dan penjelasan. Data dikumpulkan menggunakan angket validasi dan angket respons mahasiswa. Validitas dianalisis menggunakan indeks Aiken's V, sedangkan kepraktisan dianalisis secara deskriptif. Hasil penelitian menunjukkan bahwa LKM memiliki tingkat validitas sangat tinggi dengan nilai rata-rata Aiken's V sebesar 0,905. Uji one-to-one menunjukkan kepraktisan awal yang baik, sedangkan uji small group memperoleh skor rata-rata 89,34% dengan kategori sangat praktis. Mahasiswa menilai LKM mudah digunakan, memiliki struktur yang sistematis, serta membantu menganalisis masalah secara bertahap melalui tahapan PBL dan penyajian kasus yang kontekstual. Penelitian ini memberikan kontribusi dengan mengintegrasikan pembelajaran bilingual sebagai scaffolding instruksional dalam LKM berbasis PBL pada materi perkembangan emosional. Namun, penelitian ini masih terbatas pada evaluasi validitas dan kepraktisan sehingga belum mengukur secara langsung peningkatan keterampilan berpikir kritis mahasiswa. Oleh karena itu, LKM yang dikembangkan dinyatakan valid dan praktis sebagai bahan ajar bagi calon guru.

KATA KUNCI

Problem-Based Learning, LKM Bilingual, Calon Guru, Perkembangan Emosional, Berpikir kritis

ABSTRACT

This study aimed to develop and evaluate the validity and practicality of a bilingual Problem-Based Learning (PBL)-based student worksheet (Lembar Kerja Mahasiswa; LKM) designed using critical thinking indicators to support analytical learning in pre-service teachers on emotional development. The study employed a Research and Development (R&D) approach using the Tessmer formative evaluation model, consisting of expert review, one-to-one evaluation, and small group evaluation. Participants included nine expert validators, three students in the one-to-one stage, and ten students in the small group stage. The worksheet incorporated critical thinking indicators analysis, evaluation, inference, and explanation through contextual problem-solving activities. Validation questionnaires and student response questionnaires were used, with validity analyzed using Aiken's V and practicality analyzed descriptively. Validation involved experts in content, pedagogy, design, Indonesian, and English. The worksheet achieved a very high validity level (Aiken's V = 0.905). The one-to-one evaluation indicated good initial practicality, while the small group evaluation showed a very practical category (89.34%). Students found the worksheet easy to use, well structured, and helpful for step-by-step problem analysis through contextual PBL activities. This study addresses the limited integration of bilingual instructional scaffolding in PBL-based worksheets for emotional development in pre-service teacher education. By integrating bilingual elements with PBL syntax, the worksheet provides instructional scaffolding that supports analytical and reflective learning. Although limited to validity and practicality evaluation, the developed worksheet can be considered a valid and practical instructional material for pre-service teacher education.

KEYWORDS

Problem Based Learning, bilingual worksheet, pre-service teachers, emotional development, critical thinking

1. INTRODUCTION

Emotional development is a crucial component in teacher education, as it is closely related to classroom interaction, student behavior, and learning outcomes [7,10,21]. Learning about emotional development requires not only conceptual understanding but also the ability to interpret situations, analyze problems, and formulate appropriate pedagogical responses. Therefore, learning in this area should be designed to facilitate analytical and reflective thinking processes in pre-service teachers.

However, based on observations and needs analysis conducted in the Student Development course, the current learning process has not fully supported the development of students' critical thinking skills. The results of the needs analysis questionnaire showed that 61.2% of students expressed the need for problem-based teaching materials to support deeper case analysis, while 71.4% of students experienced difficulties in relating theoretical concepts to real-life situations. These findings indicate that existing instructional approaches and materials have not optimally facilitated students' engagement in analytical and problem-solving activities, particularly in higher education contexts [3,4,5].

This condition is closely related to the limited facilitation of critical thinking processes in learning. Critical thinking involves skills such as analysis, evaluation, inference, and explanation, which are essential for understanding complex educational situations and making appropriate decisions [1,2,10,21]. In the context of teacher education, these processes are necessary to prepare future teachers to respond to diverse classroom challenges [10,21].

Problem-Based Learning (PBL) is considered an appropriate approach to address these challenges. PBL uses contextual problems as the starting point of learning and encourages students to actively engage in investigation and independent problem-solving processes [7,8]. Previous studies have shown that PBL can enhance students' engagement, improve learning outcomes, and promote higher-order thinking[7–12,17]. Most of these studies primarily focus on outcome measures or students' perceptions rather than examining how learning processes are systematically facilitated. As a result, limited attention has been given to how instructional design components, particularly learning materials, support the development of structured analytical thinking during learning activities.

In the implementation of PBL, instructional materials play an important role in supporting students' learning processes. Student worksheets (Lembar Kerja Mahasiswa; LKM) are one form of instructional material that can function as scaffolding to guide students in understanding problems, conducting analysis, and formulating solutions systematically. Previous studies have reported that PBL-based worksheets can achieve high levels of validity and practicality and may contribute to improved learning outcomes[17,18–20]. However, in many cases, these worksheets tend to function mainly as task-oriented materials or exercise sheets, rather than as structured scaffolding that explicitly guides students through step-by-step analytical and reflective thinking processes. From a methodological perspective, prior research often emphasizes the effectiveness of instructional strategies without adequately exploring how instructional materials are designed to support students' reasoning processes during learning.

Furthermore, although PBL is widely implemented, several studies highlight its limitations when not supported by well-designed instructional scaffolding. Without adequate structure, students may experience difficulties in organizing their reasoning processes, leading to superficial understanding or ineffective problem-solving[7–12,17]. This indicates that the effectiveness of PBL is not only determined by the learning model itself, but also by how instructional materials are designed to guide students' thinking. Therefore, there remains a need to develop instructional materials that not only align with PBL principles but also function as structured scaffolding to support students' analytical processes.

On the other hand, challenges in higher education learning are also related to students' ability to access English-language learning resources. Based on the results of the Universitas Sriwijaya English Proficiency Test (USEPT) taken by the participating students, most students obtained scores below the expected standard, indicating difficulties in understanding English scientific literature. This limitation may hinder students' ability to engage with broader academic references and academic discourse[1,2]. Therefore, integrating bilingual elements into instructional materials can provide scaffolding that supports students' comprehension while maintaining conceptual clarity[6]. However, previous studies mainly focus on the role of bilingual materials in improving learning outcomes, rather than positioning bilingual elements as academic scaffolding that supports analytical and reflective thinking processes.

Although numerous studies have developed PBL-based worksheets, most have focused on science and mathematics contexts and emphasized cognitive learning outcomes such as conceptual understanding and critical thinking skills[18–20]. Studies specifically addressing emotional development in teacher education contexts remain limited[7,10,21]. More importantly, previous studies have not explicitly designed PBL-based worksheets that integrate bilingual elements as structured academic scaffolding to systematically guide students' analytical and reflective thinking processes. Therefore, the integration of bilingual instructional scaffolding within PBL-based worksheets in the context of emotional development for pre-service teacher education represents a specific gap that remains underexplored.

This study offers a distinct contribution by positioning bilingual elements not merely as translation support, but as structured academic scaffolding integrated within a worksheet based on Problem-Based Learning (PBL). In contrast to previous studies that tend to treat worksheets as task-oriented materials, this study emphasizes the design of instructional materials that explicitly guide students through step-by-step analytical processes by integrating PBL syntax with bilingual scaffolding.

Therefore, this study aims to develop and evaluate the validity and practicality of a bilingual PBL-based student worksheet designed according to critical thinking indicators and intended to facilitate critical thinking processes in pre-service teachers on the topic of emotional development.

2. METHODE

2.1 Research Design

This study employed a Research and Development (R&D) approach to develop and evaluate the validity and practicality of a bilingual Problem-Based Learning (PBL)-based student worksheet (LKM). The study was limited to product development and evaluation, focusing specifically on validity and practicality, and did not aim to examine instructional effectiveness or students' critical thinking skills.

The formative evaluation stage adopted Tessmer's model, which includes expert review, one-to-one evaluation, and small-group evaluation. The learning activities incorporated into the LKM were designed based on critical thinking indicators-interpretation, analysis, evaluation, inference, and explanation-which served as a conceptual framework for structuring learning tasks rather than as measurable research variables.

2.2 Research Subjects and Location

The study was conducted in the Chemistry Education Study Program, Faculty of Teacher Training and Education, Universitas Sriwijaya. The research involved nine expert validators representing the areas of content, pedagogy, instructional design, Indonesian language, and English language.

The validators were selected based on their academic qualifications, professional expertise, and relevance to the aspects being evaluated. All validators held at least a master's degree (M.Pd., M.Si., or M.Hum.) and were affiliated with Universitas Sriwijaya. Content and pedagogical aspects were assessed by chemistry education experts, whereas instructional design was evaluated by specialists in instructional design. The language aspects were reviewed by experts in Indonesian and English language education.

The Indonesian language component was evaluated by a single expert specializing in Indonesian language education. This was considered adequate because the assessment focused on linguistic clarity, readability, and the appropriateness of academic language. The use of a single language validator is consistent with linguistic validation practices, which emphasize expert judgment rather than comparisons across multiple raters. To ensure consistency, structured validation criteria aligned with established language quality standards were employed.

The product trial involved three students during the one-to-one evaluation stage and ten students during the small-group evaluation stage. The three participants represented high-, moderate-, and low-achieving students to identify usability issues across different levels of academic ability. The small-group evaluation followed Tessmer's formative evaluation approach, which recommends relatively small samples for iterative product refinement rather than statistical generalization.

Participation in the study was voluntary, and informed consent was obtained from all participants before data collection. Participant anonymity and confidentiality were maintained throughout the research.

2.3 Research Procedure

The research procedure followed Tessmer's formative evaluation model, consisting of four stages: analysis, design, development, and formative evaluation. The formative evaluation comprised expert review, one-to-one evaluation, and small-group evaluation. This study was conducted up to the small-group evaluation stage.

The analysis stage was carried out to identify the need for developing the student worksheet (Lembar Kerja Mahasiswa, LKM). This stage included curriculum analysis, content analysis, and student needs analysis. Student needs were identified through questionnaires and classroom observations to determine the gap between expected and actual learning conditions.

During the design stage, the structure and content of the bilingual PBL-based LKM were developed. The development stage produced the initial product (Prototype I), which was revised through self-evaluation to generate Prototype II. Prototype II subsequently underwent expert review, one-to-one evaluation, and small-group evaluation to obtain feedback for further refinement.

To facilitate data collection throughout the formative evaluation process, several research instruments were employed, including expert validation sheets and student response questionnaires.

2.3.1 Research Instrument

The research instruments consisted of validation sheets and student response questionnaires designed to evaluate the validity and practicality of the developed LKM. The validation instruments covered four aspects: content, pedagogy, instructional design, and language (Indonesian and English). Each instrument was developed based on relevant theoretical frameworks, particularly critical thinking indicators-analysis, evaluation, inference, and explanation and principles of instructional design. These dimensions and indicators were constructed to support analytical learning processes through PBL-based activities.

The number of items varied across the evaluated aspects according to their conceptual scope and specific evaluation criteria, ensuring proportional representation of each dimension. The content instrument consisted of 15 items, the pedagogical instrument 16 items, the instructional design instrument 15 items, and each language instrument (Indonesian and English) comprised 13 items.

Each item was developed by translating theoretical indicators into measurable statements reflecting the characteristics of the LKM and students' responses to the learning activities. This process ensured that every item adequately represented the intended construct. Examples include: (1) the indicator of case relevance, represented by the statement "The presented case is relevant to emotional development concepts"; (2) alignment with the PBL syntax, represented by "The LKM facilitates

students in analyzing problems using emotional development theory"; (3) design clarity, represented by "The layout of the LKM is systematically organized"; and (4) language clarity, represented by "The instructions are easy to understand."

All items were rated using a five-point Likert scale ranging from strongly inappropriate to strongly appropriate. The instruments were reviewed by experts to establish content validity. Detailed information regarding the distribution of items, indicators, and complete instrument statements is provided in the Supplementary Material to enhance transparency and reproducibility.

2.3.2 Data Analysis

Content validity was evaluated using Aiken's V [22] to determine the degree of agreement among expert validators regarding the relevance of each instrument item. The index was calculated using the following formula:

$$V = \frac{\sum s}{n\,(c-1)}$$

where $s = r - l_0$, r represents the score assigned by the validator, $l_0$is the lowest score, $c$is the highest score, and $n$is the number of validators.

The interpretation of Aiken's V values referred to the following criteria: 0.80–1.00 (very high validity), 0.60–0.79 (high validity), 0.40–0.59 (moderate validity), 0.20–0.39 (low validity), and 0.00–0.19 (invalid). Practicality data were analyzed using percentage calculations with the following formula:

$$Practicality = \frac{Obtained\ Score}{Maximum\ Score}\ x\ 100\%$$

To assess the consistency of expert judgments, the Intraclass Correlation Coefficient (ICC) was calculated as an indicator of inter-rater reliability.

Descriptive statistics, including the mean and standard deviation, were also computed to examine response variability and consistency across the evaluated aspects. Furthermore, score distribution analysis was conducted to identify response patterns and support the interpretation of reliability findings.

Qualitative data obtained from student responses were analyzed descriptively to complement the quantitative findings. This analysis focused on identifying patterns related to usability, clarity, and response consistency, thereby providing a more comprehensive understanding of the practicality of the developed LKM within the context of formative evaluation. The integration of quantitative and qualitative analyses strengthened the methodological rigor of the study by providing a more nuanced evaluation of the product's validity, reliability, and practicality.

3. RESULT

3.1 *Analysis*

3.1.1 Curriculum Analysis

Curriculum analysis was conducted to identify learning outcomes relevant to the development of the student worksheet (Lembar Kerja Mahasiswa; LKM) on the topic of students' emotional development. The results of the curriculum analysis of the Student Development course are presented in Table 1.

Table 1. Results of Curriculum Analysis

Component	Analysis Results
Sub-CLO	Students are able to analyze problems related to students' emotional development based on relevant theories
Learning Objectives	1. Analyze theories of emotional development through real-life cases; 2. Identify factors influencing emotional development; 3. Formulate alternative educational solutions
Cognitive Level	C4-C5 (Analyzing, Evaluating)
Learning Implications	Instructional materials are needed to facilitate case analysis and systematic problem-solving processes

Based on Table 1, the learning outcomes require students to be able to analyze problems related to students' emotional development based on relevant theories. These outcomes are categorized at a higher cognitive level, namely C4–C5 (analyzing and evaluating), indicating that the learning process is oriented not only toward conceptual mastery but also toward higher-order cognitive processes rather than mere conceptual recall. This finding implies that instructional materials used in the course should not only present theoretical content but also facilitate structured analytical activities that enable students to interpret cases, identify influencing factors, and formulate appropriate educational responses. The emphasis on analytical processes reflects the need for learning environments that support systematic problem exploration and decision-making processes.

Furthermore, although these cognitive processes are conceptually related to the critical thinking indicators proposed by Facione, such as analysis, evaluation, and inference, in this study they are positioned as a conceptual basis for designing learning activities rather than as directly measured outcomes. Therefore, the curriculum highlights the need for instructional materials that can function as scaffolding to guide students through structured problem analysis. In this context, the development of a Problem-Based Learning (PBL)-based student worksheet becomes relevant, as it provides a structured framework aligned with the expected cognitive processes.

3.1.2 Student Needs Analysis

The needs analysis was conducted to identify the gap between the curriculum demands and the actual learning conditions in the *Student Development course.* Normatively, higher education emphasizes student-centered learning and the development of higher-order thinking competencies.

However, the findings indicate that the current learning process has not fully supported these demands. A total of 71.4% of students reported difficulties in conducting in-depth case analysis, particularly in relating theoretical concepts to real-world problems. These findings suggest that students lack structured guidance in conducting analytical and problem-solving processes. Classroom observations further revealed that learning activities were not supported by instructional materials specifically designed to guide systematic analytical processes. This condition indicates that students tend to receive conceptual information without adequate support to develop structured analytical skills.

This finding suggests that the limitations in case analysis may be attributed to the absence of integrated scaffolding activities that enable students to progressively connect theoretical concepts with real-world contexts.

Furthermore, the results of the English Proficiency Test (USEPT) showed that 66.6% of students scored below the minimum standard, indicating difficulties in understanding English-language learning resources. This limitation may hinder students' ability to access academic literature and comprehend scientific terminology relevant to the learning content. On the other hand, this finding also suggests that students need support in becoming accustomed to using English-language literature and instructional materials as part of the learning process. In addition, this limitation is not solely related to language ability but also to the lack of pedagogical support that integrates academic terminology into the learning process in a gradual manner.

Based on these findings, instructional materials are needed not only as sources of information but also as scaffolding to guide students in conducting structured case analysis. This study specifically highlights the limited availability of instructional materials that integrate contextual problem-solving activities with bilingual academic support, particularly in the context of emotional development in teacher education.

Therefore, the development of a bilingual Problem-Based Learning (PBL)-based student worksheet is considered relevant, as it provides a structured learning framework while simultaneously supporting students' gradual understanding of academic terminology without reducing conceptual clarity.

3.2 Development of PBL-Based Student Worksheets (LKM)

The development stage aimed to produce a bilingual Problem-Based Learning (PBL)-based student worksheet (LKM) that is appropriate for use in learning activities. The development process was carried out progressively through several prototypes that underwent continuous evaluation and revision.

3.2.1 Prototype I

Prototype I represented the initial design of the student worksheet (LKM), which was developed using Canva and Microsoft Word. At this stage, the LKM was designed by integrating the syntax of Problem-Based Learning (PBL), including problem orientation, problem identification, theoretical investigation, case analysis, and solution development. The integration of PBL syntax is important because problem-based learning uses contextual problems as the starting point to encourage students to engage in investigation and independent problem-solving processes[7,8]. Furthermore, these stages are aligned with the characteristics of PBL, which has been shown to support analytical and reflective learning processes[9,10]. The initial appearance of the LKM is presented in Figure 1.

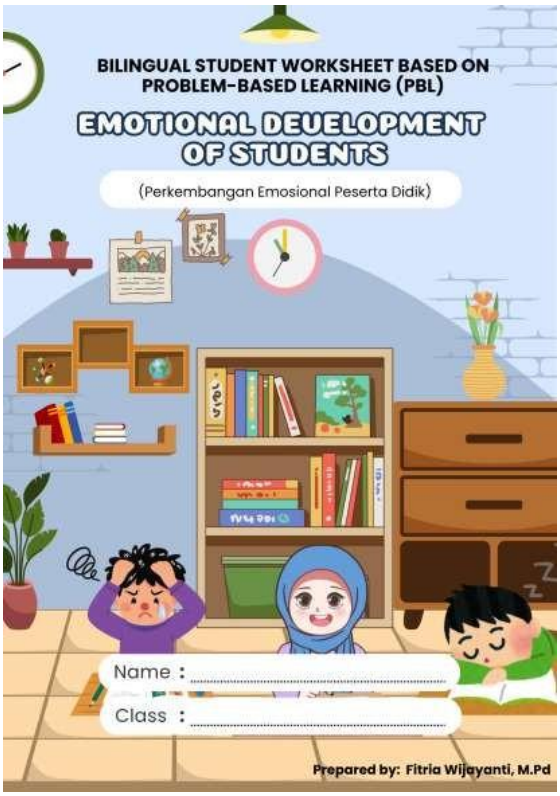

Figure 1. Initial Draft of the PBL-Based LKM

Figure 1 shows that the LKM was designed with an attractive and well-organized visual layout, including the title, course identity, and illustrations relevant to the topic of emotional development. The communicative cover design was intended to enhance students' learning motivation while providing an overview of the learning content and objectives. One stage of the LKM, namely problem orientation, is presented in Figure 2.



Figure 2. Problem Orientation Stage in the LKM

The alignment between the PBL stages and the structure of the LKM ensures that learning activities are organized systematically, enabling students to engage in

step-by-step problem exploration rather than fragmented understanding.

Figure 2 illustrates that the problem orientation stage was presented through contextual cases related to students' emotional development. The use of contextual cases allows students to connect theoretical concepts with real-life situations, thereby enhancing engagement and supporting the initiation of analytical processes. Each stage of the LKM was designed to guide students through case interpretation, problem analysis, and solution formulation. This structured sequence functions as instructional scaffolding that supports students in progressively developing their analytical skills through guided activities. These activities were structured to facilitate thinking processes without directly measuring critical thinking skills. Therefore, the design of the LKM focuses on facilitating analytical processes rather than claiming direct development of critical thinking skills as a measured outcome.

The bilingual approach was implemented as instructional scaffolding to support students' familiarity with academic terminology [6]. This approach not only supports comprehension but also gradually introduces students to English academic discourse, thereby fostering the development of their academic literacy. This indicates that the contribution of the LKM lies in its design as bilingual instructional scaffolding rather than as an empirically tested intervention to improve learning outcomes. Thus, the value of the developed product is positioned in its instructional design, which integrates structured problem-solving activities and bilingual support within a single learning resource.

3.2.2 Prototype II

Prototype II was developed following revisions to Prototype I based on a self-evaluation process. This stage involved a systematic review of the alignment among the learning objectives, instructional materials, and the implementation of PBL syntax within the LKM.

The self-evaluation process identified several aspects requiring improvement, including the clarity of instructions, coherence between learning activities, and the relevance of contextual problems. These aspects were considered critical because unclear instructions and weak coherence may hinder students' ability to follow structured analytical processes. Accordingly, revisions focused on improving the clarity of task instructions and strengthening the logical sequence of learning activities. This refinement aims to ensure that each stage of the LKM effectively guides students through a step-by-step analytical process rather than presenting disconnected learning tasks. In addition, improvements were made to enhance the relevance and quality of contextual problems. More representative and relevant cases were incorporated to better support students in connecting theoretical concepts with real-life situations, which is essential for promoting analytical engagement. These revisions were aimed at strengthening the function of the LKM as instructional scaffolding that guides students through structured analytical processes, rather than enhancing measurable learning outcomes. Thus, the revisions focus on improving the quality of the learning process design rather than claiming direct improvement in students' critical thinking skills.

Furthermore, adjustments were made to enhance the overall quality of the learning activities and promote greater student engagement. These improvements emphasize the facilitation of analytical and reflective processes as part of instructional design, without positioning them as directly measured outcomes.

3.2.3 Prototype III

Prototype III was produced through formative evaluation of Prototype II, which included expert review, one-to-one evaluation, and small group evaluation.

3.2.3.1 *Expert Review*

The expert validation results indicate that the developed LKM achieved a very high level of validity. The Aiken's V values for all assessed aspects ranged from 0.839 to 0.943, with an overall average of 0.905, indicating very high validity. The detailed results are presented in Table 1.

Table 1. Validation Results of the LKM Based on Aiken's V

No	Aspect	Aiken's V	Category
1	Content	0,943	Very High Validity
2	Pedagogical	0,935	Very High Validity
3	Design	0,917	Very High Validity
4	Indonesian Language	0,891	Very High Validity
5	English Language	0,839	Very High Validity
	Average	0,905	Validitas Sangat Tinggi

To complement the validity results, descriptive statistical analysis was conducted using mean and standard deviation to examine the consistency of expert judgments. The results are presented in Table 2. Most aspects obtained high mean scores accompanied by relatively low standard deviation values, indicating a high level of agreement and consistency among expert validators. This consistency indicates that the validity results were not only high but also stable across validators, thereby strengthening the credibility of the findings.

Table 2. Mean and Standard Deviation of Expert Ratings

No	**Aspect**	**Mean**	**SD**	**Category**

1	Content	4,83	0,20	Very High
2	Pedagogical	4,70	0,12	Very High

3	Design	4,65	0,29	Very High
4	Indonesian Language	4,56	0,43	Very High
5	English Language	4,48	0,41	Very High

In addition to validity and descriptive statistical analysis, inter-rater reliability was examined using the Intraclass Correlation Coefficient (ICC) to assess the level of agreement among expert validators. The ICC results are presented in Table 3.

Table 3. Inter-Rater Reliability Results Using ICC

No	Aspect	Number of Items	Number of Validators	ICC Value	Interpretation
1	Content	15	3	-0.03	Low (ceiling effect)
2	Pedagogical	16	3	-0.02	Low (ceiling effect)
3	Design	15	2	-0.01	Low (ceiling effect)
4	Indonesian	13	1	N/A	Not applicable
5	English	13	2	-0.02	Low (ceiling effect)

Note: *The low ICC values are attributed to the limited variability of scores, as most ratings were concentrated in the highest categories (scores 4 and 5). This condition indicates a ceiling effect and does not reflect poor agreement among validators*.

The analysis indicated relatively low numerical ICC values across several aspects. However, further examination of the data distribution revealed that most ratings were concentrated in the highest categories (scores 4 and 5), resulting in limited variability among validators' ratings. This condition indicates a ceiling effect, which may lead to underestimated or unstable ICC values.

Therefore, the low ICC values do not indicate poor agreement among validators but instead reflect the limited variability of the ratings, as no substantial discrepancies were observed across evaluators.

In the content aspect, the high validity score indicates that the material is relevant, accurate, and aligned with the learning objectives. This result may be The design aspect also achieved a high validity score, indicating that the layout, visual elements, and organization of the LKM are appropriate for instructional use. This may be attributed to the structured layout and clear visual hierarchy, which facilitate navigation and help students follow the intended learning sequence. Previous research has highlighted that well-designed instructional materials improve usability and student engagement [17].

In the language aspect, both Indonesian and English components showed relatively higher standard deviation values compared to other aspects, indicating variability in the evaluation results. However, the sources of this variation differ between the two components. In the Indonesian language aspect, where the evaluation was conducted by a single validator, the variation reflects differences across evaluated indicators rather than differences among raters. The results indicate that while several indicators, such as grammatical accuracy and sentence clarity, received very high scores, other indicators related to word choice, terminology consistency, and clarity of instructions obtained slightly lower scores. This suggests that the quality of language components within the LKM is not entirely uniform across all indicators.

In contrast, the variation observed in the English language aspect reflects differences among validators, as attributed to the use of contextual cases that closely reflect emotional development issues, as well as the alignment between PBL stages and the conceptual structure of the material. This finding is consistent with previous studies showing that contextual problem-based materials enhance conceptual relevance and support meaningful learning processes [7,8].

In the pedagogical aspect, the high score reflects the alignment of the LKM design with PBL principles. The structured sequence of learning activities enables students to engage in step-by-step analytical processes, thereby supporting systematic learning. This is supported by studies indicating that well-structured PBL stages can guide students through inquiry and analytical processes effectively [9–12].

this component was evaluated by more than one expert. This variation may be attributed to differences in evaluators' perspectives regarding language clarity, readability, and the balance between academic accuracy and accessibility in bilingual presentation. Validators with different areas of expertise may emphasize different criteria, leading to slightly varied assessments Overall, these findings indicate that the variability in the language aspects arises from differences in both item quality and evaluators' perspectives, highlighting the need for further refinement to improve language consistency throughout the LKM.

Overall, the expert validation results indicate that the developed LKM is suitable for use as an instructional material. However, these findings should be interpreted within the scope of product validity and do not imply effectiveness in improving students' critical thinking skills.

3.2.3.2 One to one evaluation

The one-to-one evaluation was conducted with three students representing high, moderate, and low levels of academic ability to examine the usability of the developed LKM. The results indicate that the LKM achieved a high level of practicality across all assessed aspects, as presented in Table 4

Table 4.One to One Evaluation Results

Aspect	Mean	SD	Category
Visual Design	4.67	0.35	Very High
Language & Instructions	4.20	0.85	High
Material Effectiveness	4.80	0.15	Very High
Ease of Use	4.10	0.70	High

The highest mean score was obtained in the material effectiveness aspect (M = 4.80, SD = 0.15), indicating that the LKM effectively supports students in understanding the learning content This result may be attributed to the use of contextual cases and structured problem-solving stages, which enable students to connect theoretical concepts with real-life situations. This finding is consistent with previous studies showing that problem based and contextual learning can enhance meaningful understanding [7,8].

The visual design aspect also received a very high rating (M = 4.67, SD = 0.35), suggesting that the layout, illustrations, and overall presentation were clear and engaging. This may be attributed to the structured layout and clear visual hierarchy, which help students navigate the learning process more easily.

However, relatively higher standard deviation values were observed in the language and instruction aspect (M = 4.20, SD = 0.85) and ease of use (M = 4.10, SD = 0.70). This variation reflects differences in students' ability to interpret instructions and adapt to structured problem-based learning activities.

This condition may be related to the variation in students' academic abilities, as the one-to-one evaluation involved participants with different levels of academic performance. Students with higher academic ability adapted more easily to structured analytical tasks, whereas those with lower academic ability required more time to understand the instructions and task sequence. Thus, the findings suggest that although the LKM is generally practical, improving the clarity of instructions and task guidance may further enhance its usability across students with different levels of academic ability. Furthermore, these findings also highlight that the effectiveness of instructional materials is closely related to how well they guide students through structured learning processes rather than merely presenting content. This is in line with studies indicating that scaffolding plays a crucial role in supporting student engagement and understanding in problem-based learning environments [9–12].

Overall, the results of the one-to-one evaluation indicate that the LKM is highly practical for initial implementation. However, these findings reflect students' perceptions of usability and do not imply direct improvement in critical thinking skills.

3.2.3.3 Small group evaluation

The small group evaluation was conducted with ten students to examine the practicality of the developed LKM in a broader learning context. The results indicate that the LKM achieved a high level of practicality across all assessed aspects, as presented in Table 5.

Table 5. Small Group Evaluation Results

Aspect	Mean	Category	Interpretation
Visual Design	4.77	Very Good	Highly engaging and structured
Language & Instructions	4.63	Very Good	Clear with slight variation
Material Effectiveness	4.67	Very Good	Strong learning support
Ease of Use	3.80	Good	Requires improvement

The visual design aspect obtained the highest mean score (M = 4.77), indicating that the layout, visual elements, and overall presentation effectively supported student engagement. This may be attributed to the structured layout and clear visual hierarchy, which help students navigate the learning activities more efficiently.

The material effectiveness aspect (M = 4.67) also showed a very high score, indicating that the LKM effectively supports students in understanding the learning content. This result is likely attributable to the integration of contextual problems and structured problem-solving stages, which enable students to connect theoretical concepts with real-life situations. This finding is consistent with previous studies showing that problem-based learning supports meaningful learning processes [7,8].

Similarly, the language and instruction aspect (M = 4.63) was rated highly, suggesting that the instructions were generally clear and understandable. However, slight variation in student responses suggests that some students may require more explicit guidance when interpreting structured analytical tasks.

In contrast, the ease-of-use aspect obtained the lowest mean score (M = 3.80), although it still falls within the "good" category. However, this finding requires careful interpretation. Student responses during the small-group evaluation indicated that many participants experienced time constraints when completing the tasks because they required additional time to analyze the given problems in depth. This suggests that the relatively lower ease-of-use score reflects the cognitive demands of the analytical processes rather than difficulties in using the LKM itself.

This interpretation is further supported by the needs analysis, which showed that 71.4% of students experienced difficulties in conducting in-depth case

analysis and connecting theoretical concepts to real-life situations. These findings indicate that students may require more time and adaptation when engaging in structured, problem-based learning activities.

From a theoretical perspective, this condition is consistent with the characteristics of Problem-Based Learning (PBL), which emphasizes complex problem-solving, critical thinking, and systematic reasoning processes that inherently require more time and cognitive effort. Therefore, the lower ease of use score may reflect the intensive nature of the learning process rather than a limitation of the LKM design. Overall, these findings suggest that the developed LKM facilitates deeper analytical engagement, although students may require an initial adaptation period to complete the tasks more efficiently.

4. DISCUSSION

4.1 Overall Findings and Validity

This study aimed to develop and evaluate the validity and practicality of a bilingual Problem-Based Learning (PBL)-based student worksheet (LKM) designed to facilitate analytical learning in the context of emotional development. The findings from the expert validation, one-to-one evaluation, and small-group evaluation collectively indicate that the developed LKM is both valid and practical for instructional use.

The expert validation results demonstrated a very high level of validity across all aspects, including content, pedagogical, design, and language. These findings suggest that the LKM has been appropriately designed in terms of material relevance, instructional structure, and visual presentation. This high validity may be attributed to the alignment between the PBL syntax and the conceptual structure of the emotional development material, as well as the integration of contextual cases that support meaningful learning. This is consistent with previous studies indicating that problem-based instructional materials enhance conceptual understanding and learning relevance[7,8].

Furthermore, the relatively low standard deviation values in most aspects indicate a high level of agreement among experts. However, slightly higher variation was observed in the language aspect. This variation suggests differences in familiarity with formal academic language, which may be influenced not only by limited exposure to English academic materials but also by students' habitual use of local languages in learning contexts. Thus, the issue extends beyond language proficiency and reflects broader challenges related to students' academic literacy. This finding reinforces the role of bilingual instructional materials as scaffolding to support students' gradual adaptation to academic discourse [6].

4.2 Practicality and Learning Process

The one-to-one evaluation results further support the practicality of the LKM, particularly in terms of material effectiveness and visual design. The high score for material effectiveness indicates that the use of contextual cases and structured problem-solving stages helps students connect theoretical concepts with real-life situations. This suggests that the effectiveness of the LKM lies in its ability to guide students through systematic analytical processes rather than merely presenting content. These findings are in line with studies emphasizing the importance of scaffolding in supporting meaningful learning and student engagement [9–12].

The pedagogical implication of these findings lies in how the integration of bilingual scaffolding and PBL syntax facilitates students' analytical learning in a structured manner. The PBL stages function as a cognitive framework that guides students' step by step through problem orientation, problem identification, analysis, and solution development, enabling them to systematically approach emotional development cases. At the same time, the bilingual elements act as instructional scaffolding that supports students' comprehension of academic terminology, reduces cognitive barriers, and facilitates engagement with learning tasks. This combination allows students not only to understand the content but also to organize their reasoning processes more systematically when analyzing contextual problems.

However, variation in student responses was observed in the language and instruction aspects, indicating that some students required more explicit guidance in interpreting structured tasks. This variation reflects differences in students' academic abilities and familiarity with structured analytical learning formats. The small group evaluation results confirm that the LKM is practical for broader implementation. While most aspects achieved very high scores, the ease-of-use aspect obtained the lowest score among all evaluated components. This finding is particularly important as it highlights that some students experienced difficulties in adapting to the structured learning format. This limitation may be attributed to students' varying levels of readiness in engaging with problem based and structured analytical learning activities. Students who are unfamiliar with such approaches may require additional time and guidance. Therefore, the lower ease-of-use score does not necessarily indicate a weakness in the LKM design but rather highlights the need for gradual scaffolding and adaptation during the learning process.

4.3 Pedagogical Implications

From a pedagogical perspective, these findings suggest that the integration of bilingual scaffolding within structured PBL stages plays a significant role in supporting students' analytical learning processes. The step-by-step problem analysis embedded in the LKM helps students organize their reasoning systematically, particularly when dealing with complex and context-based cases in emotional development.

In addition, the use of bilingual elements does not merely function as translation support but serves as academic scaffolding that facilitates students' comprehension of key concepts and terminology. This is particularly important in higher education contexts where students are required to engage with academic discourse while simultaneously developing analytical skills.

Therefore, the developed LKM can be positioned as an instructional design that not only presents learning content but also actively guides students in organizing their thinking, making it suitable for implementation in courses that emphasize case analysis and reflective reasoning. In this context, the contribution of this study lies in providing a valid and practical instructional design

that demonstrates how bilingual scaffolding can be integrated within PBL to support structured analytical engagement in pre-service teacher education.

4.4 Limitations of the Study

Several limitations should be considered in interpreting the findings of this study. Reliability analysis was conducted to examine the consistency of expert judgments. The results indicated that most ratings were concentrated in the highest categories (scores 4 and 5), resulting in limited score variability across validators. This condition led to low numerical Intraclass Correlation Coefficient (ICC) values due to a ceiling effect.

However, this does not indicate poor agreement among validators. Instead, it reflects a high level of consistency in their evaluations, as no substantial discrepancies were observed across ratings. Nevertheless, the absence of stable statistical reliability measures remains a methodological limitation. Future studies are recommended to include more diverse data and complementary reliability analyses to obtain more robust estimates.

In addition, the limited number of participants in the trial stages and the use of a single validator for the Indonesian language aspect should also be acknowledged as limitations of this study. Although these conditions are consistent with the principles of formative evaluation in development research, they may limit the generalizability and robustness of the findings. Therefore, future research is recommended to involve larger sample sizes and multiple validators across all aspects to strengthen methodological rigor.

Another limitation relates to the use of a single validator for the Indonesian language aspect. Although the evaluation was conducted by an expert with relevant expertise, the use of only one validator may limit the diversity of perspectives in assessing language quality. Future studies are recommended to involve multiple validators across all aspects to strengthen methodological rigor and enhance the robustness of the findings.

5. CONCLUSION

This study developed a bilingual Problem-Based Learning (PBL)-based student worksheet (LKM) designed to support structured analytical learning processes in the context of emotional development. The findings indicate that the developed LKM achieved a very high level of validity based on expert evaluation and demonstrated high practicality in both one-to-one and small group evaluations.

The results suggest that the integration of contextual problems, structured PBL stages, and bilingual elements contributes to the quality of the instructional design. These features enable the LKM to function as scaffolding that guides students in engaging with analytical learning processes and academic language.

The contribution of this study lies in providing a valid and practical instructional design that integrates bilingual support within a PBL framework, rather than in demonstrating direct improvement in students' critical thinking skills. However, this study is limited to formative evaluation stages, and the findings reflect descriptive insights into product validity and practicality.

Future studies are recommended to involve larger samples and include reliability testing as well as effectiveness evaluation to further examine the impact of the developed LKM on learning outcomes.

6. DECLARATION OF AI USE

The authors declare that no artificial intelligence (AI) tools were used in the preparation of this manuscript.

7. AUTHOR CONTRIBUTION

SHM: Conceptualization, methodology, investigation, data analysis, and writing the original draft. ZF: Validation, supervision, and reviewing and editing the manuscript. All authors have read and approved the final version of the manuscript.

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9. CONFLICT OF INTEREST

Statement The authors declare that there are no conflicts of interest regarding the research and publication of this article.

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