
DEVELOPMENT OF BRAIN-BASED LEARNING STUDENT WORKSHEETS ON SINGLE-VARIABLE LINEAR EQUATIONS FOR GRADE VII AT SMP SWASTA BANDUNG

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Abstract

This research aims to develop Brain Based Learning-based student worksheets (LKPD) on the topic of Single-Variable Linear Equations for seventh-grade students at SMP Swasta Bandung. The method applied is the ADDIE development model, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. Validation results from experts in content, media, and language show that the developed LKPD is highly valid, with an average score of 85.2%. Practicality tests conducted by teachers and students obtained an average score of 83.47%, categorized as very practical. Meanwhile, the effectiveness of the LKPD was measured through pretest and posttest scores, showing an improvement in learning outcomes, with the average score increasing from 56.52 to 80.09, and an N-gain value of 0.5855, which falls into the moderate category. The classical completeness level also increased to 80.95%. Therefore, the Brain Based Learning-based LKPD is declared valid, practical, and effective in supporting the mathematics learning process and capable of enhancing students' conceptual understanding and learning engagement. The findings of this study are expected to serve as an innovative teaching material alternative that supports more contextual learning and aligns with how the brain works.

Keywords: Development; LKPD; Brain-Based Learning; Single Variable Linear Equations.

1. Introduction

Education is a process of shaping character and developing individual potential. Its goal is to optimize the natural talents of students so that they become skilled individuals. Education is related to the role of individuals as members of society and citizens. Currently, education in Indonesia is in the spotlight because high quality reflects the progress of the country.

The standard of education in Indonesia remains relatively low when compared to other countries (Tarigan *et al.*, 2023). This is a major challenge in the national education sector. The suboptimal education system affects the low quality of society. As a result, the Indonesian education system finds it difficult to compete with other countries (Patandung & Panggua, 2022). The learning process in schools has an important role in promoting educational progress.

Learning is a process that takes place in teaching and learning activities that determines the success of students (Nurfaizah & Oktavia, 2020). Learning is also the result of memory, cognition, and metacognition, which impact understanding (Asrul, 2020). The principles of learning include implementation and various factors that influence it. Teachers are a key factor in the achievement of the learning process. The role of teachers arises as a result of the demand to be active, creative, and innovative (Prastawati & Mulyono, 2023). Therefore, teachers should be able to organize learning activities so that they take place effectively and efficiently.

One common problem is the use of conventional learning models. Learning activities that are centered on the teacher result in an ineffective learning process (Akbar *et al.*, 2024; Pasaribu & Syahputra, 2022). As a result, students are not optimally encouraged to develop their thinking skills (Srimuliati *et al.*, 2022). In school learning activities, there is a subject often considered difficult, which is mathematics; however, it remains a field of study that must be learned from elementary to secondary education and should ideally hold a special appeal for students (Hasanah *et al.*, 2024).

Mathematics is an abstract science related to numbers and numerical language. This science studies patterns, shapes, structures, and space in depth. The significance of mathematics can be observed from its connection to everyday life (Afri & Reflina, 2024). Mathematics also improves the ability to interpret ideas in the form of mathematical models. These models include mathematical sentences, equations, diagrams, graphs, and tables (Afriansyah *et al.*, 2021). Therefore, mathematics is considered a universal language for understanding the world. A person's learning success is influenced by habits that are practiced consistently. Habits that are formed will remain and are difficult to change (Siregar & Hasanah, 2022).

The stages of mathematics learning activities in Indonesia have not yet achieved optimal results. In the 2022 PISA survey, Indonesia's ranking improved to 69 th out of 80 countries (Kemendikbud, 2023). However, Indonesia's average score actually decreased to 366. This score is still below the OECD average of 472 points (Angriani *et al.*, 2024). This result places Indonesia below the average. In other words, this competency must be improved (Andhany & Maysarah, 2023). Therefore, mathematics is an element that is closely integrated within the mathematics teaching and learning process.

The process of learning mathematics enables students to understand facts, ideas, rules, and skills (Lusianisita & Rahaju, 2020). According to NCTM (2000), mathematics learning requires standards from the elementary level up to grade XII. These standards aim to develop students' thinking and mathematical reasoning abilities, as well as equip them with useful knowledge and skills. Mathematics learning provides opportunities for students to comprehend concepts based on their prior knowledge. However, to date, the teaching and learning of mathematics have not yet been implemented optimally.

One factor causing mathematics learning to remain suboptimal is that the learning process continues to be teacher-centered (Akbar *et al.*, 2024; Pasaribu & Syahputra, 2022) resulting in students playing a less active role and minimal involvement in learning (Abdillah & Astuti, 2020). Students do not participate actively, merely listening to the teacher's explanations and taking notes on example questions and answers, which makes it difficult for them to grasp the concepts being taught (Ayuni *et al.*, 2020; Narpila, 2020). In addition, the presentation or explanation of the material is uninteresting and lacks variety, causing students to lose interest and feel unchallenged to participate during the learning process (Srimuliati *et al.*, 2022; Yazid *et al.*, 2020).

The textbooks used do not sufficiently support active student involvement. Challenges such as low conceptual understanding, difficulty in designing strategies, and time pressure exacerbate the situation (Lubis & Lubis, 2024). Many students are asked to discover concepts, but the answers to the concepts are given directly (Murwanto *et al.*, 2022). Students rarely ask questions even when teachers give them the opportunity, making it difficult for them to analyze simple or complex problems. In solving problems, students need to formulate problems and choose the right strategy (Lubis & Lubis, 2024). This often leads to incorrect or inappropriate solutions (Ndek *et al.*, 2022). The lack of effective teaching materials reduces the ability to draw conclusions and formulate new questions. The teaching materials used are not yet optimal in encouraging analytical thinking among students. This situation indicates the need to develop more effective teaching materials (Fitri *et al.*, 2024).

The use of LKPD can help facilitate learning activities. To overcome student barriers, mathematics needs to be linked to everyday life (Afri *et al.*, 2024). The direct instruction model is appropriate for teaching basic knowledge in the form of concepts and procedures (Siregar, 2020). Research (Rosmana *et al.*, 2024) shows that many LKPD have not achieved learning indicators. The LKPD used generally come from publishers or are provided by schools. Many LKPD do not relate mathematical concepts to the context of daily routines (Agustin, 2021). Some LKPD are compiled without a structured flow. In the study (Pramagda, 2021) the coloring of LKPD has not been able to stimulate the brain optimally. This indicates the significance of developing more contextual and structured student worksheets (LKPD) to improve students' learning outcomes.

Students' learning achievements serve as one of the indicators of success in education throughout the learning process, encompassing behavioral changes in the cognitive, affective, and psychomotor domains (Saihu, 2020). Students' low mathematics learning outcomes can be attributed to their insufficient mastery of the material (Sari *et al.*, 2019), because the precision of students' mathematics learning outcomes is closely connected to the cognitive domain, which involves brain function and emphasizes students' thinking skills. The changes achieved by students depend on what they learn. The learning outcomes achieved by students are determined by the approach used in the learning process.

One approach that can stimulate brain activity is Brain Based Learning. This approach is based on the brain's process of optimally processing, recording, and retrieving knowledge. As a learning approach, brain based learning functions as a toolbox. This approach provides students with the opportunity to develop their potential naturally, in accordance with how their brains

work. This helps in understanding material such as Single Variable Linear Equations. An equation is an open sentence that uses the equality sign (=) and refers to a linear equation with a single variable to the first power. A one-variable linear equations contains only one variable and is linear. Its general form is $ax + b = 0$.

The research (Risantia & Zetriuslita, 2023) concluded that LKPD using the brain based learning method is of excellent quality. The research (Aini *et al.*, 2024) concluded that the LKPD is suitable and good for SPLDV material. And the research (Pramagda, 2021) concluded that Student worksheets (LKPD) based on Brain Based Learning on one-variable linear equations and inequalities can serve as supporting media in the learning process to enhance students' mathematical literacy skills. However, no research has been conducted on the development of Brain Based Learning-based student worksheets (LKPD) on the topic of one-variable linear equations (PLSV) discuss the enhancement of students' learning outcomes. Thus, the novelty of this study lies in the development of Brain Based Learning-based student worksheets (LKPD) on the topic of one-variable linear equations (PLSV) to improve students' academic achievement. Its purpose is to help students understand the learning material by utilizing the brain's natural functioning mechanisms. This approach involves emotions, connects with real life, and creates a supportive learning environment. Based on several previous studies that the researcher has read, the development of student worksheets (LKPD) on the topic of one-variable linear equations already exists with different approaches and objectives; however, students' learning outcomes remain low. Therefore, the researcher is interested in developing student worksheets (LKPD) developed using the Brain Based Learning approach on the topic of one-variable linear equations at a private junior high school of Bandung. This approach is intended to assist students in comprehending the material in a more contextual and interesting way, while also enhancing their learning outcomes. The learning outcome indicators include the ability to understand concepts and apply theories in problem-solving.

Based on the background and the defined problem boundaries, this study's problem formulation includes how the Brain Based Learning-based student worksheets (LKPD) on the topic of One-Variable Linear Equations for seventh-grade students are developed, as well as the assessment of the LKPD's validity, practicality, and effectiveness. The aim of this research is to present the LKPD product designed using the Brain Based Learning approach and to evaluate its quality in terms of validity, practicality, and effectiveness in supporting the mathematics learning process.

2. Method

This study is a research and development (R&D) study aimed at designing student worksheets (LKPD) using a Brain-Based Learning approach on the topic of Single-Variable Linear Equations for seventh-grade students at SMP Swasta Bandung. Although this material is taught in the first semester, many students still obtain low learning outcomes on One-Variable Linear Equations. Therefore, the researcher is interested in applying the One-Variable Linear Equations material using the Brain Based Learning approach in this study. The development model employed

is the ADDIE model, which comprises five stages: Analysis: This stage aims to identify learning needs, learner characteristics, learning objectives, and the problems to be solved through product development. Design: At this stage, the researcher designs the concept of the product to be developed, including determining learning strategies, media, materials, and evaluation instruments. Development: The development stage involves creating the product based on the design that has been made, followed by a validity test conducted by experts (expert judgment). Implementation: The developed product is tested with students or in a real learning environment to examine its effectiveness and applicability. Evaluation: This stage includes formative evaluation (conducted during the process) and summative evaluation (conducted after implementation) to assess the success of the product and determine necessary improvements.

In the analysis stage, a curriculum analysis was conducted to identify learning problems and analyze the learning media needed by students. The design stage included determining basic competencies, compiling materials, and designing the worksheet structure. The development stage included creating worksheets and validation by experts in the subject matter, media, and language. After validation, the product was implemented through a limited trial in one class with 21 students in the implementation stage to observe its practicality and effectiveness. The final stage was evaluation, which is conducted to evaluate the feasibility and quality of the developed student worksheets (LKPD), including product revisions based on the implementation results.

The subjects of this study consisted of three expert validators (including a content expert, a media expert, and a language expert), one seventh-grade mathematics teacher, and 21 students who acted as respondents in the trial. The types of data collected included both qualitative and quantitative data. Qualitative data were obtained through interviews, observations, and documentation, while quantitative data came from validation questionnaires, teacher responses, student responses, and learning test results.

Data collection instruments included:

1. Validation Analysis

Data analysis techniques for the results of validator assessments can be carried out by using the following formula:

$$v_1 = \frac{TSe}{TSh} \times 100 \%$$

$$v_2 = \frac{TSe}{TSh} \times 100 \%$$

$$v_3 = \frac{TSe}{TSh} \times 100 \%$$

Description:

TSe = Expert assessment score

TSh = Total score of the assessed aspects

Next, to determine the validity level, first calculate the average value using the following formula.

$$V = \frac{v_1 + v_2 + v_3}{3} = \dots \%$$

After obtaining the validation results, the determination of the validity level category can refer to the table below:

Table 1.
Validity Level Criteria

Percentage Interval (%)	Criteria
$80\% \leq V \leq 100\%$	Highly Valid
$60\% \leq V < 80\%$	Valid
$40\% \leq V < 60\%$	Moderately Valid
$20\% \leq V < 40\%$	Less Valid
$0 \leq V < 20\%$	Not Valid

Source: (Riduwan, 2011)

Next, the data were analyzed using descriptive methods to determine the validity level of the LKPD developed based on the Brain Based Learning approach. The level of validity accepted in this study is at least in the valid category.

2. Practicality Analysis

The data analysis method for students' responses can be carried out using the following formula:

$$P = \frac{\sum \text{item score}}{\text{Score maximal}} \times 100 \%$$

After the practicality results are obtained, the criteria for assessing the level of practicality can be seen in the following table:

Table 2.
Practicality Level Criteria

Percentage Interval (%)	Criteria
$80\% \leq V \leq 100\%$	Very Practical
$60\% \leq V < 80\%$	Practical
$40\% \leq V < 60\%$	Fairly Practical
$20\% \leq V < 40\%$	Less Practical
$0 \leq V < 20\%$	Not Practical

Source: (Riduwan, 2011)

The level of practicality accepted in this study is the minimum practical criterion.

3. Analysis of Effectiveness Test Results

The effectiveness of the LKPD can be measured by the students' learning achievement after using the worksheet designed with the approach based on Brain Based Learning. The following are the stages in analyzing student learning test results:

Individual learning mastery is considered achieved if students obtain a minimum score of 70% in accordance with the school's minimum passing grade (Riduwan, 2011).

$$\text{Individual mastery} = \frac{\text{Score obtained}}{\text{Score maximal}} \times 100 \%$$

The formula below can be used to determine students' classical mastery (Riduwan, 2014):

$$\text{Classical completeness} = \frac{\text{Number of students who passed}}{\text{Number of students present}} \times 100 \%$$

Table 3.

Qualification of LKPD Effectiveness

Performance Range	Description
80% - 100%	Very Effective
60% - 80%	Effective
40% - 60%	Less Effective
0% - 40%	Not Effective

Source: (Sudijono, 2010)

Then, the N-gain formula applied in this study is as follows (Nismalasari, 2016):

$$N - \text{Gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

Table 4.

Interpretation of Gain Normality

Normalcy Gain Score	Category
-1,00 < g < 0,00	Declining
G = 0,00	Stable
0,00 < g < 0,30	Low
0,30 < g < 0,70	Moderate
0,70 < g < 1,00	High

The level of effectiveness accepted in this study is the minimum criterion for effectiveness. In addition, the analysis of learning outcome improvements is determined using the N-Gain formula, which serves to identify the difference between pretest and posttest scores after the implementation of the LKPD. The N-Gain score obtained in this study is at least within the moderate criterion.

3. Results and Discussion

This study aims to design student worksheets (LKPD) based on a Brain-Based Learning approach on the topic of Single-Variable Linear Equations for seventh-grade students at SMP Swasta Bandung, using the ADDIE development model, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. A summary of the results from each stage is presented as follows:

Analysis Stage

During the analysis stage, the researcher determined the Basic Competence and Competency Achievement Indicators through a review of the curriculum, student needs, and material to design Brain Based Learning-based student worksheets (LKPD) on the topic of Single-Variable Linear Equations for seventh-grade students at SMP Swasta Bandung. The analysis results showed that the worksheets used were still teaching materials from publishers, were not very interesting, and were not yet able to improve student learning outcomes. Therefore, Basic Competence 3.6 and 4.6 along with Competency Achievement Indicators were determined as the basis for development. The material was also structured and made interesting so that it was easier to understand and in accordance with the needs and characteristics of the students.

Design Stage

At the design stage, the researcher designed Brain Based Learning-based LKPD containing contextual problems in the students' environment so that the subject of one-variable linear equations would be easier to understand. This LKPD was compiled as a learning guide for students and equipped with validation instruments by experts from UIN North Sumatra. The researcher also prepared references in the form of books and supporting images for the material, and compiled LKPD components that included the cover, supporting information, instructions, Core Competencies, Basic Competence, Competency Achievement Indicators, learning objectives, pre-presentation and preparation, initiation and acquisition, elaboration, verification and checking, celebration and integration, and a bibliography.

Development Stage

The development stage, where the previously designed plan is realized into a tangible product. The actions carried out in this phase are as follows:

1. Product Design Development

Figure 1.
LKPD design after revision

LKPD
Berbasis Brain Based Learning

PERSAMAAN LINIER SATU VARIABEL (PLSV)

UNTUK SMP/ MTs

KELAS VII

PENYUSUN:
NURUL FATMA DEWI MARDIANTO

Lembar Kegiatan Peserta Didik

Berbasis Brain Based Learning

Indikator Pencapaian Kompetensi:

- 3.6.4. Menentukan persamaan linier satu variabel.
- 3.6.6 Menentukan nilai variabel dalam persamaan linier satu variabel.
- 4.6.2 Menyelesaikan masalah kontekstual yang berkaitan dengan persamaan linier satu variabel.

Tujuan:

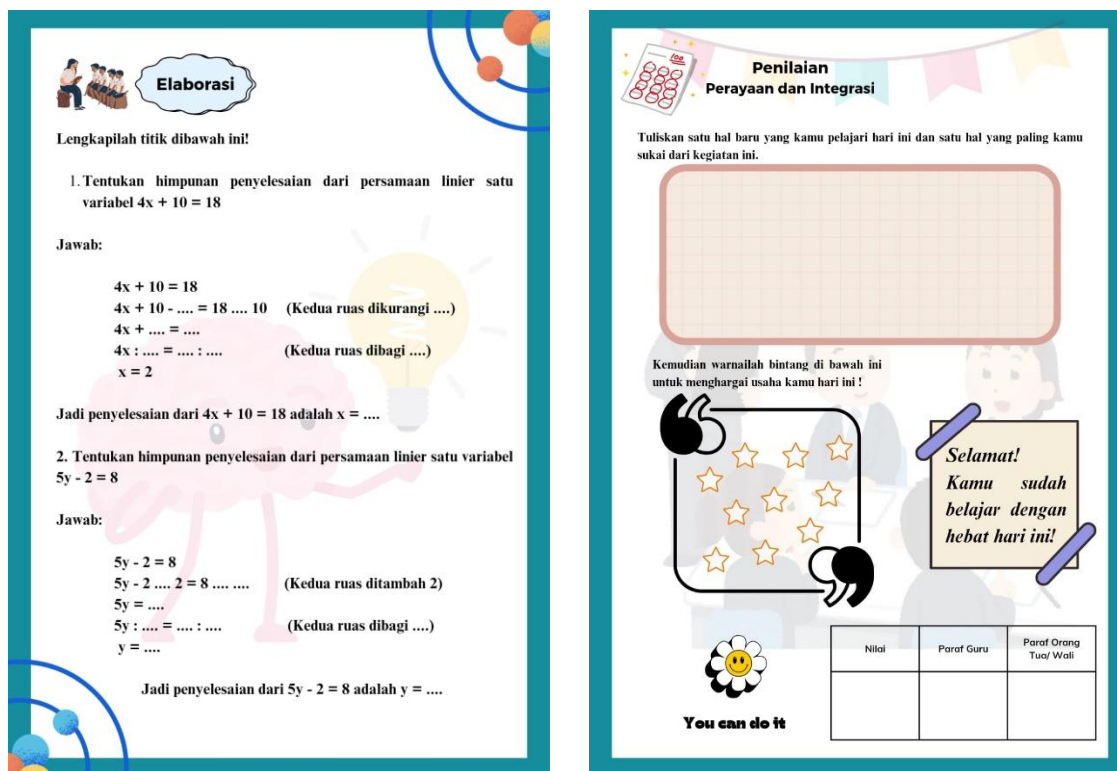
- 1. Peserta didik dapat menentukan persamaan linier satu variabel.
- 2. Peserta didik dapat menentukan nilai variabel dalam persamaan linier satu variabel.
- 3. Peserta didik dapat menyelesaikan masalah kontekstual yang berkaitan dengan persamaan linier satu variabel.

Pra-pemaparan dan Persiapan

Persamaan Linier Satu Variabel

Definisi: Kalimat terbuka yang memiliki satu variabel dan berpangkat satu

Bentuk Umum: $ax + b = 0$
dengan:
x adalah variabel
a adalah koefisien (tidak sama nol)
b adalah konstanta



2. Validation

Next, the LKPD product was assessed for its feasibility by three expert lecturers, namely a content expert, a media expert, and a language expert, as well as a mathematics teacher who also served as a content expert. The assessment results are as follows:

Table 5.
Expert Validation Results for LKPD




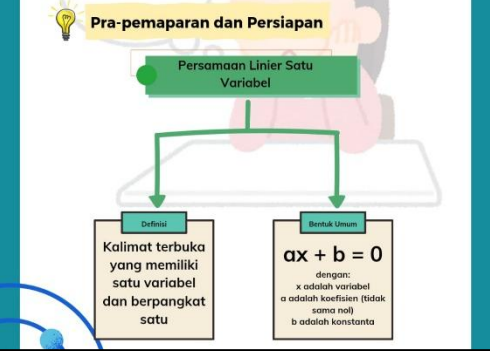


Evaluator	Average	Category
Subject Matter Expert	87,5%	Highly Valid
Media Expert	85,5%	Highly Valid
Language Experts	82,5%	Highly Valid

Based on the assessment results of the validators, a score of 87.5% was obtained from the content expert, which falls into the very valid category. The media expert gave a score of 85.5%, also categorized as very valid, while the language expert provided a score of 82.5%, likewise included in the very valid category. By taking the average score from the three validators, an overall score of 85.2% was obtained, indicating that this LKPD is considered highly valid and suitable for testing.


3. Revision

Based on the validation results, the researcher revised the LKPD according to the validators' input to improve the quality and readiness of the LKPD for learning.

Figure 2.
LKPD design

Before Revision	After Revision
 <p>No Brain Based Learning label</p>	 <p>Addition of the Brain Based Learning label in the upper right corner</p>
 <p>Improved concept map</p>	 <p>Concept map after improvement</p>
<p>Pernyataan adalah kalimat yang sudah jelas kebenarannya, sedangkan Kalimat Terbuka adalah kalimat yang belum diketahui nilai kebenarannya, kemudian, persamaan linier satu variabel itu apa ya?</p> <p>Persamaan linier satu variabel adalah kalimat terbuka yang memiliki satu variabel dan berpangkat satu. Persamaan linier satu variabel dapat dituliskan dalam bentuk $ax + b = y$ dimana x adalah variabel dan a, b, c merupakan bilangan rasional dan a, b tidak sama dengan nol.</p> <p>Misalkan kita menemukan persamaan $2x + 3 = 7$ atau $3x - 1 = 2$. Pada persamaan tersebut masing masing mempunyai satu variabel, yaitu x.</p> <p>PLSV material is still incomplete</p>	<p>Persamaan linier satu variabel adalah kalimat terbuka yang memiliki satu variabel (biasanya dilambangkan dengan huruf, misalnya x, y, p, dll) pangkat tereringginya adalah satu.</p> <p>Persamaan linier satu variabel dapat dituliskan dalam bentuk</p> $ax + b = 0$ <p>dengan: x adalah variabel a adalah koefisien variabel (a tidak sama dengan 0) b adalah konstanta</p> <p>Note: tidak selamanya variabel itu huruf x, bisa saja huruf-huruf lainnya</p> <p>Misalkan kita menemukan persamaan $2x + 3 = 7$ atau $3x - 1 = 2$. Pada persamaan tersebut masing masing mempunyai satu variabel, yaitu x dan hanya berpangkat satu.</p> <p>Contoh lainnya:</p> <ol style="list-style-type: none"> $2y - 3 = 5$ $4p + 1 = 17$ $2a + 5 = 9$ <p>1. Ada Tanda Sama Dengan "=" 2. Variabelnya satu yaitu : y 3. Pangkat Variabelnya (y) = 1 (satu)</p> <p>Addition of PLSV material on initiation and acquisition</p>
 <p>Typo in the word elaboration</p>	 <p>Typo correction</p>

<p>Inkubasi dan Memasukkan</p> <p>Ayo temukan jalan mana yang terhubung dari START menuju persamaan linier satu variabel yaitu $3x + 1 = 10$!</p> <p>START</p>	<p>Inkubasi dan Memasukkan</p> <p>Ayo temukan jalan mana yang benar untuk terhubung dari nilai x menuju persamaan linier satu variabel yaitu $3x + 1 = 10$!</p> <p>$x = 5$</p>												
<p>Jawab a. $3a + 5 = 17$ Penyelesaian:</p> <p>=> Bagaimana kamu yakin bahwa jawaban kamu benar?</p>	<p>Jawab a. $3a + 5 = 17$ Penyelesaian:</p> <p>=> Bagaimana kamu yakin bahwa jawaban kamu benar?</p>												
<p>Sentence is still not perfect</p> <p>The answer column is still not very interesting, typo in the word "akin" which should be "yakin"</p>	<p>Sentence after correction</p> <p>Corrections to the answer column and typo</p>												
<p>Penilaian Perayaan dan Integrasi</p> <table border="1"> <thead> <tr> <th>Nilai</th> <th>Paraf Guru</th> <th>Paraf Orang Tua/Wali</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> <p>You can do it</p>	Nilai	Paraf Guru	Paraf Orang Tua/Wali				<p>Penilaian Perayaan dan Integrasi</p> <p>Tuliskan satu hal baru yang kamu pelajari hari ini dan satu hal yang paling kamu sukai dari kegiatan ini.</p> <p>Kemudian warnailah bintang di bawah ini untuk menghargai usaha kamu hari ini!</p> <p>Selamat! Kamu sudah belajar dengan hebat hari ini!</p> <p>You can do it</p> <table border="1"> <thead> <tr> <th>Nilai</th> <th>Paraf Guru</th> <th>Paraf Orang Tua/Wali</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Nilai	Paraf Guru	Paraf Orang Tua/Wali			
Nilai	Paraf Guru	Paraf Orang Tua/Wali											
Nilai	Paraf Guru	Paraf Orang Tua/Wali											
<p>The celebration and integration were not very interesting, and there were no encouraging</p>	<p>Improvements to celebrations and integration, as well as the addition of</p>												

words	encouraging statements
No bibliography	 <p style="text-align: center;">Addition of a bibliography</p>

Implementation Stage

At the implementation stage, an assessment was conducted to assess the practicality and effectiveness of the developed LKPD. The following are the test results related to its practicality and effectiveness:

1. Product Trial

After validation and revision, the Brain Based Learning-based LKPD were trialed in seventh-grade classes at SMP Swasta Bandung from June 2-5, 2025, involving 21 students. Next, to determine the practicality of the LKPD, it can be assessed through the responses of the teacher and the students.

Table 6.

Teacher and Student Responses for the LKPD

Evaluator	Average	Category
Teacher Response	85%	Very Practical
Student Response	81,94%	Very Practical

The teacher questionnaire results show a practicality level of 85%, indicating that the LKPD is very helpful and does not require revision. Meanwhile, student responses show an average practicality score of 81.94%, with the category of very practical in terms of content, presentation, language, and appearance. Overall, the average practicality score from teachers and students was 83.47%, indicating that the LKPD is very practical for use in learning.

By conducting a trial with 21 seventh-grade students at SMP Swasta Bandung, pre-test and post-test data were collected to evaluate the effectiveness of the Brain Based Learning-based LKPD.

Table 7.

Student Assessment Results in the Form of Pre-test and Post-test

Respondents	Pre-test	Post-test	N-gain
Amount	1187	1682	12,297
Average	56,52	80,09	0,5855
Highest Value	80	100	
Lowest Value	20	50	

As a result, the classical mastery level increased from 33.33% to 80.95%, showing an increase of 47.62%. The students' average score increased from 56.52 to 80.09, with an N-Gain value of 0.5855, which falls into the moderate category. Thus, the implementation of Brain Based Learning-based LKPD has been shown to be effective in enhancing students' learning outcomes on the topic of one-variable linear equations.

Evaluation Stage

The evaluation stage is the final phase in the ADDIE research model and consists of two types of evaluation: formative and summative. Formative evaluation is conducted at the beginning of the development process and aims to improve the product based on input and suggestions from validators. Meanwhile, summative evaluation is carried out after the implementation stage, involving educators and students as assessors. Thus, the developed Student Worksheets (LKPD) can be considered feasible for use.

Discussion

The development of Brain Based Learning-based Student Worksheets (LKPD) on the topic of one-variable linear equations for seventh-grade junior high school students was carried out using the ADDIE model, which consists of Analysis, Design, Development, Implementation, and Evaluation. During the analysis stage, the researcher conducted interviews with the teacher to identify learning problems. It was found that conventional learning models were still dominant, causing students to tend to be passive and dependent on teachers. In addition, the delivery of material was still abstract and lacked context, resulting students' understanding of the topic of one-variable linear equations is still considered low. In accordance with the research (Akbar *et al.*, 2024) it was stated that teacher-oriented learning activities resulted in an ineffective learning process. Therefore, brain-based learning worksheets were needed to make learning more meaningful and interesting.

The design stage was carried out by compiling systematic, interesting LKPD that was in line with the Merdeka Curriculum. The LKPD design included material references, basic competencies, indicators, learning objectives, and activities relevant using the Brain Based Learning approach. Through this model, is able to help students understand the material more easily (Risantia & Zetriuslita, 2023). This LKPD is designed using communicative language and visuals to facilitate students in understanding the concepts being taught. The design results show that the initial product has met the contextual learning structure.

Next, the development stage was carried out with the validity assessment of the LKPD based on three indicators: the achievement of the Student Worksheet objectives, the Brain Based Learning indicators, and the improvement of students' learning outcomes. According to Jensen (2008), there are seven Brain Based Learning indicators: 1) Pre-exposure, 2) Preparation, 3) Initiation and Acquisition, 4) Elaboration, 5) Incubation and Memory Formation, 6) Verification and Belief Checking, and 7) Celebration and Integration. The validity assessment of the LKPD showed a score of 85.2%, which falls into the "very valid" category. Consistent with previous research (Risantia & Zetriuslita, 2023) stated that the Brain Based Learning-based LKPD on number pattern material

showed an average validity percentage score of 84.97%, validated by both content and media experts. Feedback from the validators was used to refine the product before it was implemented in the classroom. After revisions, the LKPD was trialed and applied in learning activities.

At the implementation stage, practicality was assessed based on the use of student worksheets. The researchers analysis the responses using a Likert scale. This indicates that the Brain Based Learning-based LKPD is capable of improving students' learning outcomes, engagement, and understanding of the material. Through a trial with 21 seventh-grade students at a private junior high school in Bandung, pre-test and post-test data were collected to assess the effectiveness of the LKPD. The students' average score increased from 56.52 to 80.09, with an N-Gain value of 0.5855, which falls into the moderate category. Learning materials are defined as any form of content—whether information, tools, or texts—that covers the competencies students need to master and is organized systematically and comprehensively, allowing it to be used in the learning process for planning and evaluating instructional implementation (Prastowo, 2015). Thus, the Brain Based Learning-based LKPD on one-variable linear equations is considered practical for supporting the improvement of learning outcomes for seventh-grade students.

Finally, the evaluation stage was conducted through tests, questionnaires, and observations to measure the effectiveness of the LKPD. The evaluation results indicated a notable increase in learning outcomes and favourable responses from both teachers and students. The LKPD was declared valid, highly practical, and effective for use in mathematics learning. This aligns with the findings of (Pramagda, 2021) who stated that media is an essential part of learning, encompassing learning components and providing benefits for both students and educators. Moreover, selecting the appropriate learning media plays a crucial role in supporting students' learning outcomes. This study demonstrates that the development of Brain Based Learning-based LKPD facilitates a more active, innovative, and meaningful learning process and is feasible for implementation with seventh-grade junior high school students.

Based on the research results, it was found that the Brain Based Learning-based LKPD produces learning media that is both contextual and engaging for the topic of one-variable linear equations, as well as capable of improving students' learning outcomes. Brain Based Learning itself is a learning approach that aligns with the brain's natural way of processing information, which is expected to enhance students' understanding. The 47.62% increase in students' learning outcomes was attributed to the implementation of the Brain Based Learning-based LKPD, which was designed in accordance with the Basic Competence, Competency Achievement Indicators, and feedback from the validators. This is similar to the study conducted by Zain *et al.*, (2025), which found that the improvement experienced by the students was influenced by the use of media in the learning process. The developed LKPD can be used by teachers as a supportive tool in learning activities and helps improve the learning outcomes of seventh-grade students on this topic.

4. Conclusion

This study successfully designed a Brain Based Learning-based student worksheet (LKPD) on the topic of one-variable linear equations using the ADDIE development model, which includes

the stages of analysis, design, development, implementation, and evaluation. The research results show that the developed LKPD has a very high level of validity (average validation score of 85.2%), is highly practical to use (average teacher and student response score of 83.47%), and is proven effective in improving students' learning achievement (average post-test score of 80.09, classical mastery level of 80.95%, and N-gain value of 0.5855, which falls into the moderate category). Based on these findings, this LKPD is suitable for use in mathematics learning and is recommended as alternative teaching material by teachers and schools. The researcher also recommends that similar developments be tested on a larger scale and adopt other learning approaches or methods to achieve more optimal and comprehensive results.

5. References

- Abdillah, D. M., & Astuti, D. (2020). Pengembangan lembar kerja peserta didik (LKPD) berbasis problem-based learning (PBL) pada topik sudut. *Pythagoras: Jurnal Pendidikan Matematika*, 15(2), 190–200. <https://doi.org/10.21831/pg.v15i2.36444>
- Afri, L. D., Hasanah, R. U., & Maysarah, S. (2024). *Eksplorasi Etnomatematika di Sumatera Bagian Utara*.
- Afri, L. D., & Reflina. (2018). *Self Concept Mahasiswa UIN Sumatera Utara Medan pada Mata Kuliah Persamaan Diferensial Elementer*. 1(1), 117–130.
- Afriansyah, E. A., Herman, T., Turmudi, & Afgani Dahlan, J. (2021). Critical thinking skills in mathematics. *Journal of Physics: Conference Series*, 1778(1). <https://doi.org/10.1088/1742-6596/1778/1/012013>
- Agustin, N. (2021). *Pengembangan Lembar Kerja Peserta Didik Melalui Pendekatan Advokasi Pada Materi Persamaan Linear Satu Variabel Kelas VII Smp*.
- Aini, K., N, N., & J, J. (2024). *Pengembangan Lembar Kerja Peserta Didik (LKPD) Materi Sistem Persamaan Linier Dua Variabel dengan Tahapan Polya*. 5(02), 131–140.
- Akbar, I., Hasratuddin, & Napitupulu, E. E. (2024). *Pengembangan LKPD Berbasis Pendekatan Saintifik Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Peserta Didik*. 22(1), 73–86. <https://doi.org/10.31571/edukasi.v21i1.7304>
- Andhany, E., & Maysarah, S. (2023). Pengembangan Modul Pembelajaran Digital Interaktif Berbasis Literasi Matematika. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(3), 3503. <https://doi.org/10.24127/ajpm.v12i3.6299>
- Angriani, A. D., Nakesya, K. A., Azizah Amrillah, N., Rezki Teguh Imansyah, M., Ikhsan Maulana, M., & Alauddin Makassar, U. (2024). *Analisis Kesulitan Siswa dalam Menyelesaikan Soal Literasi Matematika PISA berdasarkan Self-efficacy*. *Prosiding Diskusi Panel Nasional Pendidikan Matematika*. 36, 517–526.
- Asrul. (2020). Pembelajaran Inovatif Pada Pendidikan Dasar. *PGMI STIT Al--Ittihadiyah Labuhanbatu Utara*, 1(2), 137–150.
- Ayuni, Q., Noer, S. H., & Rosidin, U. (2020). *Pengembangan Lembar Kerja Peserta Didik Berbasis Problem Based Learning dalam Meningkatkan Kemampuan Representasi Matematis Siswa*. 9(3), 694–704.

- Fitri, I., Chairani, N. S., & Nurdin, E. (2024). *Memfasilitasi Kemampuan Berpikir Kritis Matematis Siswa pada*. 7(3), 205–212.
- Hasanah, R. U., Dwi Afri, L., & Maysarah, S. (2024). Exploration of Ethnomathematics in Pekanbaru City Traditional Hall Building. *Jurnal of Tadris Matematika (JTMT)*, 5(2), 2024. <https://doi.org/10.47435/jtmt.v5i2.3204>
- Lubis, M. S., & Lubis, N. A. (2024a). Analisis Kemampuan Argumentasi Matematis Siswa pada Materi Bangun Ruang Sisi Datar Ditinjau dari Kemampuan Awal Matematika. *Jurnal Pengembangan Pembelajaran Matematika*, 6(1), 63–78. <https://doi.org/10.14421/jppm.2024.61.63-78>
- Lubis, M. S., & Lubis, N. A. (2024b). *Matematika Tipe Hots Menggunakan Teori Newman di*. 8(1), 114–140.
- Lusianisita, R., & Rahaju, E. B. (2020). Proses Berpikir Reflektif Siswa SMA dalam Menyelesaikan Soal Cerita Matematika Ditinjau dari Kemampuan Matematika. *JPPMS: Jurnal Penelitian Pendidikan Matematika Dan Sains*, 4(2), 329–338. <https://doi.org/10.26740/mathedunesa.v9n2.p329-338>
- Murwanto, A., Qohar, A., & Sa'dijah, C. (2022). Pengembangan LKPD Daring Pendekatan Guided Discovery Berbasis HOTS Materi Persamaan dan Fungsi Kuadrat. *Mosharafa: Jurnal Pendidikan Matematika*, 11(3), 391–402. <https://doi.org/10.31980/mosharafa.v11i3.730>
- Narpila, S. D. (2020). Peningkatan Self Efficacy Matematis Siswa SMA Melalui Pembelajaran Inquiry. *Journal of Authentic Research on Mathematics Education (JARME)*, 2(2), 108–118.
- Ndek, K. Y., Suwanti, V., & Sumadji. (2022). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Cerita Persamaan Linear Satu Variabel Berdasarkan Teori Kastolan. *JRPM (Jurnal Review Pembelajaran Matematika)*, 7(1), 89–101. <https://doi.org/10.15642/jrpm.2022.7.1.89-101>
- Nismalasari. (2016). *Pengembangan LKPD Berbasis Etnomatematika pada*.
- Nurfaizah, S., & Oktavia, P. (2020). Proses Pembelajaran Siswa Sekolah Dasar di MI Nurul Hikmah. *As-Sabiqun*, 2(1), 43–48. <https://doi.org/10.36088/assabiqun.v2i1.621>
- Pasaribu, J., & Syahputra, E. (2022). Pengembangan Perangkat Pembelajaran Interaktif Berbasis Pendekatan Pembelajaran Matematika Realistik Untuk Meningkatkan Kemampuan Spasial Siswa SMP. *GENTA MULIA: Jurnal Ilmiah Pendidikan*, i, 20–46.
- Patandung, Y., & Panggua, S. (2022). Analisis Masalah-masalah Pendidikan dan Tantangan Pendidikan Nasional. *Jurnal Sinestesia*, 12(2), 794–805.
- Pramagda, A. R. (2021). *Pengembangan Lembar Kerja Peserta Didik (Lkpd) Berbasis Brain Based Learning Untuk Mendukung Peningkatan Literasi Matematis pada Materi Persamaan dan Pertidaksamaan Linear Satu Variabel pada Peserta Didik Kelas VII SMP Muhammadiyah Kota Pekalongan*. 1–13.
- Prastawati, T. T., & Mulyono, R. (2023). Peran Manajemen Pembelajaran dalam Meningkatkan Prestasi Belajar Siswa Melalui Penggunaan Alat Peraga Sederhana. *Didaktik : Jurnal Ilmiah PGSD STKIP Subang*, 9(1), 378–392. <https://doi.org/10.36989/didaktik.v9i1.709>
- Riduwan. (2011). *Rumus dan Data dalam Aplikasi Statistika*.
- Riduwan. (2014). *Metode & Teknik Penyusunan Proposal Penelitian*.

- Riduwan. (2011). *Belajar Mudah Penelitian untuk Guru-Karyawan dan Peneliti Pemula*. Alfabeta.
- Risantia, G., & Zetriuslita, Z. (2023). Pengembangan Perangkat Pembelajaran Matematika Berbasis Brain Based Learning (BBL) Menggunakan Permainan Teka-teki Silang pada Materi Pola Bilangan di Kelas VIII SMPN 6 Siak Hulu. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 7(1), 810–819. <https://doi.org/10.31004/cendekia.v7i1.1872>
- Rosmana, P. S., Ruswan, A., Lesmana, A. R. D., Andini, I. F., Yuliani, I. P., Ramanda, N., Nurfitriya, R., & Citra, W. R. (2024). Penerapan LKPD terhadap Efektivitas Pembelajaran Peserta Didik di Sekolah Dasar. *Jurnal Pendidikan Tambusai*, 8(1), 3082–3088.
- Saihu, S. (2020). The Effect of Using Talking Stick Learning Model on Student Learning Outcomes in Islamic Primary School of Jamiatul Khair. *Ciledug Tangerang, Tarbawi: Jurnal Keilmuan Manajemen Pendidikan*, 6(01), 61.
- Sari, N. R., Hidayat, W., & Yuliani, A. (2019). Analisis Hasil Belajar Matematika Siswa Kelas X SMA pada Materi SPLTV Ditinjau dari Self-Efficacy. *UNION: Jurnal Ilmiah Pendidikan Matematika*, 7(1), 93–103.
- Siregar, T. J. (2020). Perbedaan Hasil Belajar Mahasiswa yang Diajarkan dengan Model Pembelajaran Kooperatif Tipe Jigsaw dan Model Pembelajaran Langsung. *AXIOM : Jurnal Pendidikan Dan Matematika*, 9(2), 188. <https://doi.org/10.30821/axiom.v9i2.8078>
- Siregar, T. J., & Hasanah, R. U. (2022). Pengaruh Model Pembelajaran Group Investigation Berbantuan Aplikasi Android Terhadap Habits Of Mind Matematis Mahasiswa. *AXIOM : Jurnal Pendidikan Dan Matematika*, 11(1), 1–10.
- Srimuliati, S., Faisal, F., Mazlan, M., & Sari Batu Bara, W. (2022). Pengaruh Model Brain Based Learning Berbantuan LKPD Berbasis Mind Maps terhadap Kemampuan Koneksi Matematis Siswa SMA Negeri 1 Langsa. *JiIP - Jurnal Ilmiah Ilmu Pendidikan*, 5(5), 1501–1506. <https://doi.org/10.54371/jiip.v5i5.588>
- Sudijono, A. (2010). *Pengantar Statistik Pendidikan*.
- Talo, Y. A. (2022). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Etnomatematika Batu Kubur dan Rumah Adat Sumba pada Siswa Kelas IV Sekolah Dasar. *PENDASI: Jurnal Pendidikan Dasar Indonesia*, 6(1), 84–93.
- Tarigan, R. A., Saptono, A., & Muchtar, S. (2023). Enhancing Indonesia's Education Quality: Identifying and Addressing Key Challenges. *1st International Students Conference on Business, Education, Economics, Accounting, and Management (ISC-BEAM)*, 659–670.
- Yazid, M., Safitri, L. A. D., & Jauhari, S. (2020). Diagnosa Kesulitan Belajar Matematika Siswa Kelas V MI NW Pancor Kopong NTB. *Prima Magistra: Jurnal Ilmiah Kependidikan*, 1(1), 85–92. <https://doi.org/10.37478/jpm.v1i1.354>
- Zain, N. S. F., Subarkah, C. Z., & Sukmawardani, Y. (2025). Enhancing Students' Chemical Representation Ability Through Problem-Based Learning Assisted by Nearpod on Electrolysis Cell Material. *EduMatSains: Jurnal Pendidikan, Matematika dan Sains*, 10(1), 44–59.