International Journal of Trends in Mathematics Education Research
Vol. 5, No. 2 (2022), pp. 180-190
ISSN 2621-8488 (online)
DOI: https://doi.org/10.33122/ijtmer.v5i2.136

SAINTIS publishing

Research Article

# Development of mathematics learning devices with a problem based learning model oriented on the mathematics problem solving ability

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*Received: 11 March 2022* *Revised: 18 April 2022* *Accepted: 27 May 2022* *Available online: 30 June 2022*

## ABSTRACT

The aims of this study is to produce a mathematical learning device with a Problem Based Learning model oriented to mathematical problem-solving abilities on the subject matter of the size of the concentration and distribution of valid and practical data for class VIII SMPN 1 Rengat Barat. This research on the development of mathematics learning tools uses a 4-D model, namely: 1) Define, 2) Design, 3) Develop, and 4) Disseminate. The data collection instruments used were RPP validation questionnaire sheets and LKPD validation questionnaire sheets and practicality sheets. The data collection technique used was non-test with a questionnaire validation of learning devices. The analytical technique used is descriptive statistical analysis. From the results of the study, it was obtained that the average value of RPP validation was 88.73% with a very valid category, while the validation in terms of RPP aspects obtained an average value of 89.24% with a very valid category. The results of the analysis of the average validation of LKPD are 87.5% with a very valid validation level, while the validation in terms of aspects obtained an average value of 87.98% with a very valid category. The average practicality of learning tools obtained a value of 85.4% with very practical category. Based on this study, it was found that the mathematics learning device with the Problem Based Learning model oriented to mathematical problem-solving abilities on the subject matter of the size of concentration and data distribution of class VIII students of SMPN 1 Rengat Barat has been tested for validity and practicality.

**Keywords:** Mathematic learning devices; learning tools; mathematics problem-solving ability; problem-based learning;

## 1. INTRODUCTION

Education is always changing and developing in accordance with the changes and developments in human life (Irawan and Hakim 2021). Education is a systematic effort that aims to improve the quality of Human Resources (HR) for the better by mastering science and technology (IPTEK) (Kurniaaji, Muryani, and Sarwono 2018; Riswandi 2013; Laily and Yolanda 2021; Yusuf 2018). Rapid technological and scientific advances have brought rapid changes in lifestyle and global order (Ngafifi 2014). The need for this technological development is a need and an effort to improve the quality of education as a whole and improve the learning system (Andriani 2016). Education is expected to be able to create a quality generation so that it is able to face and respond to the challenges of changing times (Rinawati 2015). The main purpose of the educational process is the ability of students to solve problems (Zulfah, Fauzan, and Armiati 2018). Problem solving in mathematics is knowledge of basic abilities that can be obtained and improved on students in a given problem (mathematical problem) so that the problem becomes complex and unconventional (Amam 2017; Ariani, Hartono, and Hiltrimartin 2016; Rambe and Afri 2020). The actual situation at school shows that the ability of students to solve mathematical problems is still very low. The low mathematical problem solving ability of students is also obtained from the results of several previous studies.

The results of research conducted (Komarudin 2017) show that the ability of students of class XI SMP IPA 2 MA Al-Amiriyah still has errors in their ability to solve mathematical problems, namely errors in understanding the problem, re-examining the results obtained and determining the solution strategy. The results of research conducted (Suraji, Maimunah, and Saragih 2018) state that students' mathematical problem solving abilities are still not good and low, because students always have problems when writing problem solving into mathematical language, and do not check problems on questions. Each student has different abilities in overcoming a problem. Seeing the low mathematical problem solving ability of students, the teacher needs to work hard to improve it. In order to improve students' mathematical problem solving abilities, the learning process according to an appropriate and applied curriculum that focuses on the characteristics of students and

learning objectives requires a learning process that provides opportunities for students to solve problems in more complex contexts (Rahmani and Widyasari 2018). With problem solving skills, students are guided to improve their mathematical knowledge and can connect with other disciplines. Furthermore, students are trained to think that everything has many points of view so that they can see several possible solutions to problems accurately and thoroughly, analyzes that are carried out properly and correctly and the process of developing problem solving (Heriyansyah 2018). In the learning process, there are parties involved, namely educators and students. Education is closely related to educators, namely teachers. Teacher is a term for a profession that devotes itself to the field of education that has special qualifications that can only be obtained from the disciplines of education and has special skills to teach (Buchari 2018; Santi, Hutapea, and Murni 2022; Shabir 2015). Teacher professionalism is measured based on broad insight, as well as understanding of the field of study and creative so that the material taught is not monotonous or focused on material in the book (Illahi 2020). Educators provide learning to increase students' knowledge. According to (Ratnasari and Masruhin 2019) the success rate of a teacher to his students is influenced by learning activities which are a teaching and learning process.

In achieving learning objectives, optimal learning planning is needed. According to (Nasution 2017) learning planning is a structured design that includes a study of learning needs, formulation of learning objectives, development of teaching materials, methods and development of learning, as well as evaluation as a measuring tool to determine the desired learning targets. Teachers must be able to plan learning in the classroom so that learning objectives are achieved. The programs include: (1) annual program, (2) semester program, (3) syllabus, and (4) lesson plan (RPP). Curriculum development such as making Learning Implementation Plans (RPP), Student Worksheets (LKPD), and teaching aids media is one of the efforts so that the teaching and learning process can run effectively so that curriculum planning is needed. (Kunandar 2014) said that the purpose of the 2013 Curriculum is for humans to have the ability to live as individuals and make productive citizens so that they are able to contribute to the life of society, the country, and also to the world. Based on the results of interviews conducted by researchers with one of the mathematics subject teachers at SMP Negeri 1 Rengat Barat which was held on October 20, 2020 related to the implementation of the 2013 Curriculum, problems were found in the learning process, the problems found included: 1) The Learning Implementation Plan (RPP) used is not in accordance with the learning model in the 2013 Curriculum; 2) The teacher is still explaining the subject matter, giving examples of questions, giving exercises and homework; 3) The teacher is familiar with the Problem based learning model, but the teacher has not applied the model to learning activities; 4) Teachers have difficulty compiling Student Worksheets (LKPD) in accordance with the 2013 Curriculum; 5) The teacher has difficulty in compiling the assessment. Because in the 2013 Curriculum teachers are asked to assess knowledge and skills; 6) Students are less motivated in solving problems that exist in real life. Students prefer to memorize formulas but do not understand the real meaning so they cannot relate mathematics learning in class and practice outside the classroom;

Due to the lack of planning during the learning process, the problems identified were not in accordance with the 2013 curriculum, which prioritized personal experience with a scientific approach. Teachers are still having difficulty compiling Learning Implementation Plans (RPP) and Student Worksheets (LKPD) 2013 curriculum, so that they do not meet the expected learning objectives. The Student Worksheet (LKPD) used by the teacher from the publisher does not help students to solve the problems in the Student Worksheet (LKPD). Student Worksheets (LKPD) taken from publishers do not motivate students to be involved in the learning process. Therefore, it is necessary to develop learning tools that contain a learning strategy to be able to improve mathematical problem solving skills as a form of planning in the learning process so that learning is in accordance with the 2013 curriculum rules. The development of learning tools to be developed must be adapted to the learning model.

Most classes in general still use the lecture method as the only source of knowledge, so the lecture method remains the main choice in the learning process (Yolanda 2019). In addition to being required for a teacher to have a lesson plan, teachers are also required to choose a learning model so that students are enthusiastic and actively involved in the learning experience. To create interesting learning, teachers can connect the Problem Based Learning (PBL) model with learning activities because it can improve problem solving abilities, where students actively participate in the discussion process to identify problems, understand, and solve problems using various sources of knowledge and information. According to (Rusman 2016) teachers must be required to be able to determine and master learning models that can spur the enthusiasm of each student to learn actively. With the rapid development of information technology, triggering the influence of the development of software and hardware learning media, the teacher as a source of learning will slowly but surely change to the role of the teacher as a facilitator (Tayeb 2017). One of the learning models that can be used to develop RPP and LKPD is the Problem Based Learning (PBL) learning model. This requires students to increase understanding and knowledge based on experience (Towip, Widiastuti, and Budiyanto 2022).

Problem Based Learning (PBL) is a learning model that begins with presenting real problems in everyday life that is centered on students by presenting a problem so that students are able to solve the problems that have been presented (Fathurrohman 2015; Suyadi 2013; Yolanda 2019). Problem Based Learning (PBL) aims to enable students to research and solve complex problems in everyday life. Based on research conducted by (Purba, Heleni, and Murni n.d.), in general, the learning devices developed in this study reached valid standards with a very valid category. Based on small group trials, LKPD is feasible to be tested with improvements according to suggestions. So the learning tools developed with the Problem Based Learning (PBL) model on the comparison material have met the practical criteria with an average value of 8.45%. Furthermore, based on research conducted by (Eled, Syarifuddin, and Musdi 2021), the results of the development of devices in the form of learning tools are valid, practical, and effective in increasing the ability of students to solve a mathematical problem for class VII SMP, because many students get maximum scores in indicators of solving problems in answering questions. The tests given are about 83% of RPP and LKPD with problem-assisted learning as a reference in the implement-

ation of learning that can be applied in schools. Furthermore, research conducted by (Sari 2020) can be concluded that the results of using the Problem Based Learning (PBL) model in the development of mathematics learning tools show very valid results. From the overall results, the average activity of students shows that the activities of students in the learning process are in very good criteria according to predetermined criteria. This means that the activity of students in learning with the Problem Based Learning (PBL) model that has been developed is very good. Furthermore, research conducted by (Ikmawati and Badariyah 2019) can be concluded that the results of using the Problem Based Learning (PBL) model in the development of mathematics learning tools are effective, where the results of classical learning completeness are fulfilled, namely 85% of students can complete classical learning. During the learning process, students always discuss in groups to solve problems that exist in the LKPD, and conclude a concept. Students with high academic abilities help students with low abilities. The advantages of the Problem Based Learning (PBL) learning model proposed by (Shoimin 2014) are: 1) Encouraging students to have the ability to solve problems in real situations; 2) students have the ability to build their knowledge through learning activities; 3) students have the ability to communicate scientifically in discussions or lectures; 4) students are accustomed to using knowledge sources from the library, internet, interviews and observations; 5) Overcoming individual learning difficulties of students in the form of peer teaching through group collaboration. Based on this description, the researcher is interested in conducting research on the development of mathematics learning tools using the Problem Based Learning model oriented to mathematical problem solving abilities on the subject matter of the size of concentration and data distribution of class VIII SMP students.

## 2. RESEARCH METHOD

This study used is research and development (R & D). In this study, the model used is a 4D model. According to (Kurniawan and Dewi 2017) the 4D development model includes activities, namely: (1) the definition stage, namely establishing and defining learning requirements; (2) the design stage, namely preparing a prototype of learning devices; (3) The development stage, namely to produce revised learning tools based on input from experts, including expert validation, and small group trials; (4) The dissemination stage, namely the stage of using the device on a wider scale. This research was conducted at SMP Negeri 1 Rengat Barat in the academic year 2021/2022 with the subject of the research being 15 students of class VIII using learning tools in the form of lesson plans and LKPD.

This study begins with the definition stage (Define). This stage begins with preliminary and final analysis activities that aim to analyze the basic problems that become the background of whether or not learning tools need to be developed in the form of Learning Implementation Plans (RPP) and Student Worksheets (LKPD) on the size of data concentration and dissemination. The basic problem that occurs is that the lesson plans used are not in accordance with the learning model in the 2013 Curriculum and the difficulty of compiling LKPD in accordance with the 2013 Curriculum. In addition, students are less motivated in solving problems that exist in real life. Furthermore, the analysis of students is carried out. The device developed will be used by class VIII junior high school students which, based on Piaget's cognitive theory, children at this age are in the formal operational stage where at this stage a child is able to think abstractly, formulate hypotheses, solve problems, make decisions and ideas. ideas professionally. So it can be concluded that class VIII SMP students are able to think logically, analyze the problems given, and are able to adapt to various learning models. Then proceed with task analysis, which aims to find out what competencies must be mastered by students, then detail the learning materials presented to students, in the form of an outline. Followed by a concept analysis that aims to determine the content and subject matter needed.

Finally, the analysis of objectives, the reference used in formulating learning objectives is the Competency Achievement Indicator (GPA). The next stage is the design (Design) which is where the media selection, format selection and initial design are carried out. The purpose of this stage is to design the learning tools that will be developed. The learning tools developed are in the form of a Learning Implementation Plan (RPP) and Student Worksheets (LKPD). At the development stage, the learning tools that have been developed will be given to the validators to be validated by four validators and the researchers conduct small group trials to see the practicality of the developed learning tools. The validators consisted of two mathematics education lecturers at the Islamic University of Riau and two mathematics teachers at SMP Negeri 1 Rengat Barat. Each validator evaluates four RPP and four LKPD. Then the researchers conducted a small group trial to 15 students of class VIII. Data is collected from providing the tools that have been developed along with validation sheets to each validator. For data analysis used descriptive analysis which describes the validity of the developed device. The following formula is used to analyze the level of validity.

$$Va_n = \frac{\text{TSe}}{\text{TSh}} \text{ x } 100\%$$

$$\text{V} = \frac{Va_1 + Va_2 + Va_3 + Va_4 + \ldots}{n} = \ldots \ldots\%$$

Information:
V : Combined Validity
n : Number of Validators
$Va_1$: Validity From Expert 1
$Va_2$: Validity From Expert 2
$Va_3$: Validity From Expert 3
$Va_4$: Validity From Expert 4
TSe: Empirical Store
TSh: Full Score Total

**Table 1**. RPP and LKPD Validity Criteria

| No. | Validity criteria | Validity Level |
|---|---|---|
| 1 | 85,01 % - 100 % (A) | Very valid |
| 2 | 70,01 % - 85 % (B) | Valid |
| 3 | 50,01 % - 70 % (C) | Not Valid |
| 4 | 0,00 % - 50 % (D) | Invalid |

This validation sheet is a structured questionnaire used to obtain RPP and LKPD assessment scores and an unstructured questionnaire for validator recommendations to develop learning tools. The assessment category used is the validation category (Akbar 2013) modified from the very appropriate, appropriate, inappropriate, and very inappropriate categories. According to (Sugiyono 2016) a learning device is said to be effective if the average validation exceeds 70% or falls into the valid or very valid category. The response of students to the questionnaire is a statement about learning tools that must be answered by students. The criteria for assessing student response questionnaires use the Gutman scale assessment category yes or no. According to (Silalahi, Kartini, and Hutapea 2021) learning tools are said to be practical if the average student response questionnaire results are more than 70.01% in the practical or very practical category. In finding the practicality value of each questionnaire, the following formula is used:

$$P = \frac{\text{TSe}}{\text{TSh}} \times 100\%$$

Information:
P : Practicality Presentation
TSe: Empirical Store
TSh: Full Score Total

**Table 2**. Practical Criteria

| No. | Range | Criteria |
|---|---|---|
| 1 | 81 % - 100 % (A) | Very Practical |
| 2 | 61 % - 80 % (B) | Practical |
| 3 | 41 % - 60 % (C) | Enough Practical |
| 4 | 21 % - 40 % (D) | Not Practical |
| 5 | 0 % - 20 % | Very Impractical |

## 3. RESULTS AND DISCUSSION

### 3.1 Results

#### Description of Learning Device Development Stage

Development of learning devices using the 4-D development model from Thiagarajan with the following details:

1. **Description of the defining stage**
   Based on the results of observations and learning tools at SMP Negeri 1 Rengat Barat, the lesson plans used are not in accordance with the learning model in the 2013 Curriculum and have difficulty compiling LKPD in accordance with 2013. In addition, students lack analysis in solving problems that exist in real life. In learning that aims to solve problems, students will be asked to improve their mathematical knowledge and be able to connect with other disciplines. Thus students' mathematical connection skills can be improved. The learning tools developed were in the form of lesson plans and LKPD, for the material for the size of data concentration and dissemination in class VIII of junior high school.
2. **Description of the designing stage**
   To measure students' mathematical connection ability in achieving learning objectives, an assessment tool was developed in the form of a mathematical connection ability test on the material for measuring data concentration and data distribution. The students' mathematical connection ability test uses learning tools consisting of: Learning Implementation Plans (RPP) and Student Worksheets (LKPD).
3. **Description of the developing stage**
   At this stage the learning tools that have been designed are carried out in 2 stages, namely: 1) Validation by 4 validators, and 2) small group trials. The validation results from the validator show that all learning devices meet the valid criteria. Small group trials on 15 students of class VIII were conducted to see the effectiveness of the learning tools. The results of student responses that meet practical criteria.

#### Description of the Test Result

Learning tools with valid criteria based on the validator's assessment are met, because all validators assess the learning tools developed can be used with "little revision" or "no revision". So that the learning tools obtained are RPP and LKPD with very valid criteria. The results of small group trials on 15 students of class VIII to determine the ability of classical mathematical connections showed very practical criteria. Thus it can be concluded that the learning tools in the form of lesson plans and LKPD with problem solving abilities meet the valid and practical criteria. From the research conducted, the following results were obtained:

**Table 3**. RPP Validation Results Based on Aspects

| Rated aspects | Per-Meeting Validity Percentage (%) | | | | Average | Validity Criteria |
|---|---|---|---|---|---|---|
| | I | II | III | IV | | |
| RPP Format | 96,88 | 100 | 96,88 | 96,88 | 97,66 | Very Valid |
| Aspects of Material/Content | 86,25 | 86,88 | 85,63 | 86,88 | 86,41 | Very Valid |
| Language Aspect | 96,88 | 95,31 | 96.88 | 93,75 | 95,71 | Very Valid |
| Time Aspect | 90,63 | 84,38 | 84,38 | 84,38 | 85,94 | Very Valid |
| Value Aspect | 78,13 | 81,25 | 81,25 | 81,25 | 80,47 | Valid |
| Average Each Aspect | | | | | 89,24 | Very Valid |

**Table 4**. Overall RPP Validation Results

| Meet | Validity Percentage (%) | | | | Average (%) | Validity Criteria |
|---|---|---|---|---|---|---|
| | V1 | V2 | V3 | V4 | | |
| Meet - 1 | 82,5 | 87,5 | 88,75 | 97,5 | 89,01 | Very Valid |
| Meet - 2 | 82,5 | 87,5 | 88,75 | 97,5 | 89,01 | Very Valid |
| Meet - 3 | 83,75 | 87,5 | 85 | 97,5 | 88,44 | Very Valid |
| Meet - 4 | 83,75 | 87,5 | 85 | 97,5 | 88,44 | Very Valid |
| Average (%) | | | | | 88,73 | Very Valid |

Based on the **Table 4**, it can be seen that the highest score based on the assessment by four validators is in the RPP Format with a score of 97.66% in the very valid category, while the lowest score is in the value aspect with a score of 80.47% in the valid category. Overall, the RPP obtained an assessment result with an average of 89.24% with a very valid category. For the overall validation average, a score of 88.73% was obtained with a very valid category.

**Table 5**. LKPD Validation Results Based on Aspects

| Rated aspects | Per-Meeting Validity Percentage (%) | | | | Average | Validity Criteria |
|---|---|---|---|---|---|---|
| | I | II | III | IV | | |
| Didactic Aspect | 86,25 | 85 | 88,75 | 88,75 | 87,19 | Very Valid |
| Content Aspect | 89,04 | 88,47 | 89,6 | 89,6 | 89,18 | Very Valid |
| Construction Aspect | 91,67 | 92,71 | 94,79 | 93,75 | 93,23 | Very Valid |
| Presentation Aspect | 84,38 | 81,25 | 82,29 | 83,34 | 82,82 | Valid |
| Time Aspect | 87,5 | 87,5 | 87,5 | 87,5 | 87,5 | Very Valid |
| Average Each Aspect | | | | | 87,98 | Very Valid |

**Table 6**. Overall LKPD Validation Results

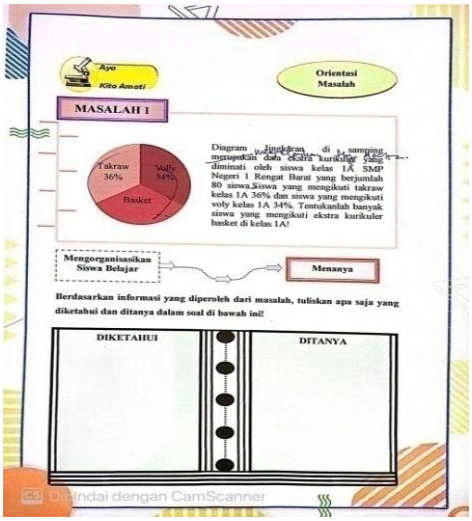
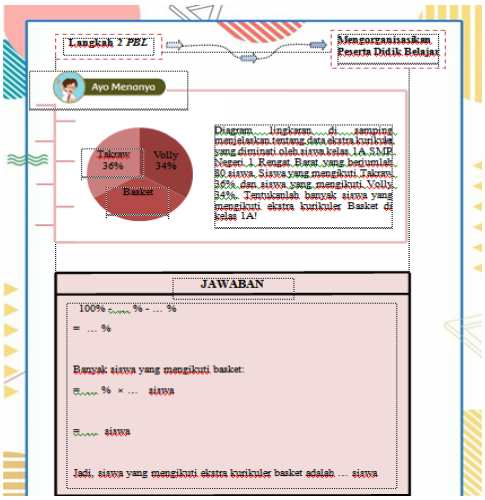
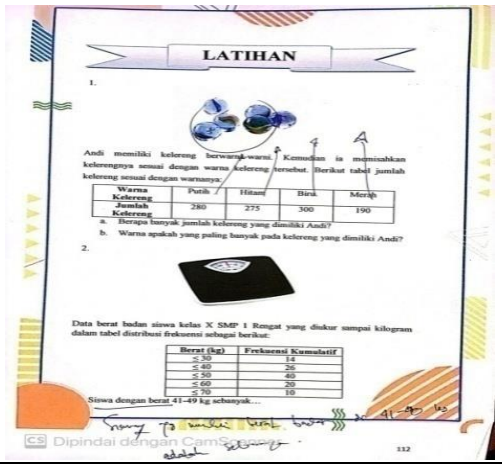
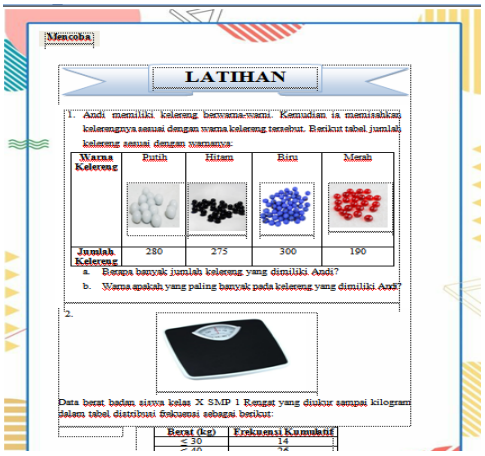
| Meet | Validity Percentage (%) | | | | Average (%) | Validity Criteria |
|---|---|---|---|---|---|---|
| | V1 | V2 | V3 | V4 | | |
| Meet - 1 | 75,86 | 86,2 | 89,66 | 97,4 | 87,28 | Very Valid |
| Meet - 2 | 75,86 | 86,2 | 87,9 | 95,69 | 86,41 | Very Valid |
| Meet - 3 | 75,86 | 86,2 | 94,83 | 95,69 | 88,15 | Very Valid |
| Meet - 4 | 75,86 | 86,2 | 94,83 | 95,69 | 88,15 | Very Valid |
| Average (%) | | | | | 87,5 | Very Valid |

Based on the **Table 5**, it can be seen that the highest score based on the assessment by four validators was found in the construction aspect with a score of 93.23% in the very valid category while the lowest score was in the presentation aspect with a score of 82.82% in the valid category. Overall, LKPD obtained an average score of 87.98% with a very valid category. For the overall validation average, a score of 87.5% was obtained with a very valid category. From the results of the average RPP and LKPD it can be concluded that the learning tools at the first meeting to the fourth meeting all aspects are very valid. Researchers continue to make improvements to the device with suggestions that have been submitted by the validator so that it can be used during the learning process at school.

**Table 7**. RPP Revised Results

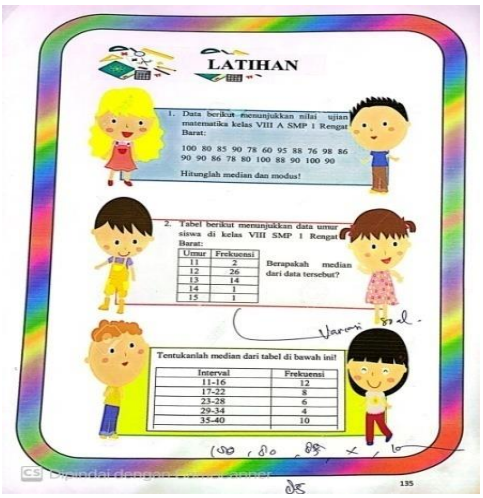
| No. | RPP Product Revision | |
|---|---|---|
| | **Before Revision** | **After Revision** |
| 1 | RENCANA PELAKSANAAN PEMBELAJARAN-1 (RPP-1)<br>Nama Sekolah : SMP Negeri 1 Rengat Barat<br>Mata Pelajaran : Matematika<br>Kelas/ Semester : VIII/Genap<br>Tahun Ajaran : 2021/2022<br>Materi Pokok : Ukuran Pemusatan dan Penyebaran Data<br>Alokasi Waktu : 2 x 40 menit<br>**A. Kompetensi Inti (KI):**<br>KI 3 : Memahami pengetahuan (faktual, konseptual, dan prosedural) berdasarkan rasa ingin tahunya tentang ilmu pengetahuan, teknologi, seni, budaya terkait fenomena dan kejadian tampak mata.<br>KI 4 : Mencoba, mengolah, dan menyaji dalam ranah konkret (menggunakan, mengurai, merangkai, memodifikasi, dan membuat) dan ranah abstrak (menulis, membaca, menghitung, menggambar, dan mengarang) sesuai dengan yang dipelajari di sekolah dan sumber lain yang sama dalam sudut pandang/teori.<br>**B. Kompetensi Dasar dan Indikator Pencapaian Kompetensi**<br>Kompetensi Dasar: 3.10 Menganalisis data berdasarkan distribusi data, nilai rata-rata, median, dan modus dari sebaran data untuk mengambil simpulan, membuat keputusan, dan membuat prediksi; 4.10 Menyajikan dan menyelesaikan masalah kontekstual yang berkaitan dengan distribusi data, nilai rata-rata, median, modus, dan sebaran data untuk mengambil simpulan, membuat keputusan, dan membuat prediksi<br>Indikator Pencapaian Kompetensi: 3.10.1 Menganalisis data berdasarkan distribusi data yang diketahui; 3.10.2 Menghitung data berdasarkan distribusi data yang diketahui; 4.10.1 Menyelesaikan masalah kontekstual yang berkaitan dengan distribusi data.<br>**C. Tujuan Pembelajaran**<br>Tujuan pembelajaran menggunakan model *Problem Based Learning* (*PBL*), yaitu: | **C. Tujuan Pembelajaran**<br>Melalui pembelajaran berbasis masalah *Problem Based Learn* pendekatan saintifik diharapkan peserta didik lebih aktif dalar pembelajaran, bertanggung jawab, memiliki rasa ingin tahu dan peserta didik mampu:<br>1. Melalui diskusi kelompok, peseta didik dapat menganalisis pe pada distribusi data dengan tepat dan benar.<br>2. Setelah diberikan contoh masalah pada LKPD yang berkait distribusi data, peserta didik dapat menyelesaikan permasal berkaitan dengan distribusi data dengan benar.<br>**D. Materi Pembelajaran**<br>1. Fakta<br>R: Jarak/ rentangan<br>K: Jumlah kelas<br>I: Interval kelas<br>n: Jumlah data<br>2. Konsep |
| | Validator Suggestions: Improve learning objectives and adjust them to KD and GPA | |
| | **Before Revision** | **After Revision** |
| 2 | semangat untuk belajar, seperti: "Banyak sekali manfaat dalam mempelajari statistika terutama dalam kehidupan sehari-hari. Kita sering menjumpai penerapan statistika dalam beberapa aspek kehidupan. Pengumpulan data tentang minat siswa dan kepadatan penduduk dapat disajikan dengan mudah menggunakan ilmu statistika. Kita juga sering melihat data tersebut disajikan dalam tabel atau diagram sehingga mempermudah bagi pembacanya. Ukuran pemusatan dan penyebaran data juga diperlukan untuk mengetahui keterangan tertentu yang diperlukan. Ukuran pemusatan menggambarkan kecenderungan data mengumpul atau terpusat, sedangkan ukuran penyebaran mengukur keragaman data".<br>5. Guru mengarahkan siswa dibagi ke dalam beberapa kelompok kecil yang terdiri dari 4-5 orang siswa dalam satu kelompok.<br>6. Guru memberikan Lembar Aktivitas Siswa (LAS) kepada masing-masing kelompok.<br>**Kegiatan Inti** — **Fase 1 : Mengorientasikan Siswa pada Masalah** — 60 menit<br>7. Guru mengkoordinasikan siswa dalam kelompok belajar yang telah ditentukan dan meminta siswa untuk mengamati LAS-1 dan memahami masalah yang terdapat dalam LAS-1. **(Mengamati)**<br>**Fase 2 : Mengorganisasikan Siswa Belajar**<br>8. Guru memberikan kesempatan kepada siswa dalam mengembangkan ide dan meminta peserta didik untuk mengajukan beberapa pertanyaan terkait dengan masalah yang telah diamati dalam Lembar Aktivitas Siswa (LAS). **(Menanya)**<br>9. Siswa diminta membuat hal yang diketahui dan yang ditanya dari masalah yang diberikan.<br>10. Sebelum menyelesaikan masalah, guru meminta setiap anggota kelompok untuk mengerjakan aktivitas siswa yang terdapat pada LAS-1.<br>**Fase 3 : Membimbing Penyelidikan Individu maupun Kelompok**<br>11. Setiap anggota kelompok melakukan percobaan dengan menanyakan tahun kelahiran teman di kelas. **(Mencoba)**<br>12. Guru meminta masing-masing siswa mengisi/mencatat hasil percobaan pada LAS-1. | pemusatan menggambarkan kecenderungan data mengumpul atau terpusat, sedangkan ukuran penyebaran mengukur keragaman data".<br>5. Guru mengarahkan peserta didik dibagi ke dalam beberapa kelompok kecil yang terdiri dari 4-5 orang dalam satu kelompok.<br>6. Guru memberikan Lembar Kerja Peserta Didik (LKPD) kepada masing-masing kelompok.<br>**Kegiatan Inti** — **Fase 1 : Mengorientasikan Peserta Didik pada Masalah** — 60 menit<br>7. Guru mengkoordinasikan peserta didik dalam kelompok belajar yang telah ditentukan dan meminta peserta didik untuk mengamati LKPD-1 dan memahami masalah yang terdapat dalam LKPD-1. **(Mengamati)**<br>**Fase 2 : Mengorganisasikan Peserta Didik Belajar**<br>8. Guru memberikan kesempatan kepada peserta didik dalam mengembangkan ide dan meminta peserta didik untuk mengajukan beberapa pertanyaan terkait dengan masalah yang telah diamati dalam Lembar Kerja Peserta Didik (LKPD). **(Menanya)** |
| | Validator Suggestions: Explaining the problems that exist in phase 1: orienting students to the problem | |

**Table 8**. LKPD Revised Results

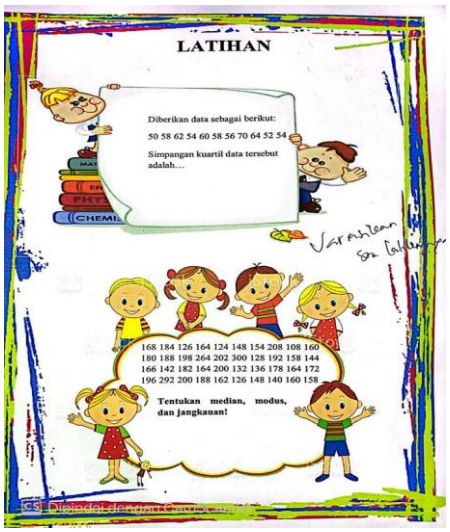
| No | LKPD Product Revision | |
|---|---|---|
| 1 | **Before Revision** | **After Revision** |
| |   |   |
| | Validator Suggestion: Correct the sentence in the question | |
| 2 | **Before Revision** | **After Revision** |
| |   |   |
| | Validator Suggestion: Add real image | |
| 3 | **Before Revision** | **After Revision** |
| |   |   |
| | Validator Suggestion: Change image | |

| 4 | **Before Revision** | **After Revision** |
|---|---|---|
| |  |  |

Validator Suggestion: Correct the word in the image

| 5 | **Before Revision** | **After Revision** |
|---|---|---|
| |  |  |

Validator Suggestions: Vary the Questions

| 6 | **Before Revision** | **After Revision** |
|---|---|---|
| |  |  |

Validator Suggestions: Vary the Questions

## Improved Student The Ability Mathematical Connection

Small group trials were conducted to see the practicality of the developed LKPD. In this study, trials were conducted on 15 students of class VIII of SMP Negeri 1 Rengat Barat. Students are asked to fill out a response questionnaire after completing all LKPD. The aspects assessed in the student response questionnaire are didactic aspects, content aspects, construction aspects, presentation aspects, and time aspects. The response of students to the LKPD as a whole is shown in **Table 8.**

**Table 9**. Overall LKPD Validation Results

| LKPD Aspect | Average |
|---|---|
| Didactic Aspect | 86% |
| Content Aspect | 85% |
| Construction Aspect | 85,5% |
| Presentation Aspect | 85,5% |
| Time Aspect | 85% |
| Average | 85,4% |
| Practical Criteria | Very Practical |

Based on the results of the student response questionnaire to the developed LKPD, it was found that the student response questionnaire in the didactic aspect reached 86% in the very practical category, for the content aspect it reached 85% in the practical category, for the construction aspect it reached 85.5% with the very practical category, for the presentation aspect. reached 85.5% in the very practical category, for the time aspect it reached 85% in the practical category. Overall, LKPD obtained an average score of 85.4% in the very practical category. This means that the developed LKPD can be used properly by students. This can facilitate students in developing mathematical problem solving skills.

## 3.2 Discussion

The study used is research and development (R & D). The learning tools developed were RPP and LKPD using the Problem Based Learning (PBL) model on the material for the size of data concentration and distribution in class VIII of SMPN 1 Rengat Barat. In this study, the model used is a 4D model consisting of the definition stage, the design stage, the develop stage, and the dissemination stage. However, in this study, the develop stage was only carried out to a small group trial to see the practicality of the developed worksheets. At the definition stage, it consists of initial-late analysis, student analysis, material analysis, task analysis, and formulation of learning objectives. This stage begins with preliminary and final analysis activities that aim to analyze the basic problems that become the background of whether or not learning tools need to be developed in the form of Learning Implementation Plans (RPP) and Student Worksheets (LKPD) on the size of data concentration and dissemination. The basic problem that occurs is that the lesson plans used are not in accordance with the learning model in the 2013 Curriculum and the difficulty of compiling LKPD in accordance with the 2013 Curriculum. In addition, students are less motivated in solving problems that exist in real life. This problem is the background to the need to develop mathematics learning tools starting from problems related to everyday life to improve students' mathematical problem solving abilities. The students who were the subjects of the research were students of class VIII of SMP Negeri 1 Rengat Barat.

Furthermore, the analysis of students is carried out. The device developed will be used by class VIII junior high school students which, based on Piaget's cognitive theory, children at this age are in the formal operational stage where at this stage a child is able to think abstractly, formulate hypotheses, solve problems, make decisions and ideas. ideas professionally. Then proceed with task analysis, which aims to find out what competencies must be mastered by students, then detail the learning materials presented to students, in the form of an outline. Followed by a concept analysis that aims to determine the content and subject matter needed. Finally, the analysis of objectives, the reference used in formulating learning objectives is the Competency Achievement Indicator (GPA). The next stage is the design (Design) which is where the media selection, format selection and initial design are carried out. The purpose of this stage is to design the learning tools that will be developed. The learning tools developed are in the form of a Learning Implementation Plan (RPP) and Student Worksheets (LKPD). At the development stage, the learning device that has been developed by the researcher validates the validator and makes revisions according to the suggestions from the validator. In this study, validation was carried out by two mathematics lecturers and 2 teachers as validators. Suggestions from validators are used as material to revise learning tools so as to produce better learning tools. The results of the revision are learning tools that have met the valid criteria. Then the researchers conducted a small group trial to 15 students of class VIII.

This research has been carried out by previous researchers. In a study by (Rahmadhani 2020) which in his research "Development of Mathematics Learning Devices with Problem Based Learning (PBL) models to Facilitate Mathematical Problem Solving Ability in Rectangular Material for Class VII SMP" where the results of this study obtained RPP validation results 84.84 % with valid category, the results of LKPD validation are 84.42% with valid categories. In the results of the validation of the Learning Implementation Plan (RPP) the average value of the overall lesson plans of the four validators is 88.73% with a very valid category. As for the results of the aspect-based analysis, the RPP format aspect has the highest percentage of 97.66% with a very valid category while the lowest percentage is found in the value aspect, which is 80.47% with a valid category. The overall average of the LKPD of the four validators is 87.5% with a very valid category. As for the results of the analysis based on aspects, the construction aspect has the highest percentage of 93.23% with a very valid category while the lowest percentage is in the presentation aspect, which is 82.82% with a valid category. This proves that the development of learning tools carried out is tested for validity with different subject matter as done by [40].

Based on the results of the student response questionnaire to the developed LKPD, it was found that the average result from LKPD-1 to LKPD-4 was 85.4% with a very practical category. Student response questionnaires in the didactic aspect reached 86% in the very practical category, for the content aspect it reached 85% in the practical category, for the construction aspect it reached 85.5% in the very practical category, for the presentation aspect it reached 85.5% in the very practical category, for the time aspect it reaches 85% with the practical category. This means that the developed LKPD can be used properly by students. This can facilitate students in developing mathematical problem-solving abilities. Based on the description of the results of the validation of the RPP and LKPD, and the results of small group trials using student response questionnaires to mathematics learning tools on the material for the size of data concentration and distribution using a problem-based learning (PBL) model, it can be concluded that the developed RPP and LKPD are valid and practical for use by class VIII junior high school students.

## 4. CONCLUSION

Based on the results and discussion above, it can be concluded that the results of RPP validation reached 88.73% with a very valid category and LKPD validation reached 87.5% with a very valid category. In addition, the results of the practicality of the learning tools show a figure of 85.4% in the very practical category.

## ACKNOWLEDGEMENTS

The authors would like to thank all those who have helped in the completion of this paper to publish in journal.

## AUTHOR'S CONTRIBUTIONS

The authors discussed the results and contributed to from the start to final manuscript.

## CONFLICT OF INTEREST

There are no conflicts of interest declared by the authors.

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