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# Development of Teaching Modules Based on Problem-Based Learning to Facilitate Mathematical Problem-Solving Skills

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**ABSTRACT**

This study addresses the limited availability of effective teaching modules that support the Merdeka curriculum. The objective is to develop a teaching module on linear equations and inequalities with one variable using the Problem-Based Learning (PBL) model, aiming to enhance students' mathematical problem-solving abilities. The research utilized the 4-D development model (Define, Design, Develop, Disseminate). The teaching module, designed for Phase D, was evaluated for validity and practicality. Validation instruments included expert review sheets assessing identity/general information, core components, and appendices. Practicality was assessed through teacher and student questionnaires. Validation results indicated that the module was highly valid. Average expert ratings were 3.74 for identity/general information, 3.73 for core components, and 3.75 for appendices. The practicality assessment showed high levels of acceptance, with teacher responses averaging 3.62. Student responses in a small group trial averaged 3.61, while those in a large group trial averaged 3.50—both categorized as very practical. The findings demonstrate that the developed module is both valid and practical for use in classroom settings. Its integration of the PBL model supports students' active engagement and enhances their problem-solving skills. The teaching module developed using the PBL approach meets the criteria for both validity and practicality. It serves as an effective instructional tool for teaching linear equations and inequalities in alignment with the Merdeka curriculum.



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## 1. INTRODUCTION

Mathematics plays a crucial role in education, enriching students' abilities and advancing human thinking. Mathematics learning in schools supports the development of critical, systematic, logical, creative, and objective thinking skills in problem-solving. Daut (2016) asserts that mathematics plays a vital role in the advancement of science and technology as well as in the development of the mathematics field itself.

In the Merdeka Curriculum, one of the general objectives of mathematics education, in accordance with the Ministry of Education and Culture Regulation No. 033 of 2022, is to develop students' mathematical problem-solving abilities. This objective encompasses a comprehensive understanding of various aspects of mathematics, including facts, concepts, principles, operations, and mathematical relations, as well as the ability to effectively apply this knowledge in solving mathematical problems. Students are considered capable of solving mathematical problems if they can understand the given problem, design an appropriate mathematical model, solve the model, and interpret the obtained results. Thus, through a problem-based approach, students can sharpen their mathematical skills, enabling them to face various challenges more competently (Sumartini, 2016).

The importance of mathematical problem-solving skills, as stated by Sumarno (in Rezi Ariawan & Hayatun Nufus, 2017), emphasizes that students possess mathematical problem-solving skills, which is crucial. This is because problem-solving skills are the goal of mathematics learning, even regarded as the heart of mathematics. Thus, mathematical problem-solving skills become the primary objective of all mathematics education and an integral part of all mathematical activities.

Many students make mistakes in solving mathematical problems due to a lack of understanding of concepts, which is influenced by shallow problem-solving learning (Szabo et al., 2020). Students often rely on memorizing mathematical concepts, resulting in low problem-solving abilities (Damianti & Afriansyah, 2022). Research by Nova Nurhanifah indicates that the problem-solving skills of Indonesian students are still lacking, despite the significance of this skill in mathematics education.

Sugiman (in Kharisma & Asman, 2018) highlights a primary issue with problem-solving abilities: misconceptions about its concept. Many perceive math problem-solving as merely applying formulas. However, most math problems in textbooks focus on calculations or formula application rather than true problem-solving. Consequently, weaknesses in students' mathematical problem-solving abilities persist, indicating suboptimal learning processes. This underscores the low problem-solving skills among Indonesian students, as evidenced by surveys and observations.

Sumartini (2016:149) and Arif Aulia Rahman (2018:28) emphasize the importance of appropriate teaching methods and effective learning tool development to ensure students respond positively to learning. Lesson planning is a crucial step in providing quality education (Nursobah, 2019; Leton et al., 2018). A good lesson plan should be detailed and aligned with established guidelines.

Practical teaching modules can be realized by using attachments such as student worksheets. These worksheets assist teachers in providing guidance to students and facilitating comprehension of the material. Innovations in mathematics education that emphasize problem-solving, such as problem-based learning models, are considered important (Herdiansyah, 2018; Rahmadani, 2019). Research by Yuhani, Zhanty, and Hendriana (2018:451) indicates that students who participate in learning with a problem-based learning approach have better mathematical problem-solving abilities compared to those in conventional learning settings.

Problem-Based Learning (PBL) is a learning model suitable for the Merdeka Curriculum, where students actively engage in solving contextual problems (Aristo, S., 2022). PBL encourages students to independently develop problem-solving skills (Rahmadani, 2019). One topic that utilizes a contextual problem approach is the material on linear equations and inequalities with one variable, which is often considered difficult by students due to its narrative format and procedural complexity (Fitriani, 2018).

According to Wondo's research (2017), the utilization of problem-based learning models can enhance students' learning achievements, problem-solving abilities, and self-confidence. Research by Ridwan et al. (2016) indicates that instructional tools employing the problem-based learning model can improve students' problem-solving skills. With this approach, students can develop their own knowledge of linear equations and inequalities with one variable through problem-solving activities.

This study aims to develop a teaching module by applying the problem-based learning model to the topic of linear equations and inequalities with one variable to enhance the mathematical problem-solving skills of phase D students, in accordance with the Merdeka Curriculum.

## 2. METHODS

The type of research employed in this study is research and development. The product produced in this study is a teaching module consisting of three parts: identity and general information, core components, and appendices, utilizing the Problem Based Learning (PBL) model on the topic of linear equations and inequalities with one variable for phase-D. The development model utilized in this research is the Four-D (4-D) development model, which consists of four stages: define, design, develop, and disseminate. The developmental research trial was conducted at SMPN 47 Pekanbaru with eighth-grade odd semester students in the academic year 2023/2024. The procedural model of the 4-D development can be seen in the following figure:

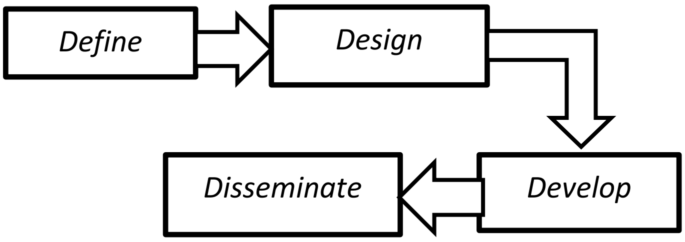



**Figure 1.** The 4D Steps According to Thiagarajan

In the define stage, seven steps are conducted according to the needs of the researcher in the Merdeka Curriculum, including initial-final analysis to determine the basic problems faced in learning implementation, student characteristics analysis, which can be conducted based on cognitive development in the learning process, concept analysis to identify the main topics to be taught and systematically organize the concepts used in learning, task analysis to analyze the basic concepts and tasks that students need to master to achieve learning objectives, learning achievement analysis to identify the established learning achievements that can be developed into learning objectives obtained through documentation of existing teaching modules and interviews, Pancasila student profile analysis to identify Pancasila values to be established according to the learning process, and formulating learning objectives to encompass the results of concept and task analysis to determine the behavior of the research subject.

After the define stage, the next step is the design stage. The activities involved include drafting test standards, selecting media, selecting formats, and initial design planning.

The develop stage involves developing the teaching module based on the previously established format and initial design. The developed teaching module is then validated by three validators, and revisions are made based on the feedback provided during validation. If the teaching module is deemed valid, it is then assessed by three teachers to evaluate its practicality. Once it is deemed practical from the teachers' assessment, it is considered suitable for use in the learning process. Subsequently, small-group testing and large-group testing are conducted.

The final stage in the development of teaching modules using the 4-D model is the dissemination stage. In the dissemination stage, the product is packaged in the form of a booklet and distributed to mathematics teachers in junior high schools.

The research data in this study consists of both qualitative and quantitative data. Qualitative data are obtained from interviews, feedback, or suggestions from validators and academic supervisors regarding the teaching module and are used as a reference to improve the developed product. Quantitative data are obtained from the scoring of validation sheets filled out by experts and users to assess the validity and practicality of the developed product. The instruments used to collect data in this study are validation sheets and practicality sheets. The data collection technique used in the development research of teaching modules involves interviewing junior high school teachers in SMPN Pekanbaru who have used teaching modules with the Merdeka Curriculum. Interviews were also conducted with several SMPN Pekanbaru students, and the instruments included teaching module validation questionnaires, teacher observation sheets, and student response questionnaires.

The data analysis technique for validation is obtained using the following formula.
$\bar{M}_v = \frac{\sum_{i=1}^{n} \bar{V}_i}{n}$ (Adapted from Amatullah, Agustiany, and Feli, 2020.)
Keterangan:
$\bar{M}_v$ : The average total validation.
$\bar{V}_i$ : The average validation score of validator-i.
$n$ : The number of validators.
The criteria for validating the teaching module can be seen in the following Table 1.

**Table 1.** Criteria for validating the teaching module.

| Interval | Indicator |
|---|---|
| $3,25 \leq \bar{M}_v < 4$ | Very Valid |
| $2,50 \leq \bar{M}_v < 3,25$ | Valid |
| $1,75 \leq \bar{M}_v < 2,50$ | Less Valid |
| $1,00 \leq \bar{M}_v < 1,75$ | Invalid |

Source: Made Juniantari (2017: 74)

The teaching module is considered valid if the average score obtained is equal to or greater than 2.50 and can be used in the learning process.

The technique for analyzing data from teacher responses and student response questionnaires to assess practicality. The analysis of the practicality of teaching modules using student and teacher response questionnaires can be conducted using the following formula.
$\bar{M}_P = \frac{\sum_{i=1}^{n} \bar{P}_i}{n}$ (Adapted from Amatullah Mu'tashimah, Agustiany, and Feli, 2020:86)
Information:
$\bar{M}_P$ : Total practicality average
$\bar{P}_i$ : Average practicality of practitioner i
$n$ : Number of respondents

The criteria for response questionnaires used can be seen in the following Table 2.

**Table 2.** Criteria for Practicality Level

| Interval | Indicator |
|---|---|
| $3,25 \leq \bar{M}_P < 4$ | Very Practical |
| $2,50 \leq \bar{M}_p < 3,25$ | Practical |
| $1,75 \leq \bar{M}_p < 2,50$ | Less Practical |
| $1,00 \leq \bar{M}_p < 1,75$ | Not Practical |

Source: Modified from Widoyoko (in Amatullah Mu'tashimah, Agustiany, and Feli, 2020)

The response questionnaire is considered practical if the average score obtained is equal to or greater than 2.50 and can be used in the learning process.

## 3. FINDINGS AND DISCUSSION

### *3.1 Findings*

Referring to the research development stages outlined in this study, the following will be explained regarding the research results according to those stages. The define stage begins with initial and final analysis stages conducted to identify the fundamental issues present in the teaching modules used by mathematics teachers at SMPN 47 Pekanbaru and SMPN 34 Pekanbaru, which have adopted the Merdeka curriculum. In this stage, information and facts were obtained that, during the implementation of the Merdeka curriculum, students experienced difficulties in the topics of linear equations and inequalities in one variable. They particularly struggled with mathematical problem-solving, especially contextual ones, as they were still unable to read the questions properly and create accurate mathematical models. They tend to rely solely on formulas and easily forget when asked to repeat previous learning. This indicates the low proficiency of students in mathematical problem-solving. Therefore, a product is needed to facilitate students' mathematical problem-solving skills (KPMM).

The next stage is analyzing the characteristics of students, aimed at examining the characteristics of junior high school students in participating in the learning process. According to Piaget, students aged 11-18 are capable of developing their formal thinking and achieving logic in drawing conclusions, interpreting, and developing hypotheses. Subsequently, the concept analysis stage is conducted to identify, detail, and systematically organize the material to be taught, referring to both the student and teacher books of the Merdeka curriculum.

The next stage involves analyzing learning achievements to assess the learning outcomes that students should achieve within a learning element. Subsequently, the analysis of the Pancasila student profile is conducted to determine the dimensions of the Pancasila student profile to realize competent, characterful, and behaviorally appropriate students in accordance with Pancasila values. In the task analysis stage, tasks are analyzed to determine the core tasks that must be mastered during learning. Then, learning objectives are formulated that align with concept analysis, learning achievement analysis, and task analysis.

In the design stage, activities include the development of test standards, media selection, format selection, and initial design. In the preparation of test standards, validation sheets are developed for teaching modules, practicality sheets for teaching modules, and practicality sheets for student worksheets (LKS). Media selection is carried out to identify suitable and relevant learning media based on the characteristics of the material according to concept analysis, task analysis, and student characteristics as users. The media used is printed media in the form of teaching modules. Next, the appropriate format is selected for the development of teaching modules. The format used for the development of teaching modules is based on the Educational Assessment Guidelines (BSKAP) from the Ministry of Education, Culture, Research and Technology in 2022. The design of teaching modules is based on the established format and adapted to the phases of problem-based learning and the steps of the scientific approach.

In the development stage, the activity involves developing teaching modules that contain identity and general information, core components, and appendices. The example snippets of the developed teaching modules can be seen in the following figure.

**Topik-1**

Mengidentifikasi PLSV dan PtLSV

**Bagian I. Identitas dan Informasi Umum**

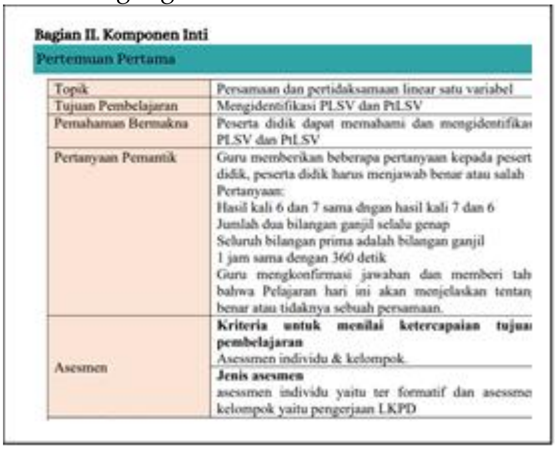
| | |
|---|---|
| Kode Modul Ajar | MAT.D.INDRA.7 |
| Jenjang Sekolah/Fase | Sekolah Menengah Pertama (SMP)/Fase-D |
| Alokasi Waktu | 2 JP/ 70 menit |

Indra Hayati Putri

| | |
|---|---|
| Kompetensi Awal | • Operasi Hitung |
| Profil Pelajar Pancasila | • **Berfikir kritis** dibentuk ketika menyelesaikan permasalahan secara kelompok dan individu<br>• **Mandiri** dibentuk ketika mengerjakan asesmen secara individu<br>• **Gotong Royong** dibentuk dalam kegiatan diskusi kelompok |
| Sarana dan Prasarana | • LCD/Proyektor<br>• LKPD<br>• Buku dan alat tulis |
| Target Peserta Didik | Semua peserta didik dalam satu kelas baik yang reguler, pencapaian tinggi maupun yang memiliki kesulitan belajar, ikut serta mempelajari materi ini. |
| Model Pembelajaran dan Pendekatan | • Model Pembelajaran *Problem Based Learning*<br>• Pendekatan Saintifik |

Figure 2. Display of Identity and General Information

On the front page, the identity and general information of the teaching module include general information related to the developed teaching module, such as the module code, author's name, school level of phase, time allocation, initial competencies, Pancasila student profile, facilities and infrastructure, target students, as well as learning models and approaches. On the next page, there are the core components of the teaching module for one meeting. The display of the core components for one meeting can be seen in the following Figure 3.



**Bagian II. Komponen Inti**

Pertemuan Pertama

| | |
|---|---|
| Topik | Persamaan dan pertidaksamaan linear satu variabel |
| Tujuan Pembelajaran | Mengidentifikasi PLSV dan PtLSV |
| Pemahaman Bermakna | Peserta didik dapat memahami dan mengidentifikai PLSV dan PtLSV |
| Pertanyaan Pemantik | Guru memberikan beberapa pertanyaan kepada pesert didik, peserta didik harus menjawab benar atau salah<br>Pertanyaan:<br>Hasil kali 6 dan 7 sama dngan hasil kali 7 dan 6<br>Jumlah dua bilangan ganjil selalu genap<br>Seluruh bilangan prima adalah bilangan ganjil<br>1 jam sama dengan 360 detik<br>Guru mengkonfirmasi jawaban dan memberi tah bahwa Pelajaran hari ini akan menjelaskan tentan benar atau tidaknya sebuah persamaan. |
| Asesmen | **Kriteria untuk menilai ketercapaian tujua pembelajaran**<br>Asessmen individu & kelompok. |
| | **Jenis asesmen**<br>asessmen individu yaitu ter formatif dan asessme kelompok yaitu pengerjaan LKPD |

Figure 3. Display of Core Components

The next part of the developed teaching module is the appendix. The appendix includes student worksheets (LKS), enrichment and remedial materials, reading sources for teachers and students, a glossary, and a bibliography. The student worksheets developed consist of two parts: the cover page and the content of the LKS. Below is an example of the cover page of the developed LKS.


Figure 4. Display of the LKS Cover Page (LKS-1)

The cover page of the LKS contains student information, learning material, learning objectives, and instructions for filling out the LKS. The content of the LKS includes learning activity steps using the phases of PBL and the scientific approach. Below is an excerpt from the LKS display on the first page.

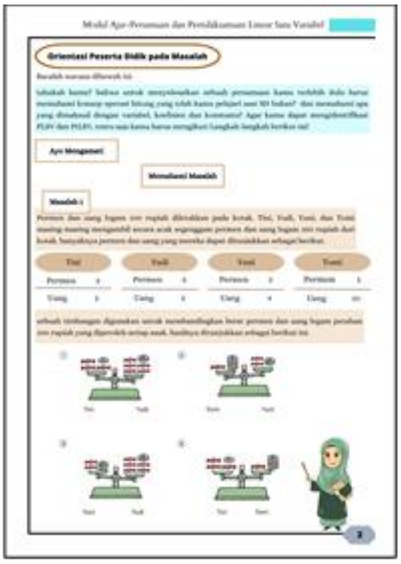



Figure 5. Display of the First Page of the Worksheet-1

The teaching module that has been developed and approved by the supervisor is then validated by three validators. Validation is conducted to assess the quality of the product and the suitability of the teaching modules used by teachers in the learning process. From the validation conducted, validators provide suggestions for improvement to the teaching module, including:

1. Validators suggest that in the section of identity and general information, the time allocation for 1 hour of learning at the junior high school level is 40 minutes; hence 2 hours of learning or 2JP is 80 minutes. In the initial competency, there is a sentence that is not precise in counting operations, where the correct one should be the counting operation. Additionally, the three-dimensional profile of Pancasila students used in the teaching module, namely critical thinking, independence, and mutual cooperation, should be expanded to include 4 dimensions of the Pancasila student profile, namely faith, devotion to the One and Only God, noble character, critical thinking, independence, and mutual cooperation. Below are Figures 6 and Figures 7 in the teaching module's identity and general information section before and after revision.


Figure 6. Identity and General Information Section Before Revision

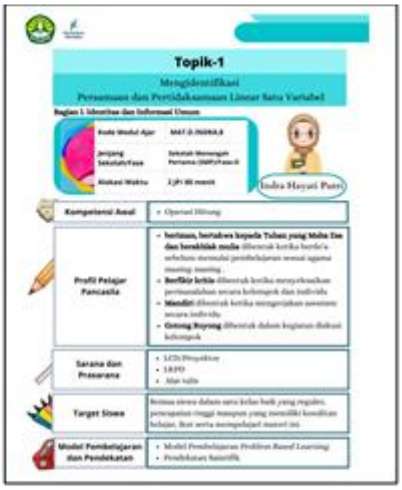



Figure 7. Identity and General Information Section After Revision

2. Validators suggest adding open-ended sentence problems to the trigger questions in the core component of the teaching module for PtLSV. Additionally, in the assessment section of the group assessment rubric, attention should be paid to the appropriate scoring for group assessment. Below are Figure 8 and Figure 9 aspects of trigger questions in the core component of the teaching module before and after revision.

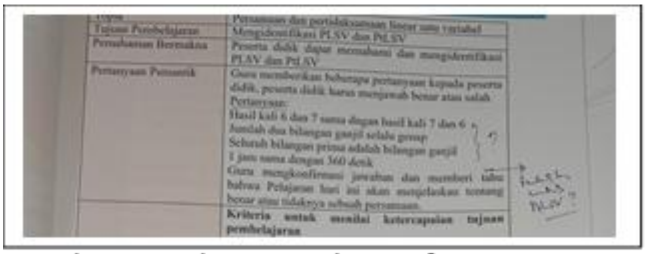


Figure 8. Trigger Questions Before Revision

**Bagian II. Kompetensi Inti**

**Pertemuan pertama**

| | |
|---|---|
| Topik | Persamaan dan pertidaksamaan linear satu variabel |
| Tujuan Pembelajaran | Mengidentifikasi Persamaan dan Pertidaksamaan Linear Satu Variabel |
| Pemahaman Bermakna | Siswa dapat memahami dan mengidentifikasi Persamaan dan Pertidaksamaan Linear Satu Variabel |
| Pertanyaan Pemantik | Guru memberikan beberapa pertanyaan kepada siswa, siswa harus menjawab benar atau salah<br>Pertanyaan:<br>Apakah hasil kali 6 dan 7 sama dengan hasil kali 7 dan 6?<br>Apakah jumlah dua bilangan ganjil selalu genap?<br>Apakah Seluruh bilangan prima adalah bilangan ganjil?<br>Apakah 1 jam sama dengan 360 detik ?<br>Apakah 4 kurang dari 6 ditulis 4 < 6?<br>Apakah tiga kali y tidak kurang dari 8 ditulis 3y = 8?<br>Apakah 9 lebih dari 4 ditulis 9 > 4?<br>Guru mengkonfirmasi jawaban dan memberi tahu bahwa Pelajaran hari ini akan menjelaskan tentang benar atau tidaknya sebuah persamaan dan pertidaksamaan. |
| Asesmen | **Kriteria untuk menilai ketercapaian tujuan pembelajaran**<br>Asesmen individu & kelompok.<br>**Jenis asesmen**<br>Asesmen individu yaitu tes formatif dan asesmen |

Figure 9. Trigger Questions After Revision

Here are Figure 10 and Figure 11 assessment rubrics before and after revision.

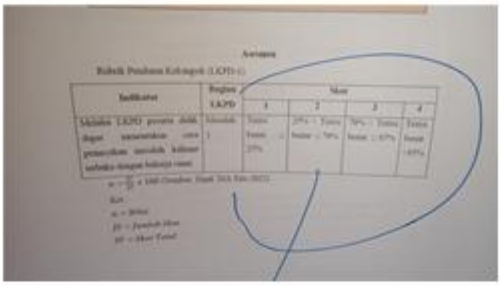


Figure 10. Assessment Rubric Before Revision

Instrumen Penilaian Praktik

Instrumen penilaian praktik yang digunakan adalah Lembar Kerja Siswa (LKS).

**LEMBAR PENILAIAN PRAKTIK**

Mata Pelajaran : Matematika

Materi : Mengidentifikasi PLSV dan PtLSV

Kelas : VIII

Pertemuan : 1

| No. | Nama Siswa | Aspek Penilaian | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Individu | | | | Kelompok | | | Nilai Akhir Diskusi |
| | | A | B | C | D | A | B | C | |
| | Kelompok 1 | | | | | | | | |
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| | Kelompok 2 | | | | | | | | |
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| | dst. | | | | | | | | |

Indikator Penilaian

| Indikator Penilaian Kerja | | |
|---|---|---|
| **Individu** | **Skor** | **Kelompok** |
| Sering | 4 | Memuaskan |
| Kadang-kadang | 3 | Baik |
| Jarang | 2 | Cukup |
| Tidak pernah | 1 | Kurang |
| **Keterangan Aspek Penilaian** | | |

| Individu | Kelompok |
|---|---|
| A : Mengemukakan ide/gagasan | A : Penyelesaian tugas kelompok |
| B : Menjawab pertanyaan | B :Ketepatan hasil diskusi |
| C : Ketelitian | C : Kerjasama kelompok |
| D : Keterlibatan dalam diskusi | |

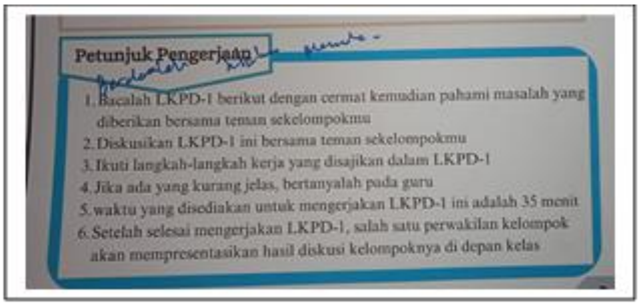
Nilai individu = $\frac{\text{Total Skor}}{\text{Skor Maksimal}} \times 100$

Nilai kelompok = $\frac{\text{Total Skor}}{\text{Skor Maksimal}} \times 100$

Nilai Akhir Diskusi = $\frac{\text{nilai individu+nilai kelompok}}{\text{Skor Maksimal}} \times 100$

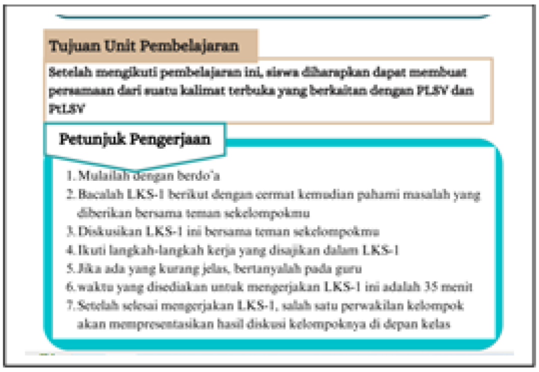
Figure 11. Assessment Rubric After Revision

3. The validater suggested in the appendix section, in the instructions for completing the work, that the sentence "Pray before starting to work on the worksheet" be added. Below are Figure 12 and Figure 13 in the appendix section before and after revision.


Petunjuk Pengerjaan

1. Bacalah LKPD-1 berikut dengan cermat kemudian pahami masalah yang diberikan bersama teman sekelompokmu
2. Diskusikan LKPD-1 ini bersama teman sekelompokmu
3. Ikuti langkah-langkah kerja yang disajikan dalam LKPD-1
4. Jika ada yang kurang jelas, bertanyalah pada guru
5. waktu yang disediakan untuk mengerjakan LKPD-1 ini adalah 35 menit
6. Setelah selesai mengerjakan LKPD-1, salah satu perwakilan kelompok akan mempresentasikan hasil diskusi kelompoknya di depan kelas

Figure 12. Instructions for Completion Before Revision


Tujuan Unit Pembelajaran

Setelah mengikuti pembelajaran ini, siswa diharapkan dapat membuat persamaan dari suatu kalimat terbuka yang berkaitan dengan PLSV dan PtLSV

Petunjuk Pengerjaan

1. Mulailah dengan berdo'a
2. Bacalah LKS-1 berikut dengan cermat kemudian pahami masalah yang diberikan bersama teman sekelompokmu
3. Diskusikan LKS-1 ini bersama teman sekelompokmu
4. Ikuti langkah-langkah kerja yang disajikan dalam LKS-1
5. Jika ada yang kurang jelas, bertanyalah pada guru
6. waktu yang disediakan untuk mengerjakan LKS-1 ini adalah 35 menit
7. Setelah selesai mengerjakan LKS-1, salah satu perwakilan kelompok akan mempresentasikan hasil diskusi kelompoknya di depan kelas

Figure 13. Instructions for Completion After Revision

4. The validator suggested replacing the questions in Worksheet-1 because the questions provided are not contextual, as seen in Figure 14 and Figure 15 below.

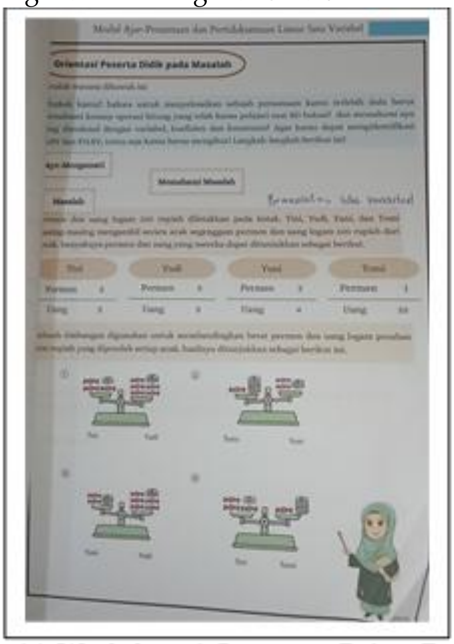


Figure 14. Worksheet-1 Questions Before Revision

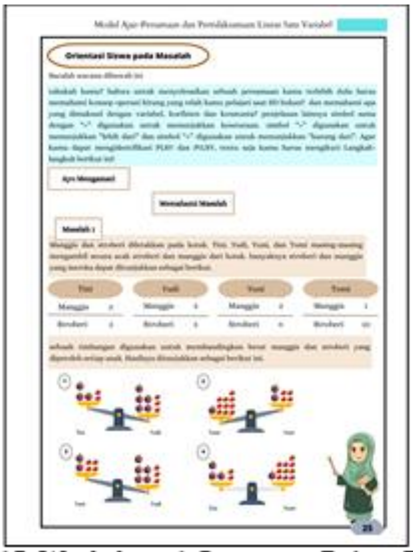


Figure 15. Worksheet-1 Questions Before Revision

5. Validator suggests expanding the answer column in the worksheet "Let's Communicate" to provide more space for students to write their conclusions. This can be seen in the following image.

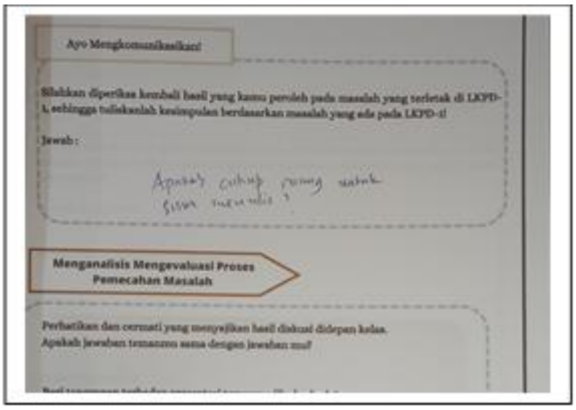


Figure 16. "Let's Communicate" Before Revision

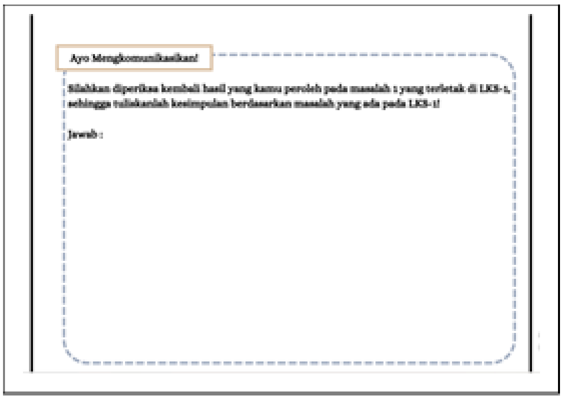


Figure 17. "Let's Communicate" After Revision

### *3.2 Discussion*

This study aimed to develop a teaching module on linear equations and inequalities with one variable using the Problem-Based Learning (PBL) model, aligned with the Merdeka curriculum. The module was evaluated for its validity and practicality through a rigorous validation and testing process involving expert validators and practitioners in the field of mathematics education. The findings from these evaluations provide essential insight into the quality, usability, and potential educational impact of the developed teaching module.

The validity of the teaching module was assessed through three core components: (1) identity and general information, (2) core content components, and (3) appendices. Each of these components underwent evaluation by three expert validators using a standardized validation sheet. The identity and general information section achieved an average score of 3.74, the core component section received a score of 3.73, and the appendices were rated at 3.75. All three scores fall within the category of "highly valid", indicating a strong alignment with pedagogical and content standards expected in instructional materials (Akker, 2020).

These findings suggest that the module meets essential design criteria, including clarity of learning objectives, coherence of content, alignment with the PBL model, and structural completeness. According to Nieven et al. (2019), a teaching module is considered valid when it adheres to theoretical foundations, maintains logical consistency, and is supported by instructional design principles. In this case, the validators confirmed that these criteria were successfully met, further strengthening the credibility and potential effectiveness of the module.

Importantly, the validation process also involved qualitative feedback from the validators. They provided constructive suggestions for refinement, particularly related to the clarity of instructions, the inclusion of real-life contextual problems for students, and the sequencing of learning tasks. These suggestions were then incorporated into the revised version of the module, demonstrating a commitment to continuous improvement based on expert feedback—an approach supported by the design-based research (DBR) paradigm in education (Anderson & Shattuck, 2012).

After the revision process, the practicality of the teaching module was assessed using a teacher-response questionnaire. Three mathematics teachers evaluated the module based on criteria such as ease of use, clarity of instructions, appropriateness of content for students' cognitive levels, and the effectiveness of the PBL model in facilitating student learning. The average score from this assessment was 3.62, categorizing the module as "very practical".

This high practicality score indicates that the teaching module is not only theoretically sound but also well-suited for actual implementation in the classroom. As noted by Plomp and Nieveen (2013), practicality refers to the extent to which an educational product can be implemented efficiently and effectively by users within a specific context. The results of this study are consistent with this notion, demonstrating that the developed module can be feasibly integrated into real teaching settings without requiring extensive adjustments by educators.

Furthermore, the feedback from teachers highlighted several strengths of the module, including the logical progression of problem-solving tasks, student-friendly language, and engaging contextual problems. Teachers also reported that the module could potentially improve students' mathematical problem-solving skills, a core objective of the Merdeka curriculum, which emphasizes student-centered learning and competency development (Kemdikbudristek, 2022). Such feedback not only validates the quality of the teaching module but also reflects its alignment with national educational reforms that prioritize inquiry-based and problem-based learning strategies.

The validators not only confirmed the module's validity but also recommended that it be tested in classroom settings, contingent upon minor revisions. Their suggestions included fine-tuning the contextual problems to better reflect students' everyday experiences, refining the formatting for improved readability, and including more scaffolding questions to support lower-ability learners. The incorporation of these recommendations ensured that the final product was not only academically rigorous but also accessible to a broad range of students.

These revisions reflect an essential characteristic of high-quality instructional design—flexibility and adaptability. As highlighted by Reigeluth and An (2021), instructional materials should be designed with consideration for diverse learner needs and should support differentiated instruction. The responsiveness of the module design to expert feedback underscores its adaptability and enhances its applicability across various classroom contexts.

From a broader perspective, this study contributes to the growing body of research supporting the use of the PBL approach in mathematics education. Several recent studies have shown that PBL fosters deeper understanding, critical thinking, and collaborative problem-solving among students (Hung, 2022; Mergendoller et al., 2021). By embedding these pedagogical principles into the structure of the teaching module, this study not only validates the effectiveness of the module itself but also supports the integration of PBL into mainstream curricular practice, especially within competency-based frameworks like Merdeka.

While the findings of this study are promising, some limitations should be acknowledged. First, the practicality assessment involved only a small sample of teachers, which may limit the generalizability of the results. Future research should consider expanding the sample size to include educators from diverse regions and school types to obtain a more comprehensive understanding of the module's usability.

Second, although the module was evaluated through expert validation and teacher feedback, the study did not yet include a quantitative measurement of student learning outcomes. Future research should implement experimental or quasi-experimental designs to examine the effectiveness of the module in improving students' problem-solving skills over time. Such empirical data would provide more robust evidence of the module's impact on student achievement and its contribution to meeting the learning goals of the Merdeka curriculum.

Lastly, longitudinal studies could be conducted to explore how sustained use of the module influences teaching practices and student learning behaviors. This would align with calls from educational researchers to move beyond short-term evaluations and consider the long-term sustainability and effectiveness of instructional innovations (Cobb et al., 2003).

In summary, the research findings demonstrate that the developed teaching module on linear equations and inequalities using the PBL model is both highly valid and highly practical. Expert validators confirmed the module's alignment with pedagogical standards, while teachers affirmed its usability and relevance for classroom instruction. The incorporation of feedback and subsequent revisions further enhanced the quality and effectiveness of the module. These findings support the integration of innovative, problem-based instructional materials within the Merdeka curriculum and provide a foundation for future research and development in this area.

## 4. CONCLUSION

This study resulted in the development of a teaching module designed to enhance students' mathematical problem-solving abilities, specifically on the topic of linear equations and inequalities in one variable, using the Problem-Based Learning (PBL) approach. The module was created using the 4-D (Define, Design, Develop, Disseminate) development model and evaluated for both validity and practicality. Validation by expert reviewers yielded average scores of 3.74 for identity and general information, 3.73 for core components, and 3.75 for appendices—each falling into the "highly valid" category. Additionally, the module received an average practicality score of 3.62 from mathematics teachers, indicating it is "very practical" and suitable for classroom implementation. These findings demonstrate that the module is both theoretically sound and feasible for use in real teaching contexts. However, a key limitation of this research is the limited scope of its practical evaluation, as it was tested by a small number of teachers without a broader classroom implementation or assessment of student learning outcomes. Future research should include larger-scale trials involving diverse student populations and employ experimental or quasi-experimental methods to measure the module's effectiveness in improving mathematical problem-solving skills. Longitudinal studies may also provide valuable insights into the module's long-term impact on both teaching practices and student performance.

**REFERENCES**

Akker, J. van den. (2020). *Curriculum Design Research*. Routledge.

Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher, 41*(1), 16–25. https://doi.org/10.3102/0013189X11428813

Ariawan, R., dan Nufus, H. (2017). Hubungan Kemampuan Pemecahan Masalah Matematis dengan Kemampuan Komunikasi Matematis Siswa. *Jurnal THEOREMS*, 1(2):82-91.

Badan, Standar, Kurikulum dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan Riset dan Teknologi. 2022. *Panduan Pembelajaran dan Asesmen*

Badan, Standar, Kurikulum dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan Riset dan Teknologi. 2022. *Panduan Penguatan Projek Profil Pelajar Pancasila.*

Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher, 32*(1), 9–13. https://doi.org/10.3102/0013189X032001009

Damianti, D., & Afriansyah, E. A. (2022). *Analisis Kemampuan Pemecahan Masalah Matematis dan Self-Efficacy Siswa SMP*. INSPIRAMATIKA, 8(1).

Daut.Muhammad. 2016. *Kemampuan Koneksi Matematika Dalam Pembelajaran Matematika*. J.M.E,58-67.

Fitriani. (2018). Analisis Kesulitan dalam Menyelesaikan Soal Cerita Pada Materi Persamaan dan Pertidaksamaan Linear Satu Variabel. *Pedagogy*, 3(1), 138-155.

Herdiansyah, K. (2018). Pengembangan LKPD Berbasis Model Problem Based Learning Untuk Meningkatkan Kemampuan Berfikir Kritis. *Eksponen*, 8(1), 25-33.

Hung, W. (2022). Problem-based learning: Past, present, and future. *Educational Technology Research and Development, 70*(2), 455–472. https://doi.org/10.1007/s11423-021-09998-2

Juniantari, M. 2017. Pengembangan Perangkat Pembelajaran Matematika Berorientasi Pendidikan Karakter dengan Model Treffinger Bagi Siswa SMA. *Journal of Education Technology*, 1(2), 71-76.

Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi [Kemdikbudristek]. (2022). *Panduan Implementasi Kurikulum Merdeka*. Jakarta: Kemdikbudristek.

Kharisma, J. Y., & Asman, A. (2018). Pengembangan bahan ajar matematika berbasis masalah berorientasi pada kemampuan pemecahan masalah matematis dan prestasi belajar matematika. *Indonesian Journal of Mathematics Education*, 1(1), 34-46.

Leton, K. B., Pd, S., Kase, E. B. S., Fil, S., Ta, E. D., Ag, S., Tinggi, S., Keuskupan, P., & Kupang, A. (2018). Pengaruh Penggunaan Perangkat Pembelajaran Terhadap Prestasi Belajar Peserta Didik Di Sekolah Dasar Inpres Lewoneda Kabupaten Flores Timur Tahun Ajaran 2017/2018. Hal: 59-66

Mergendoller, J. R., Maxwell, N. L., & Bellisimo, Y. (2021). The effectiveness of problem-based instruction: A comparative study. *Journal of Educational Psychology, 113*(3), 472–486. https://doi.org/10.1037/edu0000501

Mu'tashimah, A., Putri, A. D., & Ramury, F. 2020. Lilin sebagai Konteks Materi Tabung pada LKPD Berbasis PMRI. *JKPM (Jurnal Kajian Pendidikan Matematika)*, 6(1), 83-98.

Nieveen, N., McKenney, S., & Akker, J. van den. (2019). Educational design research. In T. Plomp & N. Nieveen (Eds.), *An Introduction to Educational Design Research* (pp. 17–50). Netherlands Institute for Curriculum Development.

Nursobah, A. (2019). Perencanaan Pembelajaran MI/SD. In *Duta Media Publishing*.

Plomp, T., & Nieveen, N. (2013). *Educational Design Research – Part A: An Introduction*. Netherlands Institute for Curriculum Development.

Rahmadani, R. (2019). Metode Penerapan Model Pembelajaran Problem Based Learning (pbl). *Lantanida Journal*, 7(1), 75.

Rahman, A. A. 2018. Pengembangan Perangkat Pembelajaran Berbasis Pendekatan Realistik untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa SMP N 3 Langsa. *MAJU: Jurnal Ilmiah Pendidikan Matematika*, 4(1).

Reigeluth, C. M., & An, Y. (2021). *Instructional-design theories and models: The learner-centered paradigm of education*. Routledge.

Ridwan, R., Zulkardi, Z., & Darmawijoyo, D. (2016). Pengembangan Perangkat Pembelajaran

Aritmatika Sosial Berbasis Problem Based Learning di Kelas VII SMP. *Jurnal Elemen*, 2(2), 92-115.

Sumartini, T. S. (2016). Peningkatan kemampuan pemecahan masalah matematis siswa melalui pembelajaran berbasis masalah. *Mosharafa: Jurnal Pendidikan Matematika*, 5(2), 148-158.

Szabo, Z. K., Körtesi, P., Guncaga, J., Szabo, D., & Neag, R. (2020). *Examples of problem-solving strategies in mathematics education supporting the sustainability of 21st-century skills. Sustainability,* 12(23), 10113.

Wando, M. T. S. (2017). Pengembangan Perangkat Pembelajaran Matematika SMP kelas VII Semester Genap dengan Model Problem Based Learning. *PYTHAGORAS: Jurnal Pendidikan Matematika*. 12(1). 76

Yuhani, A., Zhanty, L.S., Hendriana, H. (2018). Pengaruh Pembelajaran Berbasis Masalah Terhadap Kemampuan Pemecahan Masalah Matematis Siswa Smp. *Jurnal Pembelajaran Matematika Inovatif*. 1(3):451